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Teck Meng TAN

Singapore Management University, tmtan@smu.edu.sg

Wee Liang TAN

Singapore Management University, wltan@smu.edu.sg

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The Implications of the Knowledge Economy for Venture Promotion Policies

Teck-Meng TAN
Wee-Liang TAN
Singapore Management University

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Abstract

The advent of the knowledge economy brings with it needed new public policy initiatives on the part of governments desiring to ensure that enterprises in their economies are able to participate and excel in this new arena. The knowledge economy brings with it opportunities for new ventures as it embroils the global economy in a revolution where information technology is a pervasive and enabling force; where knowledge is the critical asset. This paper explores the implications this revolution for small and medium-sized enterprises and suggests policy initiatives that would assist in promoting ventures for this brave new world.

Introduction

The knowledge economy has arrived. The "information age", "knowledge economy", "post-industrial society" and other similar phrases have been coined to refer to the new paradigm that looms before us as we enter the new millennium. The new paradigm envisages that the business arena, if not all of life, will involve the information highway, web sites and information technology. The new economy has been called the knowledge economy because knowledge becomes the asset upon which enterprises will rely upon for competitiveness; knowledge-workers, knowledge-enterprises and knowledge-entrepreneurs will be the key players. It brings with it implications for governments wishing to promote entrepreneurship and enterprises. Entrepreneurship has been shown to be a key element that will enable the Asian economies to sustain and continue to grow in the new millennium.

The advent of the knowledge economy calls for different approaches to promoting entrepreneurship as the knowledge age provides smaller ventures with vast opportunities. It has created a new playing field where size, entry barriers, may no longer be sources of competitive advantage, or at least, will no longer pose hurdles as access to suppliers, subcontractors and customers is no longer limited to the traditional means or networks, and no longer restricted by the gatekeepers of old. Whilst there is a plethora of opportunities before enterprises and would-be entrepreneurs, different skills are required for this new economy. Knowledge and knowledge skills become a premium. SMEs need to be equipped with new skills and trained to enter the various arenas in the new economy. Business success and competitiveness will no longer depend on the goods one produces or the services rendered. Instead as recent success stories on Internet companies (called the "dot.coms") have shown, success depends on having the skills and knowledge to leverage opportunities that are often created.

SMEs may need to engage in different industries that they may have been involved in previously. This is because the medium for business will be the seemingly seamless World Wide Web on the Internet. It offers a range of economic benefits for all economies for it has

eliminated the key element that has affected international business distance. Whereas access to markets was determined by geographical location previously, the Internet enables smaller firms to compete with MNCs for business. It reduces transaction costs, decreased marketing and communication costs, and permits the opportunity of virtual alliances, global expansion and improved networking.

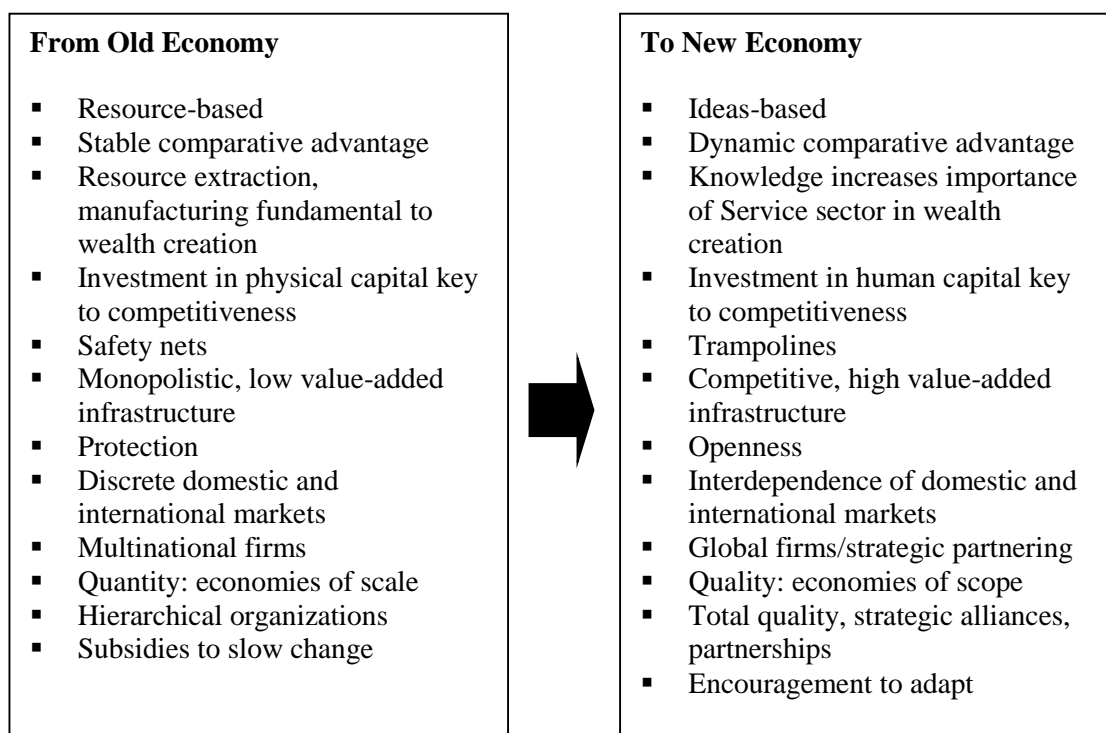
This paper explores the policy options and objectives that could be adopted to develop ventures and entrepreneurs that can contribute in the new paradigm. This paper adopts the stance that the role of the government is not one of intervention but facilitation. It argues that the policy instruments and programs needed to promote SMEs for the information age should focus on economic restructuring (outside the scope of this paper); training and development of entrepreneurs and their personnel; implementing knowledge/IT infrastructure at the national and firm level; and providing an entrepreneurship infrastructure with elements for the information age.

