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Formulating a long-term strategy for developing the construction industry of Singapore

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The technique of strategic planning is discussed and the conceptual frameworks adopted by writers on construction industry development are categorized. Plans formulated for developing the industry in Singapore are reviewed. Finally, a more appropriate approach to the formulation of a strategy for improving the performance of the construction industry in Singapore is offered and lessons from Singapore's experience for developing countries outlined. It is suggested that the strategy should aim to exploit the nation's *total* experience and resources.

Keywords: Development, conceptual framework, Singapore, strategic planning, resource exploitation, national planning.

Introduction

Strategic planning

Strategic planning has been applied almost exclusively in business organizations for which the earlier works (Ackoff, 1969) and most of the recent ones (Porter, 1985; Ohmae, 1990) were designed. With increasing awareness of the intensity of competition facing not only enterprises but also industries and countries and the dynamism of their operating environments has come the appreciation of the relevance of strategic planning to entities beyond enterprises (Gibbs, 1989; Suh, 1989).

Porter (1990) offers a strategic planning framework for nations. He suggests that the economic progress of industry segments within nations depends mainly on continual increases in productivity realized by companies searching for competitive advantage. Governments aid this process by creating a conducive environment. Good environments are distinguished from bad ones by factor conditions, the strategy, structure and rivalry of domestic competition, demand conditions and related and supporting industries (clusters). As these factors combine, in each nation, certain industry segments would have more conducive environments than others. Whereas these features (which form 'the diamond', in Fig. 1) reinforce each other and help firms to increase their productivity, leading to economic growth, each feature can contribute to decline by hindering companies' upgrading efforts (*The Economist*, 1990a).

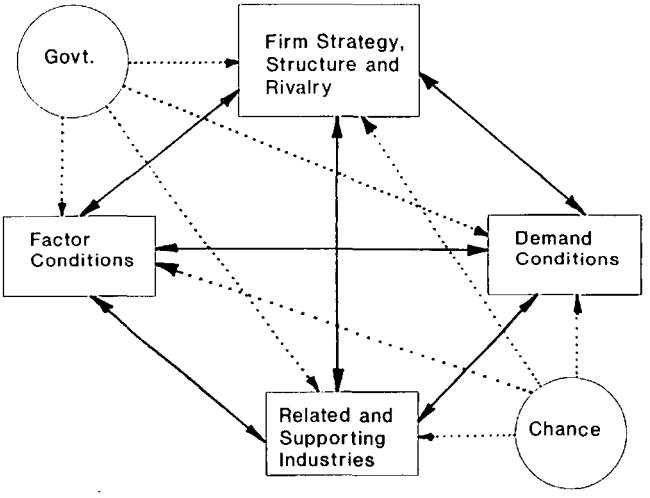

Figure 1 Determinants of a nation's competitiveness. Source: Porter (1990)

While writers on strategic planning agree on the need for a long-term perspective, they are not unanimous about main approaches and tactics (*The Economist*, 1990b; Betts and Ofori, 1993). Porter's analysis has been

criticized as oversimplifying a complex issue of national economic development (Eilon, 1992), failing to consider quality of life (Cooper, 1992) and not considering industrial productivity, which is more important than competitiveness (Armstrong, 1992). However, it has been integrated into the mainstream of strategic planning thought (Kogut, 1991; Shan and Hamilton, 1991). It has been used by the governments of Singapore (Economic Planning Committee, 1991) and Malaysia (Sheriff, 1992), among other countries, to prepare strategic plans for their national development. It has also been used to formulate proposals for improving the cost competitiveness of New Zealand (Crocombe *et al.*, 1991).

Planning construction industry development

In construction, strategic planning has mainly been applied to enterprises (Hillebrandt and Cannon, 1990; Betts and Ofori, 1992). Betts and Ofori (1993) have assessed its relevance for professional and trade bodies. Plans for developing the construction industry are relatively rare. They are more common in the developing countries than the industrialized ones and tend to be of the shopping-list type. An example of industry-level strategic planning in a developed country is that of Japan (Construction Industry Vision Study Group, 1986). However, even without proper plans, most countries attempt to develop or support their construction industries (Chow, 1990; Ofori, 1990). Some writers on construction industry development stress the importance of planning for construction, most preferably by including construction in national development plans (Turin, 1973; Drewer, 1980) or at least to plan for construction resources (Hillebrandt and Miekle, 1985). The United Nations Scientific and Cultural Organization (1986) presents a useful review of methodologies adopted for socio-economic planning (and, hence, in a few relevant cases, planning for construction industry development) in various developing countries.

