Supporting the e-business readiness of small and medium-sized enterprises: approaches and metrics

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Abstract

Government initiatives are continuously being designed to create stable and supportive environments for developing new industries. Presents a conceptual model for use by governments in creating and sustaining an appropriate climate that facilitates the national adoption of e-business. It focuses specifically on the needs of small and medium-sized enterprises (SMEs). Also suggests six categories of e-business readiness metrics and measures to be used for assessing how a country is performing in terms of providing a positive e-business readiness climate. Examples of innovative initiatives are provided from Canada, The Netherlands, Norway, and Singapore. Concludes that a balance among attention to infrastructure components has not yet been achieved in these countries.

Introduction

Spurring economic development is a goal of most governments. One focus of government intervention is on behalf of the small-to-medium-sized enterprises. Globally, it is recognized that approximately 80 per cent of economic growth comes from the SME sector. A total of 99 per cent of all businesses in North America and Europe are SMEs (Adam *et al.*, 1999). It is therefore likely that government strategies, aimed at facilitating SME adoption of Internet-enabled business processes and practices, can help increase national GDP.

This paper proposes a conceptual model that defines what areas governments should pay attention to in preparing their SMEs for the global knowledge economy. Examination of various countries' work at setting up infrastructure for e-business readiness shows the problems, such as market dislocation and "brain-drain", that may arise when one type of e-business infrastructure component is emphasized over others.

Metric results can show the imbalances that each country must address. In late 2001, European Union countries published the results of their innovation scoreboards (EUScoreboard, 2001). Each participating country detailed their strengths and weaknesses according to 17 qualitative indicators grouped in four categories of human resources, knowledge creation, the application of knowledge and innovation finance. The scoreboard's focus is innovation in SMEs, thereby facilitating benchmarking and debate for policy makers, researchers and business. Our work goes beyond the European efforts in terms of the detail of specifying and identifying measures and metrics for what infrastructure is required to support e-business readiness in SMEs.

SMEs have special needs because of their limited resources in terms of personnel, finances, and knowledge pertaining to management, marketing, commercialization, or information technology. Globalization pressures arising from e-commerce operations often mean that SMEs have to acquire international trade knowledge. Some smaller supplier businesses have suffered because large customers have started buying online on a

global basis or joined international purchasing portals, resulting in downward and sometimes unsustainable price pressure (Brooks, 2001). It is now critical for smaller suppliers to compete internationally or regionally and they often lack knowledge and expertise about international trade issues and foreign markets.

Although limited resources are a distinguishing characteristic of SMEs and thus a barrier for them to compete in the global e-business sector, there are also many counter-balancing advantages as well. An obvious advantage is that small and medium sized companies are usually more entrepreneurial and willing to experiment and innovate in terms of business models and operations than larger organizations with established hierarchies. Thus, government initiatives aimed at increasing the e-business readiness of SMEs can result in a higher level of national competitiveness in this crucial sector. This paper focuses on such initiatives and proposes ways to measure and thus compare national environments of e-business readiness for SMEs.

The paper is organized as follows. Next, a model for government support for e-business readiness is presented. A subsequent section describes and compares the innovative e-business readiness initiatives for the SME sector from four countries by providing snapshots of the results of countries' initiatives for SMEs. This is followed by a section which discusses measurement problems and other related works. The paper concludes with a summary that presents the next steps of this research.

A model for government support for e-business readiness

Countries and other entities require well-defined e-business strategies and plans if they wish to obtain competitive advantage. This section develops a conceptual model that defines the infrastructure components and associated processes for government facilitation to build a knowledge-based economy. Such a model is useful for the purposes of guiding government efforts at developing an e-business readiness climate as well as efforts aimed at

assessing the success of concerted actions. The model must specify both the infrastructure and supporting services for e-business readiness as well as lay out specific outcome measures and metrics for success. These outcome metrics should be in place before e-business readiness implementation to ensure that the strategy is correctly interpreted and followed.

The following six components to support e-business readiness can be identified for government efforts at fostering e-business readiness climate, especially for supporting the small and medium-sized sector:

(1) knowledge and innovation process-based economy;
(2) e-government leadership;
(3) regulatory, trust, and financial infrastructure;
(4) content infrastructure (including content management processes);
(5) human infrastructure including skills distribution network; and
(6) communications and information systems infrastructure and access.

A knowledge and innovation-based economy is the outcome of effectively building the other five model components. Each component has associated process inputs and outputs. The dependencies that exist in the model are conceptualized at a high level in Figure 1. Details on each major component are found in the subsequent sections.

The foundation for all e-business readiness is based on modern technologies and the access to those technologies in the areas of communications and information systems. Included in communications and information systems infrastructure are networking and computer hardware, underlying application software technologies for e-business applications, and the applications representing automated business processes. SMEs that create and commercialize evolutionary new technologies directly output new innovation (see flow 1).

However, personnel in a majority of SMEs learn about, as opposed to create their new technologies and its possibilities and create transformational business processes, new skill sets, and innovations (flow 3). Note that flow 3 goes to both process 0 (create knowledge and

Figure 1 A model for government support for e-business readiness in SMEs
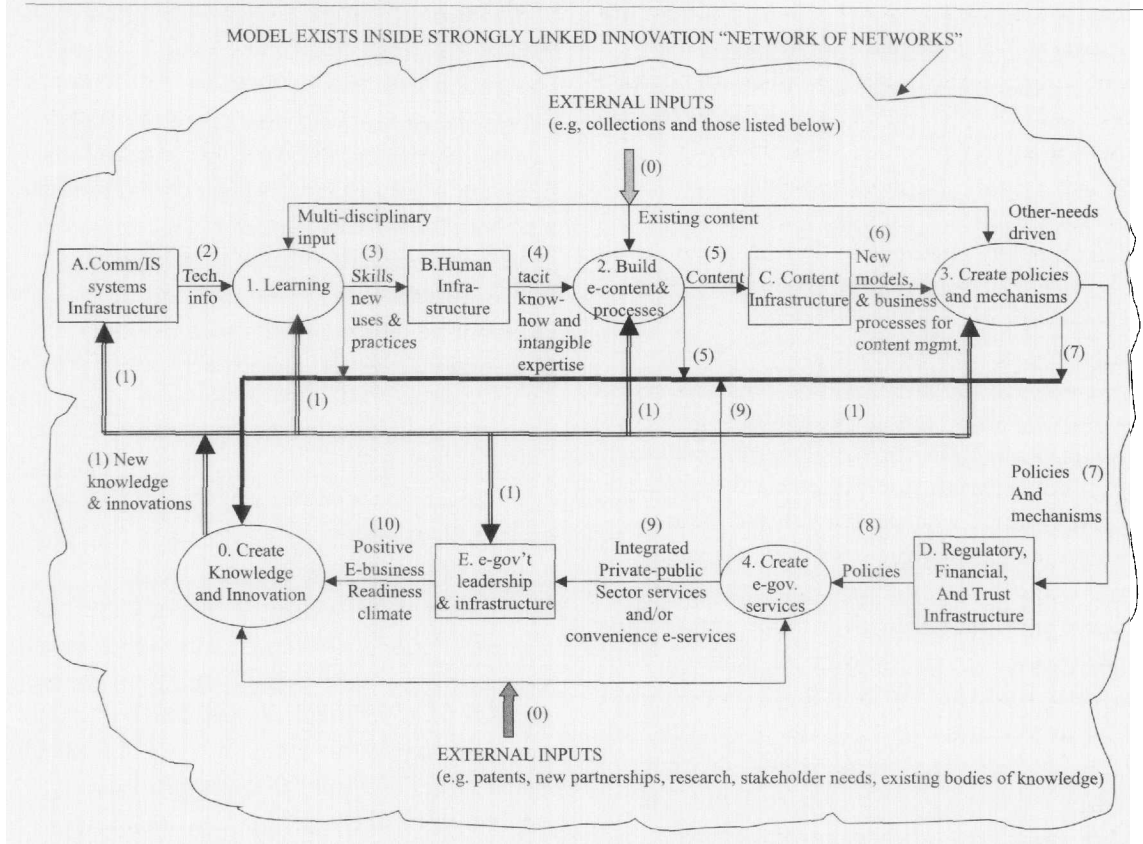
innovation) and component B (human infrastructure) as illustrated in Figure 1. Diffusion of new skill sets and other outputs of human expertise may be facilitated by a skills distribution network. Connectivity and a partnership-based innovation network can be leveraged for skills distribution to SMEs.

After human infrastructure is crafted with the skills necessary to manage and execute new electronic processes, new content and processes to manage the content are created. SMEs require special mechanisms for content management. For example, what mechanism can be put in place to list an SME that sells Christmas trees in the top three results of a Web engine search? Data repositories, content for Web pages, shop-fronts, and shopping cart icons are some examples of the output of process 2 (flow 5). Flow 5 is simply labeled "content" but it includes new content, content models, and content management processes. Subsets of these content compilations are innovations in themselves, as are new patentable business, and engineering processes (flow 5).