The Knowledge Economy - Its Impact on SMEs

The information age will be characterised by new businesses in industries that shift away from the old paradigm of tangible products and services. Whist manufacturing, for example, may have been the mainstay of most economies and SMEs primarily engaged in the business arena as subcontractors and suppliers, in the knowledge economy the mainstay will be characterised by knowledge, information and skills that may involve products or services (with these no longer being the determining factors). This change in the subject matter of business and the bases of business has immense implications for businesses and policy-makers that both communities may not completely comprehend even though the terms "knowledge economy", "information age", and "digital world" may have been bandied around.

It would be helpful for our discussion to examine some aspects of the changes this new economy brings. The key characteristics between the old scheme of things and the new knowledge economy have been summed in Figure 1 below. Central to the change in the economic paradigms is the advent of the information super-highway and the advances in telecommunications that have improved and continue to advance global communications. It was once merely an academic belief that there could be a "One-World, One-Market." This belief is no longer a theory or a distant dream but, with the Internet, is very quickly becoming a reality. Communication links with all countries, offices and homes around the world provide access to the Internet, and anyone can now log on a computer and go shopping in any country. Before this development, global marketing was traditionally the realm of large companies, while smaller businesses often remained local or regional in their respective markets. Size was an advantage. The biggest change that the internet brings for SMEs lies in the access to the global market because "smaller firms tend to be excluded from international trade because of their difficulty in capturing export markets and their costs of training overseas" Farisell, Oughton, Picory and Sugden, 1999. Furthermore, "markets throughout the world tend to be dominated by large global producers." Farisell, *et al*, 1999. "Multinational business" and "entrepreneurship" were largely separate fields, both academically and practically; viewed as two diametrically opposed poles with one associated mainly with huge multinational corporations and the other linked with SMEs.

Figure 1: Differences between Old and New Economies



Source: Preliminary documents relating to *Building a More Innovative Economy*, Industry Canada, July 1994 cited in *Connection, Community, Content: The Challenge of the Information Highway* (Final report of the Information Highway Advisory Council).

Yet whilst the opportunities exist, when one considers the changing environment, it becomes very clear that the SMEs face certain challenges. We have outlined the opportunities and the associated challenges or policy implications that arise in Table 1 below.

Table 1: Opportunities and Challenges to SMEs Competitiveness in the Knowledge Economy

<u>Opportunities</u> SMEs can:	<u>Threats & Implications</u> SMEs may:
<ul style="list-style-type: none"> ▪ Access global markets 	<ul style="list-style-type: none"> ▪ Lack the ability to understand and identify opportunities. ▪ Lack the networks that enable global access to markets technology, products, services, and resources.
<ul style="list-style-type: none"> ▪ Use new technologies to innovate and new ways of doing business 	<ul style="list-style-type: none"> ▪ Lack skills to harness new technologies. ▪ May not understand or be alert to technological changes.
<ul style="list-style-type: none"> ▪ Compete with other global players; they need only depend on knowledge and skills and are no longer restricted by borders, hindered by smallness in size, of paucity of resources. ▪ Improve productivity through knowledge and technology 	<ul style="list-style-type: none"> ▪ Do not possess knowledge or have the skilled manpower. ▪ May not invest in R & D. ▪ Lack resources, physical and financial, to make investments that will permit them to compete.