Writers on construction industry development adopt four broad conceptual frameworks. First, construction is considered as a production sector helping to meet a specific national need (such as housing) (Department of Economic and Social Affairs, 1962; United Nations Centre for Human Settlements, 1987). Second, construction is treated as the sector providing most of each nation's fixed capital and infrastructure, thus playing a key role in national development (Ministry of Finance, 1961; Turin, 1973; Drewer, 1980). Third, construction is recognized as a distinct sector of the economy contributing directly to economic growth and stimulating further growth through its linkages with other sectors (World Bank, 1984; Ofori, 1990). Finally, construction is considered separately, its performance

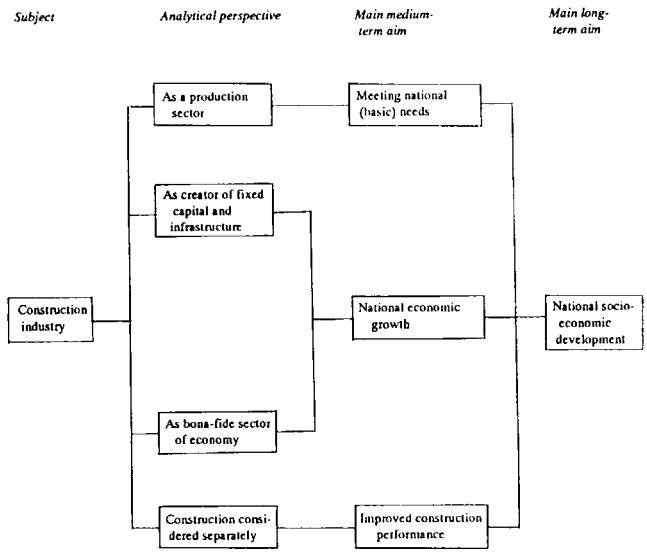

Figure 2 Conceptual frameworks for research on construction industry development

reviewed and measures for addressing perceived shortcomings offered (Ministry of Works, 1977; Chow, 1990).

These four perspectives are closely related: some writers adopt a combination of them. A framework unifying all these perspectives would appear to be the most appropriate as it would afford the most comprehensive consideration of the industry (Fig. 2).

In the rest of the paper, these conceptual frameworks and Porter's (1990) concepts are used to analyse Singapore's attempts to plan for the development of its construction industry and to propose an approach for formulating a strategy for the industry. Lessons for developing countries from Singapore's experience are proposed.

Previous approaches in Singapore

Works on and initiatives for construction industry development in Singapore have been based on perspectives similar to those outlined above and a variant of the third conceptual framework, using the accumulated construction expertise to contribute to economic growth through the export of construction services.

Construction as a provider of particular physical need(s)

Since its formation in 1960, the Housing and Development Board (HDB) has helped the construction industry to upgrade its operations and thereby facilitate the achievement of the national aim of providing affordable mass housing (Wong and Yeh, 1985; Ofori,

1989). The measures adopted include financial incentives such as the Interest-free Financing Scheme and the former Merit Star and Core Contractor Schemes, stockpiling of key materials to meet HDB contractors' needs, requirements for the use of particular grades of personnel and types of equipment for various types and sizes of projects and institution of management systems and technical advisory services for contractors (Ofori, 1989). As a result, the HDB has consistently surpassed the physical targets under its 5 year programmes and over 87% of the population live in some 670 000 units of relatively high-quality public housing, with nearly 80% owning their homes (HDB, 1992).

Other public-sector client agencies have also generally endeavoured to improve the demand conditions of construction enterprises to help upgrade their performance and ensure that they can complete social and infrastructural projects (Chow, 1990). The initiatives include streamlining tendering procedures, expediting certification of work done and facilitating technology transfer (Ofori, 1988). These initiatives have contributed to propelling construction to newly industrializing economy status within a generation (Ofori, 1988).

Construction in economic development

In Singapore's first development plan (Ministry of Finance, 1961), the implications of a programme of rapid industrialization, mass housing, school building and infrastructure development for the construction industry and the necessary measures, were articulated. However, highlighting the weaknesses of planning and the difficulty of construction industry development (Ofori, 1990), although most of the suggested courses of action were taken, few of the spending targets were met, owing to inadequate construction capacity (Economic Planning Unit, 1964). But in two decades (1960–82) the industry grew by over 30 times in real terms and built facilities which had helped the economy to expand by seven times: the length of roads doubled, electricity and gas production grew over 10 and 7 times respectively, and enrolment in secondary schools increased 3-fold and that in universities by 3.5 times (Department of Statistics, 1983).

