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TECHNOLOGICAL DEVELOPMENT OF PREFERRED SUPPLIERS

A Proposed Project in the Regional Technology Strategy

SUMMARY

This report, representing an application of the Holistic model of innovation in developing a regional technology strategy, implies that there may exist an association between the size and the technological capabilities of businesses. Very large and large businesses can probably afford to perform the technology development activities such as 'basic research' or 'industrial research and development - R&D'. Small and medium enterprises -SMEs - often deal with less complicated technological development activities of design and development - D&D - such as "supplying" or "imitating". Regional technology strategies may be initiated through supporting the development of technological capabilities of the supplying SMEs.

PRIME CONTRACTORS AND THEIR SUPPLIERS AND SUBCONTRACTORS

In Western manufacturing, a particularly interesting example of specialization has been the rise of manufacturers who make only component parts and subassemblies, particularly for the automobile, electric and electronics industries. Brand name manufacturers often specialize in the design, marketing and sometimes the assembly of finished products, using component parts made by subcontractors and suppliers[1].

Companies that produce complex manufactured products typically do not fabricate all (or even the majority of) the parts and sub-assemblies which go into their final products. They usually act as "Prime Contractors" or "Original Equipment Manufacturers - OEMs". Prime contractors have sourcing relationships with a network of parts and component suppliers and subcontractors. Suppliers and subcontractors, mainly SMEs, may number in the thousands.

Supplying and subcontracting allow prime contractors to focus on and specialize in those activities that are crucial to the performance of their firms[2]. On the other hand, prime contractors cannot remain in isolation. They require an appropriate support structure of suppliers and subcontractors.

Through subcontracted manufacturing, the technological advances conceived by American, German or Japanese engineers can therefore create employment not only at home but also overseas. Modern subcontracting networks are also international trading networks, with operations that depend critically on transportation, communication and data-processing facilities that were unimaginable in 1800[3].

Subcontracting, concentrating on producing well defined parts and sub-assemblies, constitutes a distinct level of technological capabilities and a vital part of innovation structures. Subcontracting is also an essential structure in the process of economic development.

Study of post war Japanese industrial development reveals that Toyota and Nissan, current leaders of the automotive industry, were sub-suppliers of GM and Ford. This permitted them to acquire knowledge about different aspects of mass production technology development. Magna, in Canada, is an another excellent example. In 1957 Magna evolved from Multimatic, a shop for producing auto parts. Currently Magna is one of the world's largest suppliers of automotive components and systems.

The importance of the networks between prime contractors and their suppliers in the national techno-economic systems has been demonstrated in many countries [4]. Subcontracting companies are now seen as important links in the chain of production and, as such, are powerful forces for the development of solid national infrastructures. Given the current climate of world wide rivalry, subcontracting firms are increasingly becoming an important consideration in prime contractors' decisions concerning where to locate, and as a result, they constitute a potentially important competitive advantage for regions as well as nations.

In the world of increased segmentation, where product design and quality become competitive assets of the utmost importance, a large company is obliged to change the nature of its relationships with its suppliers and subcontractors. When competitiveness was based essentially on cost, it was fair to attempt to exploit the effects of independence, choosing the subcontractors who offered the lowest costs. However, when product quality and design or speed of delivery become the essential competitive weapons, it is vital to promote partners' longevity in order to benefit from high-quality service and know-how, as well as the innovative ideas that flow from increasing specialization.

The performance of subcontracting firms in terms of meeting prime contractors' requirements depends, to a great extent, on those firms' capabilities. In response to a demand for better quality, flexibility, price and delivery time, subcontractors must continuously develop their innovation capabilities; both technological innovation and organizational/managerial and human resources development.

The competitive advantage of supply businesses derives not from the development of new products or even parts, as this has already been performed by the client firms. The competitive advantage of suppliers and subcontractors is related to their 'non-product development capabilities' like process and equipment design, quality control and assurance; and management of technology.

All industries must continuously keep abreast of developments in new technologies which may take place outside of the industry but which must be integrated rapidly. Many industries are subject to numerous environment of constraints, in part due to the many risks involved. Competition from companies in the Pacific Rim has made competition especially fierce in North America. In addition, industries must continuously adjust to cyclical demands, as has

been experienced through the late 80's, early 90's and now in the mid 90's. Sometimes the demands become very sensitive to political issues as well.