The challenges faced by SMEs and new ventures in the knowledge economy can be seen by considering an example. Ford Motor is a good example of the opportunity the knowledge economy provides. Through the Internet one of its subsidiary companies conducted an online bidding exercise for the supply of circuit board (Ford Motor, 1999). The participants in the bidding had been pre-selected from about a hundred suppliers globally. They were able to see the prices being posted for items, and submit their bids in real time. It is reported that a total of US\$150m worth of new contracts was awarded to component supplier. Ford Motor's experience in electronic commerce (e-commerce) and on-line bidding is an example of what will be a growing trend in the global economy. The challenge to SMEs here is being able to not only do business on-line but also to be competitive as they would have to be efficient in order to place competitive bids.

Whilst business will be conducted on the Internet, research by Jupiter Communications (1999) in the US shows that only 6 per cent of online commerce in 1999 would represent incremental sales with much of the high growth of e-commerce being achieved by taking business away from traditional sales channels. In other words, companies that do not embrace e-commerce will increasingly lose their existing customers to online competitors. With e-commerce, competition will be global and intense. Companies will need to continuously improve their performance in every aspect of their entire business value chain to remain competitive. As it would be easy for one's customers to seek another supplier around the globe, error or inefficiency cannot be tolerated. Companies more likely than not, will face demands to integrate their internal systems with those of their business partners to reduce costs, enhance quality, and shorten turnaround time. With the global market opened up, companies will have to re-engineer and innovate constantly to tap new and growing markets. These new challenges pose a problem to SMEs because they may not be ready for the knowledge economy. Whilst we hear stories of enlightened SMEs who have created new opportunities on the Internet, most of them are not in the same situation.

The list of threats or policy implications will vary across different economies. It is these areas in the right hand side of Table 1 that government initiatives are required. However, before discussing the various policy measures that can be developed, it is necessary to consider whether governments should be involved in developing ventures for the knowledge economy and whether they assist the existing SMEs in preparing for the new business environment.

The Appropriate Role for Government

There is an extreme view that suggests that the only role for government is non-intervention in the economy. This view suggests that where businesses are concerned the government should only put the resources in place for the knowledge economy. If this requires the installation of new telecommunications equipment, Internet structures, new market structures such as a new board for the stock exchange, and elements of what one would consider to form the external environment of a firm, it would be permissible. In this vein, governments should introduce policies to regulate e-payment systems; competition and regulatory policies aimed at e-commerce (Farisell *et al*, 1999). However, it does not extend to actual assistance being rendered to the firms such as education and training to provide smaller firms with the knowledge to access new technologies and to exploit e-commerce via networking relationships, which Farisell *et al* (1999) also suggests that policies address.

There are valid reasons for governments doing more for SMEs and new knowledge ventures. First, economic growth and competitiveness of nations requires governments consider how to

ensure that the enterprises in their economies do not end up being the "have-nots" and laggards in the information age. The other extreme position where government gets directly involved in business should be frowned upon. The intermediate position where government facilitates and provides some assistance is one that most government adopts. Most governments provide avenues by which enterprises may obtain the needed knowledge, resources, information, and assistance with tasks (the authors call these four elements an "entrepreneurial infrastructure").

A second reason for governments to introduce policy measures for the knowledge economy is the fact that this new paradigm with its new technology and knowledge base enables economies on a lower section of the growth curve to "catch-up" because they can use the new technology to "leapfrog". The so-called leapfrogging argument, an idea popular among many in the technology and policy analysis field, holds that with the diffusion of information and electronics technology some developing countries may be able to leapfrog older vintages of technology, bypass heavy investments in previous technology systems and catch up with advanced countries (Hobday, 1995). Hobday (1995) noted that according to some observers, Singapore developed quickly using information technology making it an interesting test case of leapfrogging.