In line with the nation's export-based economic policy, export of the construction expertise and capacity acquired in the nation's development was a key strategic thrust in the 'Ten-Year Plan' (Ng, 1982). Under the plan, track records of construction firms would be built up, consortia integrating professionals with contractors encouraged and financial and fiscal incentives provided. However, despite these intentions, the export of construction services was ignored by the industry until a severe downturn in local construction demand in the mid-1980s.

Economic committee

The Economic Committee (1986) examined the long-term problems and prospects of the Singapore economy, identified new growth areas and defined new strategies for promoting growth. Reviewing the performance of the construction industry the Committee observed that whereas local contractors had generally developed their technical and financial resources and managerial and technical expertise, they could not compete for sizeable projects with their foreign counterparts, both locally and abroad.

Growth niches for construction included maintenance and renovation, development of tourist-related facilities and export of construction services. A strategy to develop the industry would embrace incentives to support export and encouragement of the financial institutions to offer support, development of expertise in countertrade and promotion of technology transfer. The industry should also be helped to mechanize, upgrade its techniques and skills, expand its R&D efforts and exploit the 'total Singapore capability' (Economic Committee, 1986, p. 201) in their export ventures.

Strategic economic plan

Singapore's strategic economic plan (SEP) (Economic Planning Committee, 1991) is based on Porter's (1985, 1990) ideas. It seeks to help propel Singapore to developed-country status. The SEP provides an overview of the economic landscape over the next 20–30 years, defines a vision for the economy, analyses the vision and key strategies and programmes necessary to achieve it and enlists the support of labour, business and government in the formulation and implementation of the shared vision. It identified eight strategic thrusts: enhancing human resources, promoting national teamwork, becoming internationally oriented, creating a conducive climate for innovation, developing manufacturing and service clusters, spearheading economic redevelopment, maintaining international competitiveness and reducing vulnerability.

The SEP offered programmes for developing each of the 14 identified clusters of Singapore's economy but only those for the manufacturing and services sectors were presented in detail. The vision statement for the construction cluster in the plan is:

(i) to enhance Singapore's competitiveness in construction services;
(ii) to establish Singapore as one of the centres for construction services for the Asia Pacific region (Economic Planning Committee, 1991, p. 134).

The industry will be upgraded to enable it to achieve higher productivity and higher quality of work, the level of export of construction services will be enhanced and

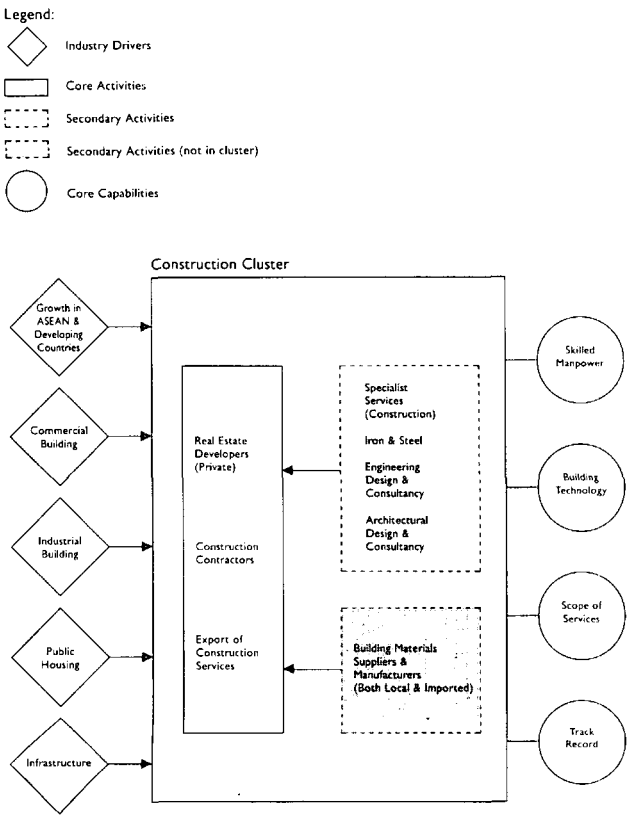

Figure 3 Depiction of construction cluster in the SEP. Source: Economic Planning Committee (1991)

the resource efficiency in labour utilization will be improved. Figure 3 shows the depiction of the construction cluster in the SEP.

Construction considered separately

A number of studies have considered the construction industry in Singapore on its own and formulated measures for improving its performance.