E-business transactions that manipulate content (flow 6) at first operated in the common regulatory framework of the day for business transactions. However, it is well known that the Internet, due to increased transparency, lack of borders, and enormous reach, creates myriad problems such as privacy, taxation, and jurisdictional conflicts. Thus, necessary for SMEs to break the online trust barriers and thus conduct e-business on any scale, is regulatory, trust, and financial infrastructure support for e-business. Electronic processes, electronically stored data, and associated implications are examined by regulatory, financial, and trust bodies to create new policies or mechanisms to facilitate SME conduct of e-business such as international trade. An example of financial and trust infrastructure is the banking system agreeing to be a trusted third party in transactions for SME customers that accept online credit card payments. Another example of a trust mechanism (see flow 7) is the insurance industry providing the SME e-business with "online customer privacy loss" protection.

E-government services, similar to SME e-business services, build in parallel on the four preceding infrastructure components:

(1) communication and information systems;
(2) human;
(3) content; and
(4) regulatory, financial, and trust, and associated process flows.

An example of flow 8 would be a policy not to use cookies on a government Web site.

SMEs can incorporate e-government services to create new higher value aggregate services – a bouquet concept. A service example of flow 9 would be an SME travel company offering a seamless experience in providing the airline booking service, complete with fast online checks for the traveler's passport expiry dates, online application for new passports, and checks with the Department of Health for what vaccinations are required to travel to a particular country (Regio, 2002). A positive e-business climate and subsets of flow 10 includes access to venture capital, inciting tax regimes, human performance rewards, and SME incentives for e-business practices.

For SMEs, knowledge and innovation process-based economy is the outcome or output of the combination of the five model infrastructure components and their related processes. To facilitate the knowledge and innovation creation and diffusion process, all components "live" in innovation networks. Imaginably, the most complex innovation network would be a network of many existing networks. Conceptually, such an innovation network could connect the SME association networks into government policy making networks, public research sector networks, SME insurance brokers networks, technical developer networks, human resource networks, and so on. Knowledge management tools and human resource service of the new channels opened among many more players are necessary to manage the complexity. However, such tools are valuable even in the simplest of innovation networks.

An example of a simple innovation network is the International Innovation Network (IIN), which is led by two respected Canadian accounting associations. IIN (*CA Magazine*, 2001), is "a collaborative organization of

accounting bodies around the world, committed to sharing new product ideas and market research". Just a few advantages that innovation networks provide are communication facilities to reach the right people, creating partnerships of stakeholders from many groups, social capital creation, and aggregation of their competencies for greater chances of innovation success (Jutla *et al.*, 2002a; Kaufmann and Totdling, 2001). Common to all six model's components are the profound effects that government policies and actions can have on each component in terms of creation and subsequently diffusion. Government efforts and programs that foster partnerships involving SMEs can help to ensure that this critical growth sector of the economy is not left behind in the digital economy.

Although there appears to be a linear sequence among components in our proposed model, it is possible to build components in parallel, or in different orders. The order that was presented in our model was the natural and logical ordering found in most government facilitation to date on e-business readiness.

For gap analysis and to rank the e-business readiness efforts of various countries, metrics and measures should accompany the model for government efforts at fostering e-business climates. It is critical to distinguish between a metric and a measure. According to Pitts (1997):

A metric is a composite of measures that yields systematic insight into the state of processes or products and drives appropriate action. A measure is the empirical, objective assignment of a number or symbol to an entity to characterize a specific attribute. It is possible to have many measurements but no metric; a metric may be made up of multiple measures.

The subsequent sections describe the components of the model and present relevant metrics and measures.

Knowledge and innovation

Partnerships are critical to the creation and spread of knowledge, and creation and diffusion of innovations, as can be seen in the American efforts in the Internet2 initiative. "Internet2 is recreating the partnership among academia, industry, and government that fostered today's Internet in its infancy" (USInternet2, 2002).

The Netherlands EC-Platform (ECPlatform, 2002) represents the creation of an innovation network and is an alliance of government departments, business organizations from the private sector, associations, and educational institutions. It is imperative that the needs of SMEs be considered in such partnerships. In 2000, the OECD highlighted the challenges that SMEs face in industry-science relationships and suggested that governments must help to enhance the ability of national firms, especially SMEs, to partner with public research institutions as well as to access global research networks and markets (Federal Ministry of Education and Research and OECD, 2000).

Many governments recognize that partnerships are essential to e-business readiness. There are two key reasons for this. First, it is well understood that governments' efforts alone cannot ensure a fertile e-business readiness environment. Second, for political and ideological reasons it may not be prudent for governments to take complete responsibility for such efforts. Governments have a critical role in fostering the requisite partnerships that yield a common vision and set of motives and goals for national e-business readiness.

Most governments prefer to play a mobilizing role in facilitating partnerships amongst private sector businesses, public sector departments and agencies, industrial research partners, public research players, universities and educational institutions, and industry associations as a strategic means of fostering e-business-readiness. SMEs are a key part of this partnership equation.

Generally, government support for the development of e-business knowledge and innovation has focused on setting up research centers, helping e-business ventures in key national industrial sectors, and on facilitating the adoption of e-business by the SME sector. Research institutes have been encouraged to combine expertise from multiple disciplines such as engineering, computer science, business, law, and policy. Other research institutes have set up associated e-business incubators to facilitate the transfer of innovation to the commercial SME sector. Many governments are also providing funding to strengthen and expand e-business research, and to create additional places for higher education in e-business.

Countries typically measure innovation capacity in terms of macro-scale output, investments, partnerships, and organizational restructuring (The Danish Government, 2000). Macro-scale output measures typically include number of new products, services, companies, methods, and practices. Patents are important measurements in a knowledge economy where business worth is based on the intellectual property owned. Common measures include number of patents (foreign, domestic), patent applications, new businesses, and research and development employees. Innovation metrics that are less prevalent due to measurement problems include new business models, pricing models, marketing methods, sales concepts, and logistics systems that also represent innovations. Some measures such as the number of patents per million dollars of public funded R&D, the percentage of sales/exports of innovations, and the number of IT graduates, are easily available. Measures such as employee churn rate in the IT/e-business sectors, and employee productivity per sector can be obtained with a lower level of reliability. Measures such as the productive use of the Internet, purchase of innovations to create further innovation, quality of knowledge bases, and quality of knowledge transfer are much more difficult to obtain.

The focus on SME partnerships for innovation is motivated by the fact that the more the cross organizational and cross disciplinary competencies that are involved in an innovation, the harder it is for competitors to replicate them. The use of innovation networks, co-commercializing of innovations, corporate co-financing of public R&D, and traditional strategic alliance metrics can also be used for measuring the degree of successful partnering for innovation.

Another potential area for measuring innovation efforts relates to enterprise organizational structures. Many studies have shown close links between organizational structure and the ability to innovate. Flat structures, a focus on customer needs, articulated strategies for developing human resources and cross-organizational cooperation

are enablers of innovation within organizations. Because of their small size and flatter organizational structures, SMEs inherently facilitate innovation as compared to large hierarchies.

It is important to consider measurements of innovation and the impact of e-business on SMEs. Table I suggests measures of interest.

E-government leadership

Countries are providing a model for their citizens by becoming adopters of the network processes and technologies that enable convenient, cost-effective, online business-to-government, government-to-citizen, and government-to-government services. In other words, governments will be leading users of e-business opportunities. Most first-world governments have imposed deadlines, for example by 2004 in the case of the UK, as to when they expect to have at least half or most of their services online.

Governments across the world share similar challenges. Internally, each manages more data than the largest multinationals in the world. Each is faced with the great task of re-engineering and integrating business processes and technologies across agencies in order to provide the convenient services expected from its citizenry and businesses. An interoperability framework is needed for each country's governance processes.

The infrastructure for e-government has been in development for years. In 1993, the Province of Nova Scotia created a policy whereby each parcel of land must be given a unique property identification number, thus putting in place an essential enabler for an online land registry. The Province of Nova Scotia recognized that integration of business processes across agencies and departments on both a provincial and federal level was a necessity and first steps were needed. At the provincial level, a new department called Services Nova Scotia and Municipal Relations (SNSMR) brought together Business Consumer Services and various isolated registries. Subsequently, SNSMR has succeeded in integrating licensing, registration, and permitting in real time for the agencies of Registry of Joint Stock Companies, Canada Customs and Revenue Agency, and the Worker's Compensation Board. Two of these agencies are provincial and Revenue Canada is federal, thereby illustrating interoperability of two different levels in the governance hierarchy.

Private sector partnerships are essential for implementing e-government. The software solutions provider must learn about business processes from the experts and users in government and create the applications for these users' needs. In turn, application solution providers are, or partner with core software and hardware companies from the private sector such as Microsoft and IBM.

Table I List of metrics and measures for knowledge and innovation for SMEs

Patents or first-of-a-kind in SMEs	Investments	Adoption	Partnerships and organizational structure
No. of new business model patents	Corporate/public R&D spending ratio	Use of new business models	See Craig and Jutla (2001) for lists of partnership metrics and measures
No. of new pricing models	Spending on market analyses, design, product testing, and patents	Use of new pricing models	Investments in training of staff
No. of new marketing methods		Use of new marketing methods	
No. of sales concepts	No. of start-ups with reputable venture capital (VC) funding	Use of sales concepts	Degree of involvement of employees in decision making
No. of new logistics models		Use of new logistics models	
	Availability of seed money funds and venture capital fund managers		Proportion of flexible companies
	No. of start-ups in first/second/third round VC financing.		