Each industry, depending on its technical requirements, may have specific constraints which differ from the other industries. For example, in the automotive manufacturing industry, the main characteristics can be described in terms of mass production and the search for economies of scale. In the aerospace industry, the main characteristics relate to the small volumes and high degree of precision required in the manufacturing and to the stricter technical demands and quality standards than in most other sectors. The aerospace industry is the prototype of the new industrial hubs, which are conceived less and less on a regional scale and more as networks of subcontractors linked together across the entire planet. It is a truly global industry and leading firms select competent subcontractors irrespective of where they may be in the world. Local subcontractors must therefore possess the required levels of skills and competencies to make them "world class" producers. Failure to comply with these requirements can be fatal, even in the short run. The challenges facing subcontractors in any industry depend, however, on the characteristics of the given industry.

Originally, prime contractors performed all the stages of design and development of needed parts and sub-assemblies, then, based on the detailed specifications, suppliers and subcontractors fabricated the required parts and sub-assemblies. However, through enhancing their technological capabilities, some firms raised themselves to "First tier suppliers", and may themselves have a network of suppliers, called "Second tier suppliers", and so apply to the "Third-tier suppliers".

In the automobile industry, the traditional (American) approach to the organization of component supply has been for the assembler firm (prime contractor) to design parts in house and then send our drawings to many suppliers for bids. The contracts offered have typically been for relatively short periods, and assemblers have not hesitated to shift orders to a lower-cost supplier on short notice or to terminate supply relationships during periods of weak demand. Suppliers have therefore had little incentives to invest their own capital in product innovations. In the new (Japanese) approach, by contrast, the assembler (prime contractor) selects a small number of first-tier (preferred) supplier to design and deliver whole vehicle systems. The assembler deals primarily with these first-tier suppliers, who then deal with a second tier of suppliers, and so on. The web of relationships is close knit and durable, which allows the car-makers to spread their risks, since the suppliers are able and willing to be partners in the product-development process[5].

Imitating Japanese success, prime contractors and their suppliers tend to establish long term and stable relationships. Prime contractors tend to assist their suppliers through technical advice, or by requiring them to install certain technologies, such as quality control assurance procedures (QS9000, ISO9000), and computer-assisted design -CAD.

The resulting stability and climate of trust enables subcontractors to feel more secure and thus to contemplate making the investments in resources required to meet the prime contractors' demands, such as acquisition of high-performance machinery and equipment, the use of

appropriate management methods, and continuous enhancement of their technical and administrative skills and know-how.

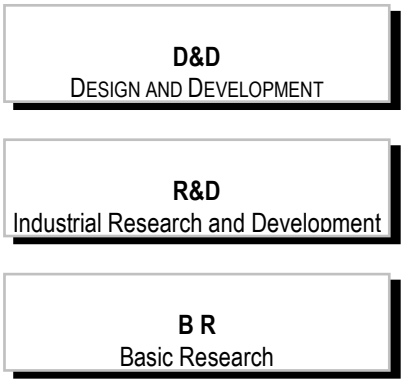
The nature of the relationships between prime contractors and subcontractors has in fact changed profoundly. Many companies have drastically reduced their base of suppliers and subcontractors, limiting themselves to one or two subcontractors for each type of specific activity, and in the process developing closer and longer-lasting relationships.

During the last decade, several big prime contractors, for instance Boeing, have reorganized their supply system to select a group of preferred suppliers and consequently reduce their total number of first tier supplier firms. The preferred suppliers must develop their technological capabilities to be able to perform a wider range of design activities, for instance the development of new sub-assemblies. Magna International is currently a preferred-supplier of GM. It takes a vast amount of technological effort and dedication for a first tier supplier to become a preferred supplier.

The MIT Commission on Industrial Productivity concluded that "The vertical linkages in an economy, which connect a firm with its suppliers below and its customers above, can be conduits not only for incoming materials and finished products, but also for technological innovations and other developments that enhance productivity. Know-how can move up and down the value-added chain. Many foreign companies are adept at capturing the benefits of this technology transfer[6]".