Ad hoc *committees*

A Commission of Inquiry into the Construction Capacity of Singapore (1961) assessed the capacity of the Singapore construction industry in the light of the planned rapid development programme and recommended measures to address its shortcomings. Another committee (Science Council of Singapore, 1971) studied the problems facing the industry as a result of the increase in its activities and suggested solutions. Both teams offered shopping-list recommendations, including further education and training, registration of contractors, more appropriate project documentation, further mechanization and more R&D. They also suggested some proactive measures: levels of construction activity and resource needs should be forecast and a central coordinating body for the industry formed.

Property Market Consultative Committee

The Property Market Consultative Committee (1986) addressed a serious property over-supply situation. Its suggestions included publication of relevant, accurate and timely data, assignment of oversight of all aspects of property development to a single ministry or statutory board (preferably the Ministry of Finance), help for construction enterprises to build up their track records and, hence, their overseas competitiveness, farming out of government agencies' design work to private practitioners and regulation of the number and activities of foreign contractors.

Construction Industry Development Board's corporate plan

The Construction Industry Development Board (CIDB) was set up in 1984 'to promote the development, improvement and expansion of the construction industry' (Government of Singapore, 1984, p. 6). In its 'corporate plan' (CIDB, 1988), the Board's activities were reviewed and plans for developing the industry over the succeeding decade articulated. The document is the closest to a long-term strategy for the construction industry Singapore has had. Such a 'master plan' had been called for by various observers, especially the contractors' association (Science Council of Singapore, 1971; *The Contractor*, 1986a).

The CIDB (1988) foresaw opportunities as well as challenges. Construction would face more demanding tasks as the economy progressed towards maturity and firms sought opportunities abroad. In these circumstances, measures aimed at realizing *ad hoc* improvements would be inappropriate. The industry should achieve timely delivery of its products at increasingly higher levels of quality. Specific proposals for action, arranged in order of priority, were made for the short-term (12 months), medium-term (1–5 years) and long-term (5–10 years). The proposals – and the actions taken on them – are now considered.

Cost competitiveness. To improve the cost competitiveness of the local construction industry a major review of the construction process would be undertaken and relevant policy recommendations formulated – such a study was undertaken in 1988 (its report is considered below). An econometric model for forecasting construction demand and, hence, resource needs would be formulated – a task completed in 1991. Construction productivity would be improved and an appropriate measure for it developed – the report of the Task Force on Productivity was published in 1992. Ways of

assessing the progress made towards the achievement of stated objectives would also be sought.

Construction management would be improved by promoting the development of supportive design and tendering practices. A long-term aim was to make constructability a principle in design – the Buildable Design Awards were introduced in 1992. A material management system would be instituted to reduce wastage, in the long-term, to below 1% (among large contractors). The registration criteria for contractors would be periodically refined. An advisory council would be formed to guide and coordinate Singapore's construction R&D efforts – the council was established in 1989. Five year R&D plans would be prepared to give local firms a competitive edge in certain niches and make R&D a norm in large firms.

Modular coordination and prefabrication would be promoted to reduce the industry's labour requirements. A technology assessment scheme would be instituted and developed into an *agrément* system for construction products and processes for South-east Asia. A technology information clearing house would be established. An industry-wide plan for computerization and automation would be formulated. A computer applications centre for the industry would be set up – the Design Support Centre, a computer-based library of standard design details, was established by the Board and the Singapore Institute of Architects in 1990 (by 1992, it had 210 subscribers receiving design details on disk).

Quality and human-resource development. Quality management systems would be introduced, the long-term aim being the institution of quality auditing as an industry norm. A structured quality assessment system would be used to monitor firms' performance and achievements recognized through the contractors' registration system and the awards for construction excellence. The Construction Quality Assessment System (CONQUAS), an objective system for assessing the project performance of contractors, was introduced in 1989 and the Quality Premium Scheme, which offers a tendering preference to large contractors with high CONQUAS scores on public-sector projects, initiated in 1990. Since 1992, the CIDB, and the Singapore Institute of Standards and Industrial Research have certified construction enterprises under ISO 9000.

A study of labour-only subcontractors would seek to improve their performance and assess the effect of an accreditation system, training support and technical advisory services. The trade certification and continuing training programmes would be expanded (to 4000 places and 2500 places per annum, respectively): every construction tradesperson should be trained by 1995. The industry would be encouraged to assume increasing responsibility for training and take it over by 1995. Since 1989, the facilities for training and certification have been expanded, syllabi for courses and procedures for tests have been refined and efforts have been made to attract more Singaporeans into the industry.