Government departments regularly use customer satisfaction surveys to measure their performance in delivering services. Each week, Ariba, the B2B e-procurement company, applies a 60-component rating index for customer satisfaction concentrating on how Ariba impacts on the customers' bottom line in lowering costs, raising revenues, and adding value services (Ariba, 2002). Boeing is another example of a company that places emphasis on customer measures. The company has developed a measurement instrument that suppliers use to evaluate Boeing as the customer (cited in Craig and Jutla, 2001). Relevant metrics and measures are:

(1) *Metrics and measures for e-governance leadership*:
- presence of an e-government interoperability framework;
- degree of inter-agency integration;
- percentage of online services;
- percentage of automated processes;
- percentage of high-cost processes that are non-automated;
- percentage of municipal-provincial-federal system integration (Canadian and others);
- percentage of local-state-federal system integration (US and others); or
- percentage of local-regional-central system integration (generic).

(2) *Metrics and measures for government e-services*:
- abandonment rate;
- accuracy rate;
- average response time;
- call duration;
- chargeable call duration;
- chargeable/nonchargeable service problem ratio;
- community index (for example, access to expertise in newsgroups);
- customer feedback availability;
- customer retention ratio;
- customer satisfaction level;
- elevation and transfer rate;
- e-mail response system availability;
- knowledge access index;
- non-chargeable call duration;
- number of incident reports per product;
- number of calls before a problem is resolved;
- personalization index;
- product or service knowledge levels;
- partner loyalty and satisfaction indexes;
- customer loyalty and satisfaction indexes.

Regulatory, trust, and financial infrastructure

Trust in all its many definitions (Bromiley and Cummings, 1995; Hosmer, 1995, Mishra, 1996; Sitkin and Roth, 1993) is clearly a necessary enabler to e-business. Lewicki and Bunker (1995a, b) discuss three different forms of trust:

(1) personality theorists' view of trust as an individual difference;
(2) economists' and sociologists' view of trust as an institutional notion; and
(3) psychologists' view of trust as an expected behavior and outcomes of another party in a transaction.

All these definitions apply to e-business, and the mechanisms described above address various elements of each form of trust. Dove (2000) states "cultivating trust should be a conscious relationship development strategy with managed objectives, performance metrics, and progression monitoring".

Small businesses are often much more trusting than big business with sometimes undesirable outcomes. There is a clear need for education to improve contractual arrangements and management at the SME level. Signing of non-disclosure documents should be a norm rather than the exception at the employee and partner levels. SMEs need an active climate of trust and redress to aggressively engage in B2B internationally, or B2C commerce at national and international levels. Public and private sectors are beginning to propose alternative and cheaper trust and dispute resolution mechanisms. We outline some of these mechanisms next from a top-down perspective. Metrics for trust mechanisms are:
- presence of a regulator for the trust providers;
- percentage of businesses that transact in foreign countries;

- percentage of SMEs that transact in foreign countries;
- strengths of the guarantee for non-repudiation, authentication, and non-interference of digital transmission;
- scalability of the trust solution mechanism;
- sophistication of the PKI management infrastructure;
- quality of online ADR mechanisms;
- cost of online ADR mechanisms/cost of traditional arbitration;
- usage of online ADR mechanisms;
- percentage of SMEs that have accredited seals;
- percentage of SMEs that look at seals before transacting business;
- degree of jurisdictional clarity in SMEs' operating areas;
- degree of compliance with UNCITRAL;
- degree of business compliance with uniformity legislation;
- degree of government department's compliance with legislation;
- degree of commonality of laws in targeted operating areas;
- percentage of transactions outside of state operating with different laws;
- degree of taxation automation (how many of the transactions completed required new rules or human intervention because of taxation);
- weighted ratio of favorable taxation rules to unfavorable rules;
- degree of seal awareness at SME level;
- privacy index;
- customer satisfaction with trust provider;
- consumer protection index;
- service level agreement compliance;
- number of disputes;
- time to resolve disputes.

Many associations have been formed in alliance with government to create specific domains of trust. TrustUK (2002) is a project under the auspices of the Alliance for Electronic Business in the UK. The aims are to "foster consumer trust and confidence in Internet trading through the accreditation of on-line codes of practice". In 1999, an industry led, self-regulatory body called tScheme (2002) was set up to approve electronic trust service providers and their services. tScheme provides an approval mark to trust provider companies when they meet criteria that match internal approval profiles. tScheme is a preferred provider for dealing with the UK's Electronic Communication Act. Thus SMEs in the UK are encouraged to use a trust provider that has the tScheme seal of approval.

The security of data transmissions depends on the encryption of data and authentication of source and destination of data that are provided through public key security systems. The primary obstacle to the widespread deployment of such systems is the lack of national support structures – a public key infrastructure (PKI). A PKI associates authentic public keys with authorized users; administers the management of the keys, including their generation, distribution, and deletion; and stores, retrieves, and archives keys. The goal of the companies maintaining the PKI infrastructure is to validate each party involved in an Internet transaction, that is, they guarantee and confirm that the individuals exchanging information online are who they claim to be. Governments are actively supporting the companies that have the technology infrastructure and financial wherewithal to maintain the stability of PKI security mechanisms to provide data transmission security.

SMEs deal with local, national and international banks continually. Mechanisms to make it easier to transact B2B commerce between SMEs in different countries are appearing through financial sector networks. For e-business readiness, the banking sector must support electronic financial transactions among SMEs, and foreign investments and partnerships with SMEs utilizing information and communication technologies. In April 1999, a network of banks launched Identrus (2002), a PKI-type infrastructure that permits financial institutions to issue digital certificates to their business customers. Identrus allows the business customer to seamlessly deal with multiple financial institutions. That is, a single digital certificate will enable the customer to settle transactions with many different institutions. Identrus applications include e-billing, secure messaging, and document handling. Bank of America, Chase, Citibank, Wells Fargo, ABN Amro, and the Deutche Bank are among those enabling secure commerce through Identrus. The implications

of Identrus for SMEs are in the area of international trade. If you are an SME in Canada wanting to do business with an SME in Europe, and if both businesses are using banks on the Identrus network, there are intermediaries between the two that implicitly state that they know about these businesses, thereby encouraging trust.

TrustInfo (2002) works somewhat analogously to Identrus but is in a chamber of commerce setting. The traditional chamber of commerce is considered the voice of the SMEs. TrustInfo is the premier trust seal in use at the International Chambers of Commerce, the World Chamber of Commerce, and the Paris Chamber of Commerce. The idea is in order for businesses to obtain the TrustInfo seal, the business must be a member of a local chamber of commerce, therefore be known to a trusted third party. The accreditation process for the seal actually involves four parties: the business registry in the local area, the local chamber, a contact person in the SME company, and a local bank. TrustInfo is currently used in B2B transactions between small businesses in France, Ireland, Canada, USA, UK, Greece, Romania, Bulgaria, many of the Mediterranean countries, and South East Asia through local chambers of commerce.

The chambers of commerce are promoting online alternative dispute resolution for their SME members. The International Chamber of Commerce is partnering with eResolution.ca for provision of the cheaper online alternative dispute settlement mechanisms. Most member companies cannot afford to fight battles outside of jurisdictional boundaries. The decision as to which country's laws apply often predicates how a dispute can be settled. In May 2001, the EU entertained discussion on a controversial Brussels Regulation, known as the Rome II Greece Paper which lets consumers in European Union countries sue global Internet companies in the home country of consumers (Usher, 2001). The Brussels regulation is hotly debated in the USA as major global Internet companies are US-based and uphold the US government policy of anti-regulation with respect to the Internet. However, uniformity in cross-border rules, and alternative dispute resolution (ADR) mechanisms, enable a wider sense of security for e-business transactions.

Uniformity and consistency of governmental regulations continues to be a major issue. In the European Union, analogously to the USA, difficulties arise even when the laws are adopted in each member country/state. We find that each country/state interprets and executes the rules quite differently. Although the United Nations Commission on International Trade Law (UNCITRAL) has the task to "further the progressive harmonization and unification of the law of international trade" (UN, 2001), there are a number of countries that have varying degrees of compliance. Businesses selling in a global marketplace must be aware of these legal considerations for reasons ranging from taxation to privacy to criminal proceedings. Businesses must be aware of whether the business content is considered legal within the jurisdiction that the business is operating, or which countries' legal processes are applicable in the target market.

Another area requiring uniformity is taxation. The OECD has five policies that the member states have agreed should be used to form policies for taxation, including: neutrality, efficiency, certainty and simplicity, effectiveness and fairness, and flexibility. Taxation rules within e-business raise two specific issues for businesses: a government's right to tax and double taxation. The government's right to tax concerns their ability to tax business activities that happen within their state. Difficulties quickly arise due to the stateless nature of the e-business environment that does not have the normal boundaries that define a traditional state. The double taxation issue is raised when the state finds that a business or individual is doing business in its state and taxes them in addition to the state to which that the business or individual belongs.

Government legislation to equate electronic signatures to handwritten signatures is another means to build the public's confidence in the security of Internet transactions and promotes the use of electronic communications. Throughout 2001, many of the 48 countries in the EU have introduced such legislation based on a European Commission Directive on a Community Framework for Electronic Signatures. Canada and the USA have already passed similar legislation.