It is believed that with the diffusion of the information technology paradigm and the advent of the knowledge economy, some developing countries may be able to leapfrog older vintages of technology and begin to catch up with advanced economies (Hobday, 1995). Schumpeter's definition of entrepreneurship as creative destruction, where radical new innovations give rise to the destruction of industries based upon older technologies pointed to this situation. To capitalize on the window of opportunity made possible by the new paradigm, governments must take action. Macro-level policies need to be established to create the necessary skills and infrastructure so that they have the absorptive capacity and policies may need to be directed at firms.

The question then arises, what is the appropriate role for government to play. In relation to the information technology aspects of the knowledge economy, there is guidance from the positions adopted by some economies. In 1995, the G 7 countries endorsed the principle of a collaborative effort between the public and private sectors to achieve a global information highway to make the transition to a knowledge society. The Canadian Information Highway Advisory Council included a recommendations for SMEs because they represented a sector of the economy that played in important role (1997). In addition to building Canada's new communications and information infrastructure it recommended that the Canadian government's pivotal roles include:

- Co-ordinating related policies and initiatives within an overall strategy for the Information Highway;
- Through use of its power of procurement, being a catalyst in building the Highway; procurement will stimulate scientific and industrial development and at the same time encourage SME participation;
- Being a model user inspiring all Canadians to participate and share in the benefits of the Highway (1995).

In addition to these recommendations, there is a need to introduce macro level policies in:

- **EDUCATION:** to prepare the future worker for the information age and for jobs that are not available or even exist today;

- **INNOVATION:** to encourage research and design (R&D) in the areas of new knowledge creation;
- **REGULATORY FRAMEWORK:** to encourage innovation through intellectual property protection and maximize equal access to the information superhighway;
- **TAX INCENTIVES:** to encourage business startups in the knowledge industry and to encourage the necessary investments; and
- **OTHER MACRO-LEVEL POLICIES:** in the same vein.

Macroeconomic policies need to be introduced to re-orient the economy to accommodate the new areas of business. The policies pertinent to this objective are outside the scope of this paper. Suffice to say, that individual governments may need to remove subsidies for sectors that would no longer be desirable, to introduce incentives for businesses in the selected knowledge industries, to develop markets for the new knowledge products and services. The new paradigm pre-supposes that the players will have the required skills and personnel to enable them to participate. However, the skills required for this new paradigm are not in sufficient supply. In Singapore, information technology workers are in shortage and in demand. However, there is a need for policy initiatives directed at the enterprises - at the SMEs - the main focus of this paper.

Entrepreneurial Infrastructure for the Knowledge Economy

In conceiving the policy measures to foster and develop knowledge ventures, the authors argue that they should be conceptualised as an entrepreneurial infrastructure, rather than as disparate measures. The term "entrepreneurial infrastructure" is one coined by the authors together with a colleague, John E. Young (Tan, Tan and Young, 1994). By entrepreneurial infrastructure the authors refer to the support systems and networks that are available for providing assistance to new business owners, owners of small growing businesses, and existing SMEs in the form of (1) assistance with tasks which the business owner or small firm must accomplish, (2) resources - physical or monetary, (3) information, and (4) knowledge. The word infrastructure is used outside of the ordinary sense that is commonly associated with - physical infrastructure in the form of roads, communications or telecommunications.

Entrepreneurs need and seek assistance from outside their businesses because they have limited amounts of time (Gibb, 1993) and resources (Smallbone, North and Leigh, 1993). An effective entrepreneurial infrastructure provides assistance to entrepreneurs and small growing business in the pre-startup stage, early stages of business development, and after the firm has been established. Assistance in the early stages of business development and after being established would allow an infrastructure to become part of the entrepreneur's business and strategic networks (Butler and Hansen, 1991). Each element in the entrepreneurial infrastructure represents a form of support or assistance which is rendered by an organized facility or installation which has as one of its objectives the assistance of venture creation or venture growth and development.

Whilst the concept of the entrepreneurial infrastructure was coined in relation to venture creation and enterprise growth in general, we find that it is a useful concept to apply in discussing the government policy initiatives that need to be initiated to foster new ventures that are needed for the knowledge economy. Alternative terms could be used but essentially they would refer to the same ideas. It could be referred to as the knowledge infrastructure or technology-based entrepreneurship infrastructure. One could also employ the term technopreneurship (the shortened name for technology-based entrepreneurship, now a term

much used in Singapore). In the following sections, the authors describe each element of the entrepreneurship infrastructure and suggest some ideas for the knowledge economy. It must be borne in mind that the classification is not a rigid one because one area of assistance could be also be classified under another category. The authors have opted to categorize the assistance on the basis of the primary objective of the assistance. An example would be the provision of assistance to SMEs in computerizing their operations. This assistance will also involve the provision of financial resources; hence, an overlap of two categories, assistance with tasks and required resources.