Export and strategic sectors. The export performance of consultants and contractors would be improved. An exports advisory council would be formed – the council was formed in 1989. Local firms would be encouraged to form strategic alliances and consortia and in the long-term, to develop capability for build–operate–transfer projects. The CIDB would improve its export business advisory and market information services and assistance schemes. Examples of export assistance schemes introduced are:

(a) financial incentives including the Market and Business Development Assistance Schemes which offer firms grants to set up and tender for projects overseas;
(b) technical assistance such as the Approved Public Professionals Attachment Scheme under which firms may engage public-sector experts for overseas projects; and
(c) information services including the overseas market and tendering data.

National needs would be ascertained and the capability of the local industry developed in emerging sectors such as maintenance and retrofitting, intelligent buildings, high-technology production facilities and advanced engineering works. Relevant standards, regulations, practices and training programmes would be proposed.

Cost competitiveness report

As heralded in the 'corporate plan', the CIDB (1989) compared Singapore's construction industry with those of 15 cities in developed countries such as Japan, the UK and the US (Singapore's sources of foreign investment), other newly-industrializing economies such as Hong Kong (Singapore's trade competitors) and developing countries in the region such as Malaysia (Singapore's potential competitors for foreign investment). Comparisons were made among unit construction costs for typical building types. Design and construction practices were then studied to ascertain the causes of the differences in costs and measures for improving the performance of Singapore's construction industry suggested.

The cost competitiveness of the construction industry in Singapore ranked creditably with those in other cities and unit costs of construction were between the second and fourth lowest for the various building categories. However, considering the relative levels of input costs Singapore's performance could be improved. Weak-

Table 1 Indicators of construction industry performance, Singapore, 1988–91

	1988	1989	1990	1991
Contracts awarded ($m)	3400	5500	8000	7900
Gross construction output				
Total ($m)	3900	4300	4900	6800
Per worker ($'000)	48	44	47	58
Growth rate of value added in construction	−4.4	1.3	7.2	21.0
Construction labour force ('000)	82	97	104	117
Mean CONQUAS scores of buildings (%)	66.2	67.9	69.4	70.2
Registration of contractors cases processed	6490	7152	6600	6500
Processing time				
Renewal (days)	48	28	17	4
New and upgrading (weeks)	88	68	38	10
Overseas construction contracts secured ($m)	543	806	1069	951
Number of workers trained				
Full-time courses	858	981	971	577
Part-time courses	2027	3087	3811	6490
Number of workers skill tested	2148	3615	4591	6899
Number certified	1255	1646	1630	2727
Number of supervisors enrolled	466	834	760	530
Number trained	120	490	551	450
Investment Allowance Scheme				
Allowance granted ($m)	1.0	1.1	6.9	8.0
Total investment ($m)	2.5	3.4	22.3	23.4
Construction R&D spending				
Total ($'000)	2250	3036	5472	–
Per ($m) of contracts awarded ($'000)	680	575	711	–

Sources: CIDB (1991, 1992).
All figures are in Singapore dollars.

nesses in the local industry identified included poor construction management and labour productivity, over-reliance on subcontracting, high levels of wastage on site, inappropriate contracts and administration procedures and complex and unsuitable regulations. The recommendations generally echoed those in the 'corporate plan'. In addition, the report recommended changes in government's development and building control regulations which have since been implemented.

Appraisal and need for action

The Singapore construction industry has been radically transformed during the past 30 years (Ofori, 1988). The generally good progress made under the 'corporate plan' and the cost competitiveness report is outlined in Table 1. Some key areas of success worth highlighting are increases in the number of persons tested and certified and in output per person, improvements in CONQUAS scores, increases in grants for investment and the rise in the volume of exports. However, some problems remain. Human-resource related ones may be highlighted. The industry has a poor image and attracts few Singaporeans, especially at site-operative level – over 70% of Singapore's construction workers are foreign, despite a national aim to limit this reliance. Construction productivity remains low. Over the decade 1981–91 (for most of which the industry was shedding jobs), the annual rate of growth in construction productivity averaged 3.2% compared with 4.3% for the economy. The labour subcontracting system is still prevalent although it is blamed for the industry's coordination, productivity and material-wastage problems (CIDB, 1988, 1989).

In addition to the persisting problems, many other challenges lie ahead. Furthermore, the measures in the cost competitiveness report were, by design, tactical. The corporate plan was also not long-term: most of its recommendations have already been implemented, as shown above. Thus, a new long-term strategy for developing Singapore's construction industry is required.