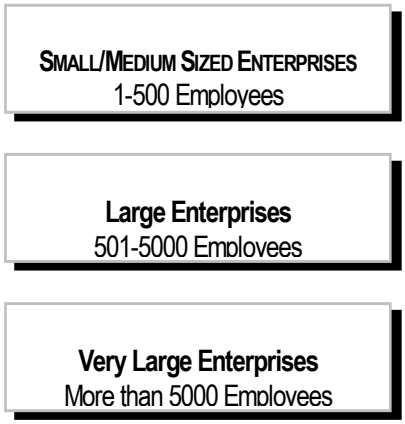
TECHNOLOGICAL CAPABILITIES

According to the Holistic model of innovation[7], the technological capabilities of businesses are organized into three main stages: Design and Development - D&D, Industrial Research and Development - R&D and Basic Research - BR, demonstrated as follows:



The Holistic model of innovation makes it clear that all businesses have access to a set of technological capabilities, because without the technological capabilities, no production can be performed and no business can be successful. However, this statement does not imply that **all** business should perform research and development (basic research and industrial research and development). In practice, existing statistics all indicate that a very limited percentage of businesses are engaged in 'research and development' endeavors. According to recent Industry Canada's Science and Technology Statistics (1991), only 3566 Canadian businesses performed research and development, or only 0.4% of total Canadian businesses. Of the total business expenditure on R&D in 1991, in fact, almost half was conducted by 25 firms. An Industry Canada discussion paper of September 1990 indicates only 3% of manufacturing firms had any research and development capability.

SIZE OF BUSINESSES



Based on the total number of employees, businesses are usually classified into the following main groups: Small, medium, large and very large. Although there is no standard definition, small businesses are often described as firms having fewer than 100 employees in the manufacturing sector and fewer than 50 in the service sector. Medium-sized businesses are often described as having 100 to 500 employees. Very large businesses may have more than 5000 employees. Distinctions between the above classifications become blurred, however, owing to dynamic changes in the economy and innovations in the business organization. The traditional classification of the size of businesses, based on the total number of employees is demonstrated above.

TECHNOLOGY STRATEGY

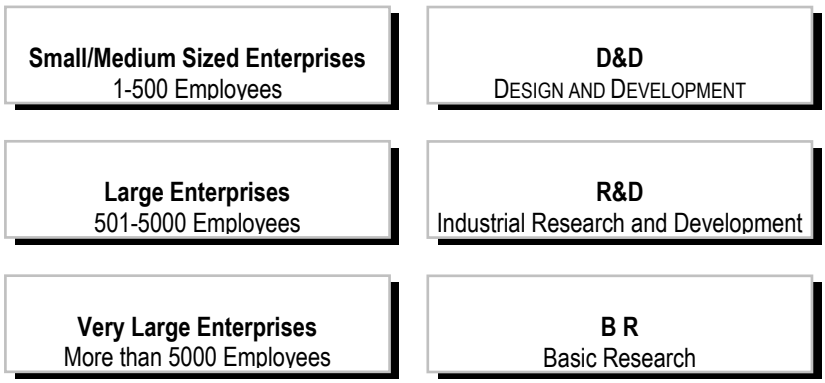
Technology strategy is the public means for nurturing technological capabilities and optimizing their application in the public interest. Technology strategies have dynamic links with economic development polices. However, the boundaries that distinguish technology policy from economic policy are fuzzy at best.

A technology strategy, in addition to the technological innovation model(s), depends on the political/administrative structure of a country. "Comprehensive technology strategy", another report of this series, expressed that the technology strategies are not confined to the central or federal governments, rather all tiers of a government should actively participate in the process of defining and developing technology strategies. A comprehensive technology strategy with the participation of three tiers of government; federal/central, provincial and regional/local, may be presented as in the diagram.

Where to Go from Here

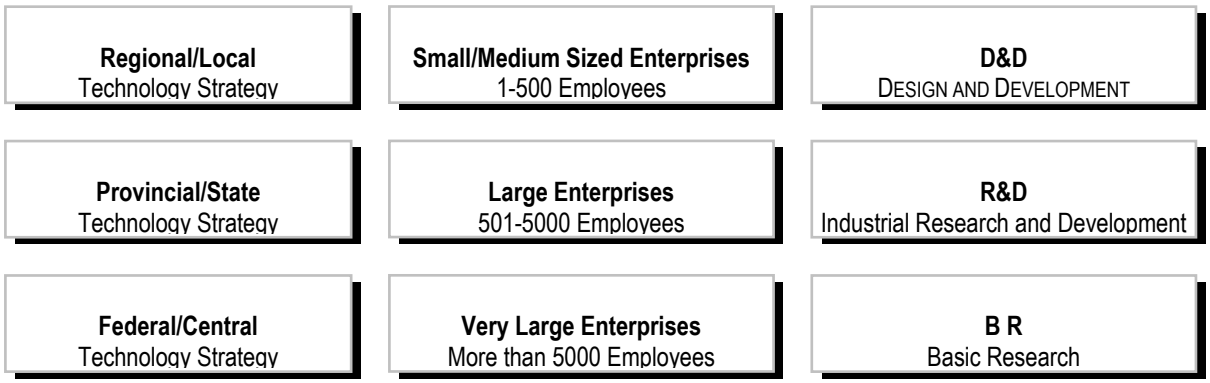
Is there any relevance between the classification of the "technology strategy" and the "technological capability" and the "size" of a business? No comprehensive survey, to my knowledge, has undertaken a broad study of this topic. Common sense, however, indicates that only very large businesses are able to dig down to the stage of "basic research", and large businesses should be able to perform systematic industrial research and development - R&D. OECD's report on "Technology and Economy: The Key Relationships" underlines that the analysis of the role of industrial R&D in the innovation process applies directly to large firms. Firms below a certain size cannot bear the cost of an R&D team[8]. It is logical to conclude that technological capabilities in most businesses are to be classified in the wide range of the D&D capabilities. Consequently one can conclude that the technological capabilities of SMEs should