Assistance with Tasks

Potential and existing entrepreneurs and their businesses continually face a series of tasks they must perform to start, grow, and develop commercially. These tasks include those personally performed by the entrepreneur such as planning, directing, and organizing various functional activities of an enterprise, and those performed by others within the businesses. Assistance with tasks can take the form of advice or consultation regarding specific internal task processes (Shapira, Roessner and Barke, 1995). Several studies have documented the value of government-sponsored assistance and consultation to small, locally-based enterprises (e.g., Birley and Westhead, 1992; Gibb, 1993; Hindle and Gillin, 1991).

To assist SMEs prepare for the information age, assistance may be provided by government agencies to help them computerize their operations, prepare their business for e-commerce, host their websites in a manner to reach the widest audience on the Internet, and ensure secure electronic payment over the Internet. This assistance could take the form of direct assistance in advice to the SMEs through full-time SME counsellors on government payroll. Alternatively, the assistance can be provided by the management consultants in the private sector which are either subsidized through a co-payment basis, that is, with government contribution being made when the SME has committed its own funds. This basis of support will ensure commitment from the business owners. An example is the Local Enterprise Computerisation Program for e-commerce provided by the Singapore National Computer Board, which seeks to jump-start the mass adoption of e-commerce among Singapore local enterprises. It provides:

- A free service to broadcast your company's e-commerce adoption needs to a group of IT consultants and solution providers.
- A grant of up to 50% of the e-commerce project cost and capped at S\$20,000 for each qualified local enterprise (connectivity to Singapore ONE may be included). It can be used to cover consultancy fee, cost of hardware and software, and subscription fee (up to 12 months).

Our research on the entrepreneurial infrastructure reveals that the provision of assistance is often a way to motivate SMEs to institute change because SMEs often desire to introduce the changes or measures addressed by a particular form of assistance when they learn that it exists, whereas no such pre-existing intention existed (Tan, Tan and Young, 1997).

In the area of innovation, facilities should be made available that are necessary for invention and innovation. Areas that spring to mind in this area include laboratory facilities, workshop facilities, prototyping services, packaging, branding, and export assistance. The emphasis is not only on the invention or innovation phase but the whole spectrum of the development process ending with the actual market launch. The facilities could currently exist in universities, polytechnics, technical institutions, hospitals, government research facilities, and

private organizations. It would require an inter-organizational committee or agency to explore the availability, willingness of the parties, mechanisms for delivery of the services or access to the facilities, and allocation of funding, if any. One oft question raised by technology based entrepreneurs who are at the idea conception stage concerns the availability of assistance with patent searches. Another question is what facilities exist that they can use at a reasonable cost.

It may be useful for a information help-line where interested persons such as new inventors, business startups, or owners of innovations can call to seek assistance. Here is an instance where the earlier point made that the elements of the entrepreneurial infrastructure is not be treated as independent of each other rings true. The help-line or call center can direct the callers to the relevant sources of assistance or provide relevant and timely information.

Required Resources: Physical or Monetary

This element of the entrepreneurial infrastructure refers to the facilitative resources that an entrepreneur would need to have to function effectively (Bruno and Tyebjee, 1982). Adequate physical accommodations and capital are but two examples of resources that aspiring entrepreneurs require for their startups. Where incubators, industrial parks or venture capital funds exist, they form the infrastructure support network (Carsrud, 1991; Kozmetsky, 1992; McMullan and Long, 1987).

To groom knowledge ventures, the government needs to initiate and establish incubators. These can be located in public institutions such as tertiary institutions, government agencies providing assistance to SMEs or agencies responsible for science and technology, and government initiated science parks. The private sector can also be encouraged to do the same through tax incentives. Private sector participants are more likely to create incubators when they realize the potential returns from the new products and services that these new knowledge ventures can created. In Singapore, for example, Orchard Parade Holdings (a property development company) has announced on 10 September 1999 a joint venture with Plan-B Technology (a technology incubator management company) to form their technology based incubator to offer resources to new aspiring technopreneurs at reasonable rates and presumably in exchange for equity in the venture (The Business Times, 1999).