Courses for action

Technique

Singapore excels in formulating medium- and long-term broad perspectives for the nation and the economy. A recent policy document outlines objectives in *all*

aspects of its development over the next 25 years (Government of Singapore, 1991) and several blueprints map out national directions in various fields. These include the SEP, *The Green Plan* and the *IT 2000 Report* considered below. The construction industry of Singapore should follow this example to carve niches for itself, considering its competitive advantages. Construction enterprises should strategically exploit the country's *total resources* to upgrade their operations, enhance their productivity and improve their competitive edge both at home and abroad. To achieve this, a long-term strategy for the industry providing the basis for rolling shorter-term action plans, will be necessary.

Considering the complexity of the task of developing the construction industry of Singapore in the future, the shopping-list approach would be inadequate. A technique which affords a more rigorous analysis of the industry and its operating environment will be necessary. The concept of strategic planning appears most relevant. It would enable a conceptual framework combining all the four points set out above and the fifth adopted in Singapore to be utilized. Porter's (1990) diamond concept would be useful. It could be supplemented by such tactical planning tools as the CIDB's econometric models for forecasting trends in demand and the resource planning models of the CIDB and the HDB.

Scenario and implications

The long-term vision of Singapore's physical planners (Urban Redevelopment Authority, 1991) is that of a world class city, an international investment hub with cultural and creative centres which retains its Asian identity. Self-contained regional centres will allow Singaporeans to have jobs closer to their better quality homes. The transport system will be improved, extended and diversified. There will be more leisure facilities and careful use of green areas, waterbodies, islands and coral reefs. The socio-economic factors which will underlie this physical transformation and influence the strategy for the construction industry are now analysed.

On present optimistic projections, Singapore's gross national product per capita will be between US$21 100 and US$25 500 by 2010 and will catch up with that of the US around 2030. This observation is well-founded: compared with Organization for Economic Co-operation and Development countries, Singapore had the highest real GDP growth rates in 1979–89, highest official reserves per capita (1990) and lowest interest rates (Economic Planning Committee, 1991). The maturing economy will pose increasingly complex tasks to the construction industry. With increasing purchasing power, there will be greater emphasis by individuals on human comforts. As the population ages (25% of the Singapore population will be aged 60 and over by 2030, compared with 9% in 1991: Government of Singapore, 1991), the society will pay greater attention to the needs of the elderly. These trends will affect the demand conditions of the industry, with implications for its structure, practices and procedures such as increasing emphasis on quality of workmanship and provision of special industrial, commercial and social facilities which will require greater skill in design and construction. Conscious efforts should be made to establish and exploit the symbiotic relationship between the local construction industry and the nation's economic development, as the General Manager of the CIDB observed:

> The industry must keep in step with the Government's goal of making Sinagpore a global hub and total business centre. It must anticipate and develop the expertise needed to deliver high quality work at optimal speed and cost (Singh, 1990, pp. 12 and 13).

The shortage of land in Singapore will be increasingly acute. Some 49% of the country's area of 640 km^2 has been used for development (Department of Statistics, 1992). It is estimated that land reclamation can increase the area by a maximum of 17% (Ministry of the Environment, 1991). Further 'land creation' will be required. Measures and techniques for dealing with such issues are already well-advanced in such countries as Japan (International Council for Building Documentation and Research Studies, 1989). It behoves Singapore to seek solutions appropriate to the local situation.

The current national desire to develop a regional economy and external trends such as the concept of 'growth triangles', the ASEAN Free Trade Area, the Association for Asia-Pacific Economic Co-operation and the proposed South-east Asian Economic Caucus will give further impetus to construction exports (Low, 1993). A comprehensive export strategy based on the 'total capability and resources' of Singapore and the concept of '*Singapore international*' (*Government of* Singapore, 1991) will be required. Managerial skills necessary for overseas operations will need to be improved and more widely disseminated in the local construction industry. Strategic alliances among construction enterprises and among such firms and those in related sectors would be required (*The Contractor*, 1986b; Low, 1993).

An increasing trend towards privatization is likely, as heralded by the restructuring of health-care institutions and the Telecommunications Authority of Singapore and the planned privatization of the broadcasting services. The importance of the public client will decline, providing opportunities for build–operate–

transfer projects. The government's interest in the construction industry may also be reduced. Measures to enable the industry to perform well in these circumstances are required.

Some key aspects of the strategy

Four of the main issues relating to the formulation of a strategy for the Singapore construction industry are now considered.