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Another area of trust is the guarantee of the privacy and proper use of individual company and person data. The EU has introduced regulations that require businesses that obtain personal data to only use the data that the businesses were given express consent from the client to use. They must use it in the manner that they said they would when they were acquiring the data. They must not use any data that predates the regulations because they was not obtained using the correct procedures. SMEs must post privacy policies on their Web sites and maintain awareness of database legislation, freedom-of-information, and personal data law.

Content infrastructure and access

From empirical observation, a problem facing SMEs in developed countries is the absence of sufficiently organized content to access. Britain has a pilot project called Culture Online (Department for Culture, Media and Sport, 2002) that produces a collection of cultural assets – text, images, theatre, and objects. The vision for the future is to have every country's cultural assets online and accessible worldwide. Even the most connected countries still need to facilitate the organization of content around verticals and clusters for SME participation and aggregation. Online collections are especially important for accessibility, lifelong learning, and the weaning off of dependencies on more expensive off-line services. Many small businesses are intimidated by walking into a consultant's office. People are afraid of the initial dollar charge as they walk in and sit down. Well-organized online and off-line resources can aid in allowing SMEs to help themselves in a more cost-effective manner.

The Internet can facilitate clusters of SMEs in vertically related industries such as Porter's (1998) examples of the Portuguese leather industry and Silicon Valley. Good examples of aggregating content for increased effectiveness are in tourism and the entertainment industries. Small start-up bands can connect with small studios with unused capacity. Other SMEs such as ISPs, accountants, lawyers, and bankers can knowledgeably complement service offerings to benefit the companies in the cluster. Complete travel experiences can be marketed by pooling the resources of geographically co-located

SMEs that provide accommodation, entertainment, and activities. Many small businesses cannot individually afford e-commerce enabled Web sites. Consumers will not find all the available attractions in an area if they have to find individual Web sites. A portal to a cluster is much more effective.

Locating SMEs on-line is a non-trivial access issue. SMEs cannot afford to pay large portals such as AOL and Yahoo to appear in the top ten results in their search engines. One solution to this problem is through the use of powerful SME associations to raise the visibility of SMEs. Currently, SMEs can go to the portal for the World Chambers Network (WCN, 2002) to use a search engine that shows only SMEs in the results.

SME employees' use of online content leads to increased productivity. Only when the integrity of the business' information is maintained can employees make good decisions from the information's aggregation. Companies such as HummingBird (2002) and Autonomy (2002) offer portal products for enhancing employee productivity. The portals provide a single interface to get to information that would ordinarily require multiple applications to be opened. For example, a single interface can be used to view word processing files, the results of a database query from Oracle or SQL server, or e-mail data. The portals support tools, which can search all popular file formats, and retrieve data on the search topic from one or more of these files. The products empower workers to capture and share knowledge. The agent content manager gives easy access to what documents are available about a certain issue and which employee(s) handled the issues. In addition, the rise in usage of technologies such as e-mail, white boarding, and multimedia conferencing in e-business is increasing the level of interactivity of employee tasks and will also have an impact on productivity.

Clearly, enablers such as knowledge management applications will play a key role in the "content" dimension (Craig and Jutla, 2001). Knowledge management metrics are applicable to the area of e-government services as well as for the SME sector. Relevant metrics and measures for content are:

- presence of an agent to create a sustainable body of content;

- quality of collection and implementation standards;
- degree of integration with offline components;
- degree of integration with related content;
- percentage of protected content;
- availability of content;
- percentage usage of the networked content;
- level of integration of all systems containing content;
- employee productivity, satisfaction, retention, loyalty, and profitability;
- customer satisfaction, retention, loyalty, and profitability;
- data currency;
- interoperability of transaction management components;
- data consistency;
- search accuracy;
- speed of update;
- search response time;
- volume (growth) index for knowledge base;
- interoperability index (with external systems);
- productivity index;
- knowledge access time;
- frequency of access to knowledge base;
- frequency of access to collaboration work areas;
- cost per task or per call;
- number of tasks that are self-service;
- time per task or per call;
- number of projects per employee;
- number of corporate/government information collections;
- number of employees per project;
- percentage of employees using knowledge base;
- number of instances of non-owner access to documents;
- average utilization rate of knowledge base;
- amount of knowledge transfer;
- knowledge accessibility index;
- knowledge transfer speed;
- increased business benefit in service;
- cost savings in business process; and
- quality of service, which includes availability of services, transaction response time, transaction throughput, video quality, audio quality, and video rate.

Human infrastructure: skills distribution network

SMEs require an IT-based workforce to compete and sustain the firms. There is a well-documented universal IT-skills gap. Developing IT-enabled skills in our children at primary and secondary school levels is recognized as necessary to the future of all countries. The UK installed the "National Grid for Learning" to increase the IT competency among teachers, and to connect all its schools to the Internet.

Some countries are investing in programs such as the International Computer Driving License (ICDL, 2002), which is a Finnish-born curriculum and test standard currently available in 49 countries. In Europe, industry workers, schoolteachers, and social services' recipients extensively earn the ICDL to signify upgrade of IT skills.

The roles of associations extend to identifying exactly what labor skills are needed for the hosting country. For example, ITAC – the Information Technology Association of Canada, the Software Human Resource Council, and the Human Resource Development Corporation have identified a critical need for good labor market information (ITAC, 2002). To promote inclusion further, IT associations often help place recent graduates from non-IT programs in internships in the IT industry.

Governments are supporting programs to create thousands of new spaces in college and university IT programs. Colleges and universities aid in skills development and extend the reach of certain skill development services through making them available through online learning and distance education. Online courses are rapidly becoming a commodity accessible to many employees of SMEs.

Online learning is promoted as providing the right information and skills to the right people at the right time. Two characteristics of online learning that are particularly suitable for SMEs are that online learning is available anywhere there is an Internet connection, and that course content can be continually updated. International Data Corporation estimates that the e-learning market will soar to US$11 billion by 2003.

One of the more useful mechanisms for transferring knowledge and innovation to the SME sector is through distribution channels such as university business development centers and networks. These provide pertinent e-business development skills at very low cost to SMEs. Traditional services have included writing business plans, developing new products, and assisting with complex accounting and taxation issues. These centers and/or networks have existing client bases that they can influence directly and hence increase the rate of e-business adoption by SMEs. Useful metrics and measures for human infrastructure and skills distribution are:

(1) Workforce turnover.
(2) Education level.
(3) Employment rate.
(4) Percentage of teachers trained in how to implement IT in learning (OECD measure).
(5) No. of adults with postgraduate education.
(6) Percentage of adults using continuing education (life-long learning indicator).
(7) No. of private/public companies in e-learning space.
(8) No. of SMEs using e-learning facilities.
(9) Percentage of SME employees using:
   • knowledge management applications;
   • supply chain applications;
   • customer relationship management applications;
   • online government services;
   • stripped-down ERP-type applications (e.g. MS WhitePlains);
   • security applications; and
   • HR applications.
(10) Percentage of existing business service centers providing e-business services.
(11) Sophistication of e-business services.

Communications and information systems infrastructure and access

A dense networking infrastructure to support digital communications is the obvious backbone of any information society. New broadband and wireless technologies are being funded and developed so that eventually all citizens and businesses in urban and the most rural areas (the last mile and the last inch) will be connected. Deployment of broadband will not

happen overnight. Upgrading, replacing, and adding to communication infrastructure is not cheap. The status in mid 2001 for the USA, Canada, and the leading European countries is that the research communities within each are on high speed 2.5 Gigabits per second (Gbps) networks. US universities and private and public sector partners are on Internet2 (2002). Canadian equivalents are on CA*net 3. The Netherlands launched SurfNet5 in late 2001 and Norway is on NORDUnet. The Dutch SurfNet link to Internet2 was upgraded with a gigabit ethernet connection in November 2001 (I2News, 2001). Singapore is on SingAREN and the latest data stated that they were at 622 Mbps capacity.

The European networks are connected through the Abilene backbone to the Internet2, and there are connection agreements with APAN, the Asia Pacific Advanced network, NII in Japan, and CA*net. Star Tap, a point of presence (POP) in Chicago, connects the continents of America, Europe, and Asia. Star Tap allows communication with US research networks, CA*net in Canada, and others in the Asia-Pacific zone.

Wireless infrastructure is also being pursued. Europe is preparing for the introduction of third generation mobile telephony, 3G, with transmission speed of up to 2Mbps in 2002. The speeds are about 200 times faster than what was available in 2001. The Swedish company Ericsson developed the 3G technology that is known as Universal Mobile Telecommunication System (UMTS). Basic research is being conducted for 4G mobile technologies that will provide the next leap forward in mobile bandwidth.

So what are the bandwidth implications for the SMEs? Currently SMEs do not have access to high bandwidth such as 2.5Gbps. For many the fastest means are cable or ADSL over telephone lines (up to 2.5Mbps capacity – 1,000 times slower than 2.5Gbps, and for the mid-sized companies, T1 and T3 trunks. The figures for broadband adoption, even at 2.5 Mbps, are extremely low. In 2000, the Nordic countries had 2.3 per cent penetration, and the UK, 0.3 per cent. Market forecasts suggest that these numbers will rise to 30 per cent and 15 per cent by 2005 (European Profile, 2001). The predicted 2005 numbers are still not very large.