For such events to take place, the government's role would include creating a vibrant investment climate with a stock exchange catering to new ventures and a venture capital market that provides financing to new knowledge ventures. The stock exchange could take the form of a second board catering for new ventures similar to the NASDAQ or special B shares for new technology stocks that are traded over the counter. To spark off the venture capital industry, it may be necessary for the government to take the lead. In Singapore, a technopolis venture fund of US\$1billion was established with the government encouraging the private sector as well as its investment arm to manage the fund. By sharing with the private sector the costs of R&D investments, the government will seed the germination of a venture capital industry for technology and innovation.

It might even be necessary for government to provide funding for the introduction of the technology. SMEs are often reluctant to computerize. It has taken a considerable period of time for Singapore to spur its SMEs to computerize. There is considerable success in this regard. However, computerization is but a start. A firm may use computers but still not be able to be conversant with the tools or technology of the knowledge economy. It would also require the provision of incentives for SMEs to make the necessary capital expenditure.

Similarly unless there is a motivation for investment in R & D, SMEs may not see the value of innovation and change. Most SMEs are preoccupied with the day-to-day problems and issues of business and not the future, be it products or services, especially when it is perceived to take a long gestation period.

Required Information

Small business owners and small, growing businesses require information in order to carry out their work effectively (Cooper, Folta and Woo, 1991; Woo, Folta and Cooper, 1992); hence, the next element in an entrepreneurial infrastructure. Such information can assist business owners make effective decisions. It includes economic, market, legal, technological and other environmentally related data. This information and data could be made available from public facilities established within the infrastructure. Private sector organizations such as consulting firms, chambers of commerce, trade associations, or not-for-profit mutual help groups may also be sources of the information. A lack of specific business and market-oriented information and knowledge is particularly problematic for smaller firms (Cromie, 1991).

In an infrastructure for technology-based ventures, the information that these ventures would require would include the following:

- Patent information - a patent resource could be made available for SMEs to check on the presence or absence of relevant patents. This is an example of the overlap between the elements of the entrepreneurial infrastructure because together with the information on patents, assistance can be provided with patent applications.
- Technological advances - government technology specialists could be available to SMEs for free consultation or at a reasonable rate on the latest technology. The authors know of an entrepreneur who was offered land to set up a factory to manufacture cellular phones. He was not involved in the telecommunications industry at all but was attracted by the offer of cheap land. He needed to know if the venture is viable. A government technology specialist in the area of telecommunications would be able to inform the entrepreneur that unless he has his own core technologies, he would have to pay licence fees to the owners of the needed technologies. The authors argue that governments should provide SMEs with access to such experts.
- Sources of new technology and knowledge - SMEs need to be accorded access to knowledge and R&D results.

One way in which to facilitate access to the required information is through networks. Policy initiatives should seek to establish open and interactive networks. In the knowledge economy, knowledge alone is not sufficient. Research and development is the wellspring of new and enhanced goods and services. To realize commercial benefits from R & D, including export, strong market linkages should be established. Linkages to business will ensure aggressive and productive R&D. The networks will also facilitate access to information and to other suppliers.

Formation of Networks

Smaller firms ought to form networks since being in networks brings the following advantages:

- access to other networks and systems where larger firms may dominate
- pooling of resources
- sharing of costs of acquiring technology and knowledge that allows access to a global system
- facilitating SME access to the global market place with scope for alliances and partnerships with network members

Here are again there are significant public policy implications (see e.g. Aoyama, 1999). For groups of smaller firms to work together in this regard, policy must stimulate such interaction, government through its various agencies must make firms aware of the potential need for interaction and must enable such activity to occur. The new information technology - computer networks and electronic payment systems - enable the formation of networks as SMEs without the resources to manage networks at the firm level, have to participate in networks. Again public policy could address this by stimulating the use of new technology thereby stimulating SMEs to create networks enabling to plug into international networks.

The government could encourage the formation of domestic clusters of SMEs, networking activities between large firms and the SMEs, and establishment of international forums in their countries. The networking between large firms and smaller firms may need to be initiated by government in formal settings, where the large firms are encouraged to take smaller supplier firms under their wings so that there is transfer of technology to the smaller firms. Economic groupings can also be suggested in industries where smaller firms proliferate.