Vision statement and cluster composition

The vision statement for the construction cluster in the SEP is appropriate. However, it emphasizes the industry's external operations, whereas an important consideration is ensuring it is able to meet national requirements, as indicated by the CIDB's mission statement:

> To develop a construction sector which is capable of providing high quality construction work and value for money and is responsive to Singapore's economic needs (CIDB, 1990, p. 6).

To formulate an appropriate vision and delineate a cluster, a suitable definition of the construction industry is required. The definitions in the CIDB Act and the standard industrial classification of economic activities relate to site activity. It would be most appropriate to define the industry widely to enable all the relevant interrelated factors to be addressed (Ofori, 1990).

Appropriate depiction of the nature of the cluster is essential to success in strategic planning. A main weakness in Fig. 3 lies in the core capabilities. Of the three 'core activities' indicated, two are organizations or persons. Under 'scope of services' and 'track record', the main strengths of the Singapore construction industry could have been made clearer. The activities included in the cluster and 'secondary activities' suggest a narrow definition of 'construction'. Of the 'secondary activities', 'specialist services (construction)' and 'iron and steel' are unclear. Finally, of industry drivers only 'growth in ASEAN and developing countries' is really a driver.

An alternative structure for Singapore's construction cluster is indicated in Fig. 4. The industry drivers are deduced from the future scenario for construction outlined above. Figure 4 differs most significantly from Fig. 3 in terms of core capabilities. Those indicated in Fig. 4 may be discussed. Singapore's framework of statutes, regulations and administrative structure concerning the planning, development and maintenance of the built environment is highly developed and offers a capability which needs to be honed to ensure the provision of a continuously up to date and sufficient physical stock to support national socio-economic

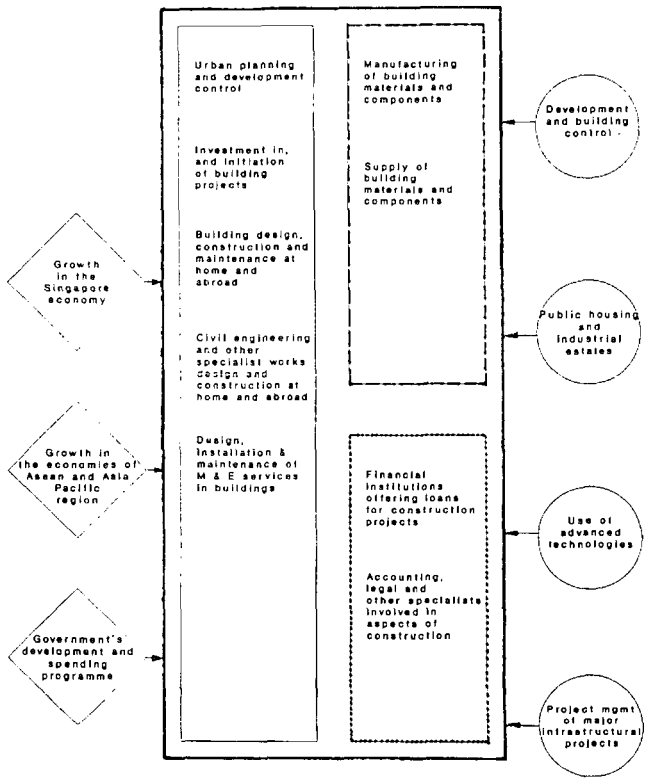

Figure 4 Proposed construction cluster composition. Core activities ▭, secondary activities ▭, secondary activities (not in cluster) ▭, industry drivers ◇, core capabilities ○

progress. Singapore's core skill of policy formulation for and planning, development and maintenance of public housing and industrial estates also needs to be continuously improved to meet the aspirations of the majority of the country's population and businesses. The application and adaptation of advanced construction materials, components, systems and techniques and the project management of large infrastructure and commercial-building projects are also key capabilities.

Financial services cluster

Through competition among rivals in Singapore's financial sector, stimulated by dynamic demand conditions from rapidly growing enterprises and imaginative national guidance and control, a world-class cluster has emerged. The construction industry seems to have benefited little from this, as many recent studies show that few local construction firms are able to offer the financial packages which are vital components of international tenders (Economic Committee, 1986).