Moving a country to over 50 per cent 2.5Gbps high-speed broadband penetration that enables one to download a movie in fractions of seconds is still years away.

However, for strategic planning it is important for SMEs to be aware of current and future developments in bandwidth, and market forecasts for communication and information infrastructure penetration, to deduce the timeline for stabilization. Bandwidth can have very direct implications on some SME business models. Take, for example, the small Canadian firm InfoInteractive that sells a call manager product, which allows users who share the same phone line for both modem and calls to seamlessly disconnect from the computer and accept the incoming call. Anecdotally, many observers thought that as cable penetrated, InfoInteractive would have to rapidly diversify its product base or go under. However, most of these observations are made without considering facts such as the large percentages of populations in rural areas and third world countries that have not yet obtained cable or ADSL. For many years, a significant percentage of the world population will be connected with modems (512K or 1Mb). AOL has recently purchased InfoInteractive.

The availability of Internet service providers (ISPs) and commerce service providers (CSPs) in a region contributes to e-business readiness. The sophistication of available e-business services affects SME adoption of e-commerce. Most ISPs/CSPs should provide hosting of Intranet and internet Web sites, e-commerce, and portal services to the SMEs that cannot afford the capital investment in hardware, software, and technical personnel.

Governments, for example the UK, Canada, and the USA, are also investing in providing every citizen access to the Internet. Several developed countries guarantee 100 per cent connectivity to their citizens by ensuring that all schools, public libraries, and community centers are wired to the Internet and have at least a terminal for browsing on the Internet.

Many initiatives are being funded to connect rural communities to the Internet and to exploit the use technology of applications for the disabled. Web sites are being upgraded for the disabled and the elderly. Many federal sites in Canada allow the elderly to "click here" for display in larger font sizes. The US Disabilities Act ensures that as soon as technology becomes available for the disabled it is deployed in every learning institution in North America. In Canada, the Community Access Program ensures that over 10,000 rural communities are connected to the high speed Internet. While access is growing very quickly in many countries, actual penetration rates show that connectivity is still a problem. For example, according to the National Telecommunication and Information Administration (NTIA, 1998) the penetration rate for the US population is around 55 per cent. A parallel and increasingly higher hurdle is to provide adequate content for access.

The communications and information infrastructure components have the most developed and commonly used measures worldwide, briefly, these are:

(1) Investment in communication infrastructure per populated square mile.
(2) Number of Internet hosts.
(3) Investment in communication infrastructure per capita.
(4) Availability of Internet hosts.
(5) Maximum broadband transmission speeds.
(6) Internet access costs.
(7) Broadband penetration.
(8) Wireless access costs.
(9) Cable penetration.
(10) Broadband access costs.
(11) Telephone penetration.
(12) Scalability of network infrastructure.
(13) Quality of telephony.
(14) Quality of cable connection.
(15) Quality of broadband connection.
(16) Availability of dial-up service.
(17) Availability of cable service.
(18) Availability of broadband service.
(19) Availability of hardware and software.
(20) Affordability of hardware and software.
(21) Percentage of schools online.
(22) Percentage or rural communities online.
(23) Percentage of community centers online.
(24) Percentage of voluntary associations online.
(25) Percentage of associations online.
(26) No. of ISPs per 1,000 inhabitants.
(27) Percentage of SMEs with a Web site.
(28) Percentage of SMEs using an intranet.

(29) Percentage of SMEs with e-commerce capability – percentage of SMEs using e-mail.
(30) Percentage of SMEs with fully integrated back-end and front-end systems.
(31) Percentage of SMEs using:
 • knowledge management applications;
 • supply chain applications;
 • customer relationship management applications;
 • online government services; and
 • security applications.

See Press (1997) for an excellent compilation of organizations that track the diffusion of the Internet, providing metrics and measure results for hundreds of nations worldwide. The metrics we have additionally proposed are in the last row of the measures dealing with access to sophisticated e-business applications.

SME initiatives in four e-developed countries

In this section, we present the state of SME e-business readiness initiatives in four specific countries that have innovated in terms of SME e-business readiness. These are Canada, The Netherlands, Norway and Singapore. At the time of writing, the linkage between the theoretical metrics and measures proposed above and the reality of what data were available for these four countries is fairly weak. Creating comparative tables is currently not feasible.

Canadian approach to e-business readiness

Approximately 630,000 of Canada's one million businesses are now online. The majority of Canadian businesses are very small; 97 per cent of the one million businesses have less than 50 employees; 78 per cent have less than five people (StatsCan, 2001). According to the Canadian Federation of Independent Businesses latest survey (CFIB, 2000), 71 per cent of firms with between 5 and 19 employees are connected, while usage among the micro businesses with fewer than five employees is around 60 per cent. SMEs employ six out of ten working Canadians. A total of 35 per cent of

SMEs have Web sites, sell, and buy online. Another 34 per cent use the Internet for browsing and e-mail only. The sectors that are most using the Internet are the business services industry (legal, accounting, and consulting fields), and manufacturers, wholesalers, and franchises where marketplaces are being created for online bidding and outsourcing (CFIB, 2000). It is clear that the growth of the SME sector is important to the Canadian economy. We will examine Canadian advances with reference to our proposed model for government involvement to support the e-business readiness of SMEs.

In terms of communications infrastructure, Canada has the world's longest purely optical network at 6,000km. In 1998, Canada's Advanced Internet Development Organization, CANARIE (2002), initiated the first project in the world to create this purely optical-based national network. CANARIE, in partnership with the Bell consortia of private companies, initially created ten GigaPOPs – ten Points of Presence operating at billions per second speeds (one GIGAPOP per Canadian province). According to CANARIE, "CA*net 3 is being used as a model for the next generation of networks in other countries (CA3, 2002)". In late 1999, Canada was leading the rest of the world in communications infrastructure by almost a year. However, by early 2001, most other countries had leapfrogged to install similar infrastructure with the same transmission speeds. Canada is reported to have delivered, but not yet deployed, 10Gbps speeds in 2001. Since the CA*net3 network is not available to SMEs, being ahead in the technical infrastructure is not enough to affect the SME economy today, but certainly impacts on companies such as Nortel and Bell Canada.

Aside from telecommunications development, Canada has made over 7 billion Canadian dollars available for the creation of knowledge and innovation through various federal-level research and development funding agencies over the next four years. Canadian researchers Lefebvre and Lefebvre (2000) illustrate how R&D and knowledge intensity in SMEs are positively related to their export effectiveness and also suggest a strong link to job creation potential.

Canada has made many advances in establishing information infrastructure, increasing access, and upgrading skills. By March 1999, Canada had connected each school and public library, under the SchoolNet and LibraryNet initiatives. A goal for 2001 was to connect every classroom. The latest figures available from the final report (SchoolNet, 2000), presented to the National Schoolnet Advisory Board in May 2000, state that there are close to half a million connected computers in Canadian schools. The goal was not reached by 2002. From SchoolNet's (2000) final report, it appears that Canadian schools connected more computers to the Internet in computer labs in schools as opposed to connecting the classrooms.

Through the community access program (CAP, 2002), Canada intends to connect 10,000 rural communities. The VolNet (2002) initiative intends to connect 10,000 voluntary organizations by March 31, 2002. Canada also uses the International Computer Driving License curriculum for professionals and teachers to upgrade IT skills. In a train-the-trainer program, the Student Connection Program (SCP) hires and trains university and college students to act as business advisors on Internet and e-business to SMEs.

Government Online or "GoL" (GoL, 2002) is Canada's naming of e-government. All provinces are mandated to place a large percentage of services online to all citizens by 2004. Behind the scenes, the Canadian government has enabled a network of government departments and agencies that service SMEs to co-ordinate and exchange research projects, experiences, and programs as an initiative under its "e-business growth strategy". To complement the public sector activities, a Canadian e-business opportunities roundtable comprising mainly private sector representatives was formed in mid-1999 to "accelerate Canada's leadership in the digital economy" (eTeam, 2002). Six subteams led by roundtable members form the e-Team Canada umbrella.

Legally, Canada's Personal Information Protection and Electronic Documents Act (Bill C-6, 2000) recognizes the equivalence of electronic signatures and documents to the physical counterparts. The Canadian Radio-Television and Telecommunications Commission (CRTC) is continuing its commitment to the exemption of Internet based services from licensing and regulation. Canada has proposed a Seal of seals for regulating trust providers.

Outreach programs to the SME community are ongoing. In 2000, agencies of Industry Canada did dozens of workshops and seminars on e-commerce for the SMEs across Canada. While uptake is good on e-mail and informational marketing Web site applications, there is a marked lack of uptake on more sophisticated e-business applications such as customer relationship management and content management applications. Also we see inconsistency on how e-business is defined by local SME associations, leading to inconclusive measures of e-business adoption.

In summary, Canada is experiencing flatness in SME e-business readiness indicators mainly due to low adoption of e-business applications, even though connectivity to the Internet is high. Subsequently, a subteam for the SME Adoption Initiative was created under the Canadian e-Business Opportunities RoundTable e-Business Acceleration team to encourage Canadian SMEs into becoming sophisticated users of e-business technologies.