Required Knowledge

Small business owners and their businesses will be ultimately successful only if the business owner or firm has attained a level of knowledge adequate for accomplishing the tasks they face. Such knowledge can be acquired by experience through trial-and-error while operating the business (e.g., Guglielmino and Klatt, 1993; Reuber and Fischer, 1993). It can also be acquired through formal training in the concepts and skill areas that can be directly applied within the business venture (e.g., Barnes and Jones, 1995; Gibb, 1983; Ghosh and Block, 1993).

Policy initiatives may include designing training programs for business owners in line with the kinds of ventures that each country wishes to encourage. Entrepreneurs of established businesses tend to be focused on their existing businesses and are often not alert to technological changes. Training programs that highlight the values of various technologies and the commercial opportunities for implementing and incorporating the technologies in new products and services. Another different training program could be designed to address the technologists and scientists so that they can be equipped to spearhead technology ventures based on their R & D results. Such a program could also be incorporated internally in research facilities, universities or companies, thereby encouraging technology spin-offs. Appreciation programs could also be organized to lead the business owners on the new ways in which business can be conducted in the knowledge age. Such programs would also include those that equip their employees to scan for relevant technologies that can be employed or incorporated in their businesses. There is little doubt that enterprises need to know how to develop knowledge assets and capture value from them (Brooking, 1996; Teece, 1998).

IT and E-commerce Skills

It should be clear from the foregoing that appropriate training is required for the SMEs. The personnel of SMEs require appropriate training in order for it to have access to the Internet. Training is often easier for larger firms as compared with SMEs. Thus this is an issue for public policy, where training is a key agenda item (Farisell *et al*, 1999). This training is making its mark on in the market place and in universities.

The required training is not confined to making the SMEs “Internet-savvy” but extends to other aspects such as attitudes and actions. By the latter, the authors refer to mindset changes. Within each organization, there may be a need to embrace the new technology in all aspects of organizational life and not just business.

Organization Culture Changes: Whilst the earlier section delved into training and equipping of individuals, in this section we examine the changes that are necessary in the SMEs at an organization. There is a needed change in the culture of the organizations. It may have been that the firm has established standard procedures, products or services. However, in the new knowledge economies, firms with cultures that value knowledge, innovation, inventiveness and entrepreneurship will be the ones that will excel. The cultures within the organizations need to be changed. New visions, values, objectives, and performance rewards systems need to be introduced.

Conclusion

In a knowledge economy, competitiveness will be determined by the ability to absorb, process and apply knowledge. The primary sources for wealth creation will change from the traditional factors of production to human knowledge residing in individuals and systems. The key driving forces will be science and technology. The exploitation of science and technology in knowledge-intensive activities have led to quantum leaps in productivity and competitiveness even in existing industries, such as the steel industry. In this setting, there is a call for high-tech startups and knowledge-based SMEs. These ventures will face challenges in market access (they need to launch their products and services onto the world market); in establishing a global presence (as they will be considered outsiders in the global market where brand awareness is yet to be established); adapting to a global business world that is far from perfect (Jolly, Alahuhta and Jennet, 1997).

In this paper we have argued that an entrepreneurial infrastructure needs to be created to provide for SMEs as we enter the knowledge economy. The involvement of government in establishing elements of the entrepreneurial infrastructure is supported by a growing agreement that structure is important for innovation to take place (Dunphy *et al*, 1997). Herbig (1991) noted three structural characteristics that distinguished the different levels of innovation observed between the UK, Australia, Canada and the US: the size of market, economic incentives given towards small businesses and entrepreneurs, and societal rigidity.

The elements of the infrastructure that each economy should introduce, depends on the factors existing in each environment. In Singapore, a high level multi-agency committee, Technopreneurship 21 Committee, comprising individuals from the public and private sectors was established to study how Singapore can best promote technopreneurship in the 21st century. The goals of the Technopreneurship 21 Committee's recommendations are to create a conducive environment for ideas to thrive, and for the originators and backers to reap rewards from their innovative efforts and enterprising spirits. However, introducing elements of the infrastructure is but a beginning as there is a need to ensure that there is publicity and awareness

of the provision, access and availability, and coordination between the various agencies. It is likely to require a multi-agency network that is coordinated by a lead agency that becomes the first place that SMEs seek out. The mere provision of incentives does not mean success; the implementation of the measures is another area that requires further consideration. If there is insufficient publicity, there will be less awareness and less participation in the infrastructure. At the same time, if there is a perception that the process of obtaining access the infrastructure is tedious, there will again be less participation. Herein lies the other part of the challenge that governments face in preparing SMEs for the knowledge economy.

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