be concentrated mostly on design and development D&D. The "Regional Innovation Survey in Etobicoke", which was performed in about 40 businesses and appeared in another report of this series, concludes that almost 70% of Etobicoke businesses, mainly SMEs, consider "development/adaptation" as their major technological capability for product development. Based on this conclusion, one may consider the existence of an association between the "technology development capabilities" and "the size of a business", as demonstrated in the following diagram. SMEs mainly endeavor with D&D, large enterprises, with D&D and R&D, and only very large enterprises with D&D, R&D and Basic Research.



There should also be a correlation between the tier of a government and the type and scale of the technology development strategies that it pursues. The European Green Paper on Innovation of 1996 vividly refers to the development of "a vigorous action to promote innovation and absorption of new technologies in SMEs" The Green Paper, continues with the statement that "public intervention must then be close to SMEs. In is therefore relevant to reinforce the regional dimension of innovation"[9]. This program obviously assumes a relationship between a 'regional technology strategy' and the 'size of the businesses' that it covers. Consequently one may conclude that according to this program, higher tiers of government, for instance the EU and central governments, should deal with large-sized businesses.

By correlating the tier of governments, the stages of technology development, and the size of businesses, one logically concludes the following diagram. This diagram implies that the best domain of regional/local technology strategies is probably in dealing with SMEs, whose technological capabilities are predominantly in the design and development stage.



In Canada, the "Basic Research" and "Research and Development" performers have traditionally been supported by the federal government as part of the science policy programs, for instance NRC and NSERC projects, and IR&ED tax credit. The R&D developers have also acquired some assistance from the provincial technology support programs. Although the relationship between the above endeavors is fuzzy at best, it appears obvious that a regional/local technology strategy could not go further than supporting D&D.

According to the Holistic model of innovation, the D&D stage, by itself embodies a wide range of capabilities as depicted in the following diagrams:

Design and Development (Based on Technology Transfer)				
Product	Process	Equipment	Plant	Management
Supplying/License	Engineering Services	Design Engineering	Turn-Key Project	
Buying Know-how	Buying Know-how	Buying Know-how	Feasibility Studies	Technical Assistance
Buying Patent	Buying Patent	Buying Patent	Installation	

Design and Development (Based on Technology Development)				
Product	Process	Equipment	Plant	Management
Copy/Imitate	Copy/Imitate	Copy/Imitate	Commissioning	Operation Management
Improvement	Improvement	Improvement	Detail Engineering	Maintenance Management
Innovation	Innovation	Innovation	Basic Engineering	Production Management
Invention	Invention	Invention	Project Management	Plant Management

The above diagrams demonstrate that "supplying" is the first layer of product development. In this context, the support of technological capabilities of suppliers and subcontractors is an area where a regional technology strategy my begin. The technological support of suppliers should aim at assisting them to become more proactive in their supplying endeavors. Support for technology development of suppliers may also include encouraging the large OEMs to support their suppliers, or assisting some suppliers to become preferred suppliers, and sundry other procedures. The support for technology development of SMEs or suppliers should not be in the form of subsidy or direct injection of financial resources.

A partnership between the federal and provincial governments is essential to assist the regional/local governments to study, define and then develop their 'regional technology strategies'. Each region must articulate a technology strategy according to the specific conditions and requirements of the location. All studies on regional technology strategies underline that there exist wider dimensions for technology strategy than subsidizing R&D endeavors by the federal and provincial governments, and land-use studies by the local governments.

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