Barriers to e-business adoption by the SMEs are being identified and pulled down. As early as 1998, the issue of the expense of credit card processing fees was identified as a prohibitor of SME adoption of e-commerce. Since then the banking sector and third parties have responded and now offer inexpensive online credit card processing services to merchants. The March 2001 report, from the SME Adoption subteam, streamed the top-level barriers inhibiting SME e-business adoption into four categories: information and education, costs and benefits, e-business resources, and security (Ivis, 2001). The report recommends an assessment of the resources and materials available from and to the public and private sectors, as well as the creation of an SME eBusiness Toolkit. According to Ivis (2001), "SMEs not using the Internet cite ROI and cost as primary inhibitors, those using the Internet cite the lack of e-business strategy as the barrier, and those implementing transactional capability say that security is the barrier". Therefore the

recommendation is for the creation of a toolkit of resources for the SMEs to overcome these barriers. A first version of the toolkit is available at ebizEnable (2002).

On a national level, SMEs are asking for leadership, consistency, and signs of stability from the federal, provincial and federal governments, who have a tendency to take different approaches to setting standards (e.g. security standards), and building systems. From SME associations and the National Liberal Caucus Economic Development Committee are recommendations for beneficial tax treatments on e-business related SME expenditures, similar to those given for Y2K in 1999.

The Dutch digital delta

The European "Go Digital" initiative is aimed squarely at SMEs for adoption of e-business. The European Commission claims that e-commerce in the European Union is hampered by lack of consumer trust. A total of 66 per cent of small companies have Internet access, but only 6 per cent of small businesses transact business online in real-time. It appears that important influences on SMEs' future uptake of e-business awareness and opportunities come from the roles of associations and governments.

The Dutch Syntens is a business innovation network for small businesses. According to the Syntens (2001) Web site, the agency has 450 staff and 15 regional offices spread throughout The Netherlands. Some of the work that Syntens does that is not listed on the Web site includes five days of free consulting for the SMEs in e-business knowledge, train the trainer programs, workshops, and seminars for the dissemination of knowledge (Couzy, 2001). Syntens was established in 1987 to promote technology innovation and change in SMEs' business processes. Syntens inundates the SMEs with e-business resources in the form of continuously held free workshops, and self-help organized libraries and case studies. Syntens offers a full range of services from drawing attention to e-business to helping SMEs to implement applications.

Syntens draws attention to e-business through campaigns with television and newspaper ads that use real-life content to inspire "could it be me", "should it be me?" thinking. One of Syntens strategies is using trained advisors to give workshops in e-commerce methods, e-procurement, e-marketing and so on. These trained advisors also join the consulting arm of Syntens.

Syntens uses a strong network of partnerships among research organizations, educational institution, industrial associations such as employers association, and unions, public and private sectors. It is supported by the EC Platform (2002), which has a dedicated staff of 15 people and a membership of 170,000 consisting of leading business organizations, associations, government agencies, and universities. Employers association, IT associations, consumer associations, standards groups, and international linkages are part of the EC platform.

In the area of trust, the government has taken the position that market forces will fill the trust/confidentiality gap. Government will be used to stimulate the development of trust in e-commerce. According to Petra Smits, policy advisor in the Dutch Ministry of Economic Affairs, The Netherlands has an acute legal environment to make it possible for market forces to stimulate such development (Smits, 2001). The Netherlands supports "freedom of proof". Anything can be taken into the courtroom as proof. The European Union established a directive on electronic signatures that translates to recognizing the equivalence of an electronic signature to a handwritten signature. The Dutch TTP.NL (Trusted Third Party Point NL) has adopted the EU digital signature directive (TTPNL, 2001). In the private sector, Identrus and corporate PKIs provide security measures. On the investment side, venture capitalists such as Twinning, Holland Venture, Gilde, and Nesbic still have lots of funds to invest in good new economy ideas (KPMG, 2001).

The eNorway approach to e-business readiness

While Norway, by choice, is not a member of the European Union, its government has generally tried to follow all European Union regulations and programmes. As a response to the launch of the eEurope, program, the Norwegian Government established its own

comprehensive plan, called eNorway in 2000, which has the objective to develop Norway as a leading nation in the electronic community (eNorway, 2000). In most ways, the eNorway plan is similar in intention and orientation to the EU initiative (EUinitiative, 2002). Its approach to implementation is, however, different in that the eNorway plan is administratively cross-departmental and can be implemented quickly given its focused orientation. Its single country perspective facilitates the more rapid mobilisation of collective resources. The eNorway plan aims at promoting e-commerce in the commercial business sector as well as establishing Norway as a leader in electronic public administration (e-leadership). All the specific e-initiatives under the action plan are monitored and integrated by a co-ordinating office led by an e-co-ordinator, who is appointed by the Minister of Trade and Industry, and who reports directly to the Prime Minister on a monthly basis. As well, this office ensures that the progress reports and status of all the various e-initiatives are available to the public thorough its Web site. This ensures transparency in the e-efforts and also provides a clear signal to the private sector as to what initiatives the government is working on so that there will not be a public-private sector conflict or overlap in efforts.

The co-ordinated e-business readiness push is already bearing fruit. One of the results has been that 23.3 per cent of Norwegian taxpayers filed their tax returns using the online option in the spring of 2001. Internet penetration at home is higher in Norway (50 per cent of households) than the EU average of 28 per cent as at October 2000. Given that many people access the Internet in non-domestic environments, particularly at work, school or college, it is also important to consider overall total percentage of Internet users in the population. This number is 67 per cent for Norway as compared to the EU average of 40 per cent. Of these, 51 per cent of Norwegians are regarded as active Internet users, defined as users who access the Internet weekly or more often. Internet shopping is also fairly widespread, with 35 per cent of Norwegians having shopped online (including online banking). Slightly more than 13 per cent of

Norwegians had shopped online in the last month. Norway's e-business readiness for mobile e-commerce is also at a high level. According to Statistics Norway, approximately 68 per cent of the total Norwegian population have their own cellular phones (StatNorway, 2001). Penetration is highest amongst younger parts of the population, with 90 per cent of 16-19 year-olds owning a cell phone.

While Norway leads Europe in terms of penetration and use of the Internet, the situation is different in terms of the costs of Internet access. In the EU, Internet access costs have been coming down quite considerably since the eEurope plan was launched. For example, the OECD has estimated that between March and September 2000, the cost for 20 hours of Internet use per month at off-peak times (which is representative of private household use) was reduced by an average of 8.6 per cent in the EU. In Norway, however, the comparable numbers show a price increase of 7 per cent. Similarly, while the costs for 40 hours of Internet use at peak rates (the more relevant metric for SMEs) have fallen by 23.0 per cent in the EU during the same six months, the comparable number in Norway represents an increase of 2 per cent. In some ways, this can be attributed to the stronger (monopolistic) role of the largest telecommunications access provider, Telenor, in Norway. Telenor, which was state controlled through ownership, became a public-listed entity on the NYSE in 2001.

The eNorway action plan also focuses on the issue of broadband Internet connections and access. Broadband access is recognised as an important enabler for large-scale e-commerce adoption. The national budget for 2001 has provisioned 300 to 350 million NOK for government spending on activities related to broadband development in Norway (Broadband, 2001). The government has signalled that it will not undertake to provide "the last mile" of access to the consumers. Rather, its focus is on laying the ground for commercial businesses and telecommunications companies to provide broadband access to consumers. The government will, however, work towards providing broadband access to public institutions, such as libraries, schools, etc. While high-speed Internet access in Europe

through ADSL (1.1 per cent of EU households) and cable modems (7.8 per centof EU households) is available, no comparable user figures are available for Norway. However, by the estimates of Telenor, 50 per cent of the telephone subscribers will have been offered ADSL by the end of 2001. Statistics from February 2001 also show that 67 per cent of high speed Internet access was through ISDN lines as against 1 per cent for cable modem access. Cable modem access is still not widely developed but the recent introduction of competition to local access networks should see more residential customers having access through this medium. As is the case in the EU, local loop unbundling (LLUB) regulation has recently been implemented and this is expected to further stimulate the deployment of broadband access services.

On September 29th, 2000, the Norwegian Parliament passed legislation giving electronic signatures full acknowledgement as a legal sign of verification. This had been an important component of the eNorway plan as a means of providing security for e-commerce transactions. There have also been significant public-private sector initiatives in terms of security for e-commerce. A prime example is the Netaxept initiative (Netaxept, 2001) that focuses on building the operational and fulfilment infrastructure for providing secure settlement and delivery for e-commerce transactions. This has been developed thorough a partnership involving Norway's largest bank (Den norske Bank), the state-owned Norwegian postal service, Posten, and the Accenture consulting organisation. Netaxept aims to become the standard for online shopping in Norway and represents the extension of an established payment system (debit cards, credit cards, GIRO) to online shopping. Netaxept is positioned as a trusted third party for Internet transactions and offers consumers full choice in banking and dispatcher selection. Consumers also do not require a special bank connection to be able to use Netaxept. Now in its second stage of development, Netaxept is planning to extend its service to provide a solution covering all of Scandinavia. It also provides electronic IDs, e-billing services, and factoring/reconciliation services to clients. It also capitalises on the state-owned regional post office network of

Posten to provide reliable door-to-door delivery and flexibility in dispatch options as well as a reverse logistics process for goods that are returned by consumers. Netaxept represents a full service option for small and medium-sized enterprises seeking to initiate e-commerce operations. Another key partnership initiative pertains to the establishment of the Nsafe seal (Nsafe, 2002), which is primarily targeted towards business-to-consumer e-commerce. This represents a collaboration between the national consumer association and an organisation representing Norwegian e-commerce businesses (e-Forum). Internet businesses that subscribe to the seal have to register (and pay a small fee) before they are allowed to display the seal, which signifies that the business complies with certain e-business standards. These include traditional auditing and accounting standards, information regulations for the site regarding organisation, products, payment, delivery and availability, and customer privacy, as well as a contract obligating the site to follow the council's rulings on consumer matters.

Through the eNorway action plan, the government has also made specific commitments to promote e-commerce among SMEs and new venture start-ups. The Statens Naerings og Distriktsutvikling (SND) governmental agency has been selected as the prime mover for these efforts aimed at facilitating the promotion of e-commerce trade and entrepreneurship in the SME sector. It had developed a Web portal called VeRDI (Verdi, 2002), which translates to value, that provides a comprehensive set of promotional and educational services for the e-commerce initiatives of SMEs. Besides creating awareness and knowledge about e-commerce among SMEs, VeRDI helps SMEs create and implement an e-strategy. It also assists in making e-commerce more feasible for this sector by analysing pertinent problem areas and promoting pilot programmes. The Web portal services include comprehensive guides and answers to questions regarding e-commerce technology, law, research, markets, etc. VeRDI also presents an online strategy guide for the use of SME management. This "tool kit" is a step-by-step guide that helps SME management develop and formulate an

e-strategy and develop e-action plans for implementation. In some instances, VeRDI also provides e-commerce consulting assistance to SMEs, especially when other projects may learn from the experiences. VeRDI has also held e-commerce workshops to help SMEs implement their e-strategies. In a sense it maintains a comprehensive e-commerce resource centre targeted at its SME customers and serves as a rendezvous for SME groups who wish to develop e-commerce amongst them. The SND organisation also provides financing for e-commerce projects but it has no stated policy on prioritising e-commerce projects over traditional business regional development projects.

Recent surveys conducted by Statistics Norway show that approximately 8 per cent of all enterprises with at least ten employees had turnover from orders received over the Internet. Based on the Internet plans of the total responding enterprises, this figure is expected to increase to 13 per cent in 2001. The hotel and restaurant industry sector had the highest percentage of enterprises with sales over the Internet (17 per cent) while the retail sector had the lowest percentage (4 per cent). Given that restaurants and retail organisations generally constitute a large component of the total number of SMEs, this suggests that SME e-commerce readiness and adoption probably varies by industry sector. While the survey did not particularly focus on SMEs, this observation is also supported by the fact that while 12 per cent of enterprises with more than 100 employees had turnover from the Internet, the corresponding number for enterprises with 10 to 19 employees was 6 per cent. Internet sales as a percentage of an enterprise's total sales were generally small. Almost 80 per cent of the enterprises with e-commerce in 2000 reported Internet sales that were less than 10 per cent of the total sales of the enterprise.

e-business readiness initiatives in Singapore

The Singaporean government has traditionally played a proactive role in championing technology-readiness efforts in the country. It was the first in coming up with and implementing its Intelligent Island (IntIsland, 2000) plans in the early 1990s, when

expectations about the potential economic impact of the Internet were uncertain. Much of the focus of the Intelligent Island initiative was on building an Internet-type broadband pipeline throughout Singapore (called SingaporeOne) so that the country would be e-ready and able to capitalise on the Internet. Later the focus shifted to e-commerce applications with the launching of an Electronic Commerce Hotbed programme (EChotBed, 2002) in August 1996. These efforts were co-ordinated by its National Computer Board, whose major role was national e-readiness in information technologies. In 1997, this body set up a national electronic commerce policy committee and pioneered various unique e-readiness programmes. These included the setting up of Netrust (2002), which was South East Asia's first certification authority in July 1997, and the Electronic Transactions Act (ETA,1998) in July 1998. An innovation fund of Singapore $50 million was set up in November 1998 to provide a boost to information technology innovation and the development of multimedia content. About this time Canada and Singapore also announced the first cross-certification of public-key infrastructure between themselves.

In late 1998 a national level Electronic Commerce Co-ordination Committee (EC3) was formed to manage e-business readiness efforts and a Computer Misuse (Amendment) Bill 1998 came into effect to further enhance the security of e-transactions. The EC3 was instrumental in releasing Singapore's Electronic Commerce Masterplan (ECmasterplan, 1998) in September 1998. This Masterplan incorporated a string of e-business readiness initiatives that would benefit the SME sector and which were implemented in the following year. This included the launch of:
- a Government Shopfront that offered public sector products and services over the Internet;
- a S$9 million Local Enterprise Electronic Commerce Programme targeted towards SMEs;
- an eCitizen centre; and
- a helpdesk for business enquiries on e-commerce policies and development information.

The Local Enterprise Electronic Commerce Programme has to date assisted more than 500 local enterprises in their e-business readiness efforts, mostly on a cost-sharing basis.

Recognising the convergence of information, telecommunications and media technologies, the National Computer Board was revamped in 1999 to make way for a new Infocomm Development Authority (IDA) that had the mandate of being the catalyst for change and growth in Singapore's e-evolution into a vibrant global info-communications technology centre. This body has released an integrated Infocomm Technology Roadmap (ITroadmap, 2002) for Singapore that is currently being implemented. One of its aims is to extend Singapore's traditional role as a regional trading and transhipment hub to the digital world as well. Various schemes have therefore been initiated towards developing Singapore as a trusted global e-commerce hub. This includes S$30 million incentive scheme to spur e-business development and growth amongst local enterprises. This e-Business Industry Development Scheme (eBIDS) aims to assist local small and medium-sized enterprises and start-ups in their e-business knowledge acquisition, technology transfer and e-business value creation (eBIDS, 2000). The IDA in collaboration manages eBIDS with Singapore's Productivity and Standards Board (PSB). The eBIDS scheme assists local SMEs with efforts aimed at extending their reach to new international markets, optimising business processes, reducing business costs and improving e-customer service and relationships.

The eBIDS scheme also builds on the Singapore ONE broadband initiative that was launched on a commercial basis in 1998. Several innovative local SMEs participated in the development of innovative interactive multimedia applications and services for users using this nation-wide high-speed broadband infrastructure. Singapore ONE services are designed to appeal to users of all ages and occupations as well as businesses. The IDA is now working at spurring the mass adoption of Singapore ONE by extending its development into a vibrant and self-sustaining broadband ecosystem. Three initiatives, aimed at stimulating the creation of broadband value-chains to increase broadband penetration and

usage, have been launched. These encourage industry partners; especially local SMEs; to focus on the development of value-add broadband applications and services for home, work and school environments and are called the Home Environment Initiative, Work Environment Initiative and Learning Environment Initiative. All three have a strong focus on using the broadband connectivity to meet the needs of the Single Owner Home Office (SOHO) category of the SME sector. Singapore currently has six broadband access providers and more than 300 broadband industry players offering about 200 broadband applications and services to about 300,000 broadband users. One plan under the eBIDS program (introduced January 2001) supports the e-business applications needs of SMEs through the use of the applications service provider (ASP) model. Under this plan, called Jumpstart (2001), e-applications pertaining to customer relationship management, electronic resource planning and supply chain management are made available to SMEs on a variable cost ASP basis. As well, providers of these solutions are required to comply with an industry code of practice that is based on ASP industry best practices. This code of practice helps to ensure delivery of good e-service level to end-users. eBIDS also supports local SMEs with 50 per cent of qualified electronic commerce related consulting expenses and for a year's subscription fees on hardware and software purchases. While this support is capped at S$20,000 per project, local enterprises are allowed to apply for multiple electronic commerce projects as long as these projects focus on developing a different electronic commerce capability. Some of the criteria used to select SMEs for e-business readiness support under this plan include:

- they must have at least 30 per cent local equity;
- their fixed assets at net book value must not exceed S$15 million; and
- their organisational size must not exceed 200 workers if in the service industry.

New start-up ventures are also eligible if they are able to provide a formal business plan that meets certain criteria.

Another plan under the eBIDS scheme is targeted at companies that already have the existing e-commerce capabilities and wish to expand them. This is to encourage local enterprises to develop into e-commerce exchanges and hubs. This funding support is performance-based and tied to the actual online transaction value brought about by the project and is limited to one e-business project per year per company subject to a maximum of S$500,000. This performance-based orientation to the e-business readiness effort is unique as it ties support to the creation of e-business value. This is defined as new electronic business revenue created by the company and specific metrics used include the level of e-business transaction value, the number of companies conducting EC transactions, and the total number of e-business transactions. Singapore's direct focus on the e-business readiness of its SME sector is exemplified by the following statement by Loh Kok Choy, the divisional director of the PSB's Local Enterprise Division (eBIDS, 2001):

> PSB has set itself the goal of having one-in-three small and medium-sized enterprises (SMEs) on e-commerce by 2003. Incentive schemes, like eBIDS, will help our SMEs jumpstart the process of embracing e-commerce. PSB has a range of other programmes, which taken collectively, will help our SMEs to develop their total e-commerce capabilities.

This division of the PSB focuses specifically on upgrading small and medium-sized enterprises by promoting productivity and innovation as well as by developing standards and methodology. It also runs a service facility called "SME First Stop" that provides a one-stop service to any SME seeking e-business readiness assistance. To supplement this, the IDA runs an electronic commerce vendor listing system that integrates information about electronic commerce services and products that are available. This information is then made available to SMEs and the general public through a Web-based search engine. Companies providing generic information technology products and services are not allowed to list unless they demonstrate that these directly relate to electronic commerce. Between them the two e-readiness agencies, IDA and PSB, also manage two other support

schemes that are accessible to SMEs. While not specifically geared for electronic commerce development, they can be used for e-business development projects. One of these is the Local Enterprise Technical Assistance Scheme which helps local enterprises defray cost incurred in modernising and upgrading their operations through the engagement of an external expert for a limited period of time (up to 70 per cent of total costs). The other is called the Local Enterprise Computerisation Programme (Lim, 1999) that aims to encourage local enterprises to achieve a higher level of competitiveness through more effective use of information technology. This supports two types of projects. The first category pertains to feasibility study projects that define and document user requirements, prepare requests for proposals, recommend hardware and software, and develop implementation plans. The second are implementation consulting projects that involve schedule planning, project monitoring and control, procedure streamlining and formalisation, data conversion, user acceptance testing, parallel runs, and post-implementation reviews.

The IDA is also working with SMEs to initiate virtual shopping malls where online shoppers can buy basic necessities like groceries, lifestyle items such as music, movies and games, and services like on-line tuition. Its aim is to attract 200,000 shoppers to shop online. It is also encouraging small and medium-sized merchants to get their customers to adopt online shopping. It is exploring developing tax incentives for this purpose with other relevant government agencies. To build consumer confidence in online shopping it is also transitioning TRUSTe (2002), the online privacy seal, into an industry "trustmark" seal.

Given its early start and co-ordinated effort, Singapore's e-readiness is now well established (InfocommSurvey, 2001; ITUindicators, 2001). By April 2001, Internet dial-up penetration had reached 48.7 per cent of the population, while mobile phone penetration was at 70.6 per cent. Subscribers to mobile data services were also growing rapidly and stood at 12,000 as at April 2001. Figures from 1998 suggest that Internet access was primarily through modem dial up (78.5 per cent) with leased lines (64Kbps) accounting for 7.84 per

cent, ISDN for 3.01 per cent and cable modem for 2.94 per cent. In an e-commerce survey conducted by the IDA with the Department of Statistics, it was found that B2B sales had grown from S$5.67 billion in 1998 to S$40 billion in 1999, with finance and banking, wholesale and retail, and manufacturing being the leading industry sectors. More than half the companies in the survey reported more than 50 e-transactions per month. In the B2C sector, e-sales jumped from S$38 million in 1998 to S$1.17 billion in 2000, with the top three sectors being: finance and banking, real estate, and hotels and restaurants. More than 20 per cent of companies in this sector registered 50 or more e-transactions per month; 43.2 per cent of the surveyed companies who had e-commerce capabilities started such activities in 1999 and 98.7 per cent of surveyed companies had access to the Internet. Besides online sales and purchases, the most commonly used applications were online government services and software downloads.

Measurement problems and other related work

Limiting the ways to compare measures across countries are traditional problems with data collection via surveys, problems including low response rates, which lead to non-representative sample sizes, and incomplete surveys. Additionally, not all measures are comparatively defined or even well-defined across different years. It is even more difficult to obtain comparative data at a fine level of granularity.

However, to overcome these shortcomings in providing comparative data, countries are beginning to define metric sets for future analysis. In Autumn 2000, the OECD started benchmarking their member states in the IT area of business and public sectors. A 1999 AT Kearney survey on the global leaders of tomorrow ranked the UK, France, and The Netherlands, 4th, 6th, and 9th respectively. The index used to rank the countries in the AT Kearney survey measures the availability of Internet hosts and access to telecommunications lines, R&D, and the existence of well-educated people.

The need for metrics for governance was also identified in the US National Center for Public Productivity's (1999) performance measurement manual. There is a lot of literature on best practices in implementing performance measurement systems, but very little on the metrics themselves. The French introduced an Innovation Chart in 1998 that is being widely adopted in Europe, however, many critically important measures are still missing from it.

Harvard University's International Development Center announced a Spring 2001 e-business readiness guide (E-readiness, 2001) consisting of 19 indicators organized into access, learning, society, economy, and policy categories. The five access indicators are speed and quality, information infrastructure, Internet availability and affordability, and hardware and software availability. The three learning indicators are: developing the ICT workforce; school's access to ICT; and enhancing education with ICT. The four society indicators are: people and organizations online; locally relevant content; ICTs in everyday life; and ICT in the workplace. The four economy indicators are: employment opportunities; B2C presence; B2B presence; and e-government. The two policy indicators are: telecommunications regulation; and trade policy. McConell is another consulting company that puts out an e-business readiness report. The latest report compares 17 e-business readiness indicators in 53 developing countries (McConnell, 2001) in five interrelated areas: connectivity; e-leadership; information security; human capital; and e-business climate. Each consulting company has its own set of indicators – there is no widespread country-level adoption of some metrics of importance.

These works, including ours, illustrate the importance of performing gap analyses for these countries, yet there are no scientific validations of the measures used. However, what we illustrate in this paper is that existing metric/measure sets are incomplete for assessing e-business readiness for SMEs. This paper builds and improves on our previous work in Jutla et al. (2002b).

Governments widely use customer satisfaction surveys to measure success in

deployment of their services. With respect to the customer stakeholder, an increasing number of companies are studying the satisfaction of customer contacts with their organizations. A technique called "critical incident" (Schneider and Bowen, 1999; Smith, 1999) has been used in many of these endeavors. The critical incident technique is a procedure for collecting descriptions of interactions between customers and the sales, marketing and service functions of companies. The main driver for today's evolution of marketing is technology, which facilitates closer interaction with the customer. Shostack (1987) suggests that marketing processes ought to be described in at least two dimensions relating to processes, and that the blueprint model can be applied to build a more robust measurement tool for assessing technology requirements. Jutla et al. (1999) detail creation of e-commerce benchmarks including customer's engage, order, fulfill, and support transactions. Jutla (2001a, b) describe metrics for electronically enabled customer relationship management, and a methodology for creating strategy for e-business using our e-business stakeholder model respectively. There are vast amounts of literature on marketing metrics such as in Ambler (2000), Brown (2000), Cronin et al. (2000), Davis (1998). Craig and Jutla (2001) describe metrics for assessing gaps in e-business strategies for both large businesses and SMEs.

Summary and conclusions

Government must balance its attention and facilitation among the model components presented in this paper. One example of a problem that arises when one model component is emphasized over another is that of market dislocation. Despite having a superior communications infrastructure and a large percentage of the population online, the fact that a large percentage of Canadian businesses (both large and small) were barely online in 1998 resulted in a large number of Canadians shopping online at US sites (Hull, 2000). This led to the Canadian government moving quickly to address the e-business readiness status of Canadian industry. These efforts have

been successful and by 2001 a much larger percentage of the Canadian online population bought goods/services from Canadian companies over the Internet. As well, Canadian e-retailing sites are emerging to serve the tastes and preferences of Canadians. For example, Chapters Online has emerged as a leader in the Canadian book e-retailing sector with a brand recognition that is now stronger than that of Amazon (Jones, 1999). Human resource dislocation is another phenomenon that has resulted in many regions suffering from brain-drain, due in part to insufficient jobs created locally in the business environment to absorb new knowledge economy graduates. Countries such as Canada decreased capital gains taxes in 2000 to re-address the imbalance (Government of Ontario, 2000).

Currently, countries appear to be focused on connectivity metrics as opposed to usage metrics. Penetration figures such as households with Internet connections, mobile telephone customers, microcomputer sales, and Internet users are all being recorded now. Even though SME use of sophisticated e-business software applications is not being measured in most countries, informal evidence suggests that uptake of e-applications such as knowledge and content management is low. Another area of focus for measurement will be localized content creation for SMEs.

SME uptake progress must be measured as countries move forward in their journey to the digital economy. Widespread adoption of the same measures will facilitate international benchmarking and sophisticated gap analyses. Governments can encourage and promote the practice of measurement as they prepare and transition their countries between the current and the future.

Due to the global problem with response rates to surveys, misconceptions as to what the surveyees are answering, and uncommon definitions, countries worldwide need a common, published, measurement vocabulary detailing indicators. A metrics framework for the area of government SME initiatives to increase e-business adoption requires:
- a conceptual model to explore the interactions and dynamics within the governance processes;

- definitions of the composition of metrics and validation of the metrics; and
- ranking in importance of metrics.

The conceptual model and proposal of pertinent metrics of e-business readiness for SMEs is provided in this paper. The detailed definitions, validation, and ranking of these metrics are ongoing research projects, results of which will be published later in the year.

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