Direct financial assistance has not featured in the attempts to improve the factor conditions of the construction industry, although the CIDB is empowered to 'provide financial assistance in the form of grants, loans or otherwise to persons engaged in the construction industry . . .' (Government of Singapore,

1984, p. 7). The 'building and development sector' is a favoured customer of the banks; there has recently been considerable innovation in financial packages for property development (Lee *et al.*, 1989). During the decade 1989–91, loans offered to the sector formed 20% of all loans to non-bank customers, while construction contributed only approximately 7% to gross development product (Department of Statistics, 1992). However, the financial institutions appear to attend to the needs of developers and end-purchasers, whereas those of contractors are inadequately catered for. Anecdotal evidence in a recent study showed that foreign banks are more willing to extend financial assistance to construction firms than local ones (Lai, 1991).

Local construction firms cannot develop the resources and business acumen of the major foreign firms overnight (Quak, 1990; Low and Rashid, 1993). However, the advanced financial services cluster, to be further improved under the SEP, offers them a positive advantage. This national 'resource' should be better exploited. To enable this to be done, a comprehensive study of the factors hindering the effective use of Singapore's financial system by construction enterprises is required.

Information technology as factor condition

Singapore aims to be 'the first Intelligent City in the Tropics'. Under a national strategy and a top–down approach, it is developing further its IT industry, infrastructure, personnel and expertise (Economic Committee, 1986) and strategically using IT to improve its economic competitiveness and the quality of life of its people (National Computer Board, 1992). With national electronic data interchange (EDI) networks ('one-stop, non-stop' information services) developed for many sectors, IT has effectively become a factor condition in Singapore.

At the turn of the century Singapore will have a Nationwide Information Infrastructure connecting computers in virtually every home and workplace which will make it a key switching centre for goods, services, capital, information and people (National Computer Board, 1992). For example, with innovative use of IT, the competitiveness of construction firms in Singapore will be enhanced through better interfirm coordination through standardized procedures for information management. This will facilitate the formation of internationally competitive consortia, support of electronic submissions to government and document exchanges among professionals and companies and transmission of electronic documents from one stage of the construction process to another, increasing productivity and minimizing errors.

Although the level of usage of computers in construction is high (over 75% of firms use computers; *The Straits Times*, 1991a), the applications are to routine administrative and accounting activities and specialized technical tasks (Chow, 1990). Contrary to developments in other economic sectors, IT applications in construction are bottom–up, tactical and uncoordinated. Initiatives launched by the government to set up EDI networks for construction include the Integrated Land Use System (ILUS) which facilitates development and building control. Considered the first of its kind in the world and involving several new technologies, ILUS integrates graphic and textual data (digitized from 35 000 maps and 8 gbytes of information) on land use, buildings, roads and development constraints (*The Straits Times*, 1990). The Construction Industry Information Network (*CoInNet*), (on tenders, input prices and contractor-related information) developed by the Singapore Contractors' Association Limited, the National Computer Board and the CIDB, became operational in 1992 (*The Contractor*, 1992). The Construction Management Information System (*COMIS*) is also being developed under the CIDB's leadership.

Unlike ILUS, *COMIS* and *CoInNet* have very modest aims. They will add to the 'islands of construction information' emerging in Singapore. Construction poses unique problems to the effective application of IT (Betts *et al.*, 1989). Progress appears most likely through a planned and properly led effort involving or at least supported by all interested parties. Effecting the strategic exploitation of IT should be a key issue in the formulation of a long-term plan for the Singapore construction industry.

The environment as demand condition

Legislative and regulatory instruments administered by the Ministry of the Environment (MoE) has guided and facilitated Singapore's success in developing a 'clean and green' city. The *Green Plan* '. . . describes the policy directions Singapore will take towards realising the long term vision of a model Environment City' (MoE, 1991, p. 1). Construction-related objectives in the plan include

(a) to assess the environmental impact of all developments before planning approval;
(b) to promote the use of clean technology and continue to monitor ambient air, water quality, noise and tunnel air quality;
(c) to introduce stricter emission standards for pollutants;
(d) to promote energy conservation and use of renewable energy;
(e) to review the content of environmental education in syllabi;
(i) to introduce a labelling system to assist consumers in identifying 'green products';

(j) to cooperate with countries in the region on environmental controls, standards and awareness promotion; and
(k) to support R&D on environmental technology.

The National Council on the Environment, an advisory body, seeks '. . . to enhance public awareness on the environment' (MoE, 1991, p. 22).

The MoE aims to make Singapore a regional centre for environmental technology transfer, offering financial incentives to firms to develop environmental technologies, thereby attracting several specialist international firms. Assisting South-East Asian countries to address industrial pollution and in other aspects of environmental control has been identified as a niche for Singapore (*The Economist*, 1992). The potential is great: South Korea and Taiwan plan to spend US$12 billion and US$10 billion, respectively, on cleaning up and the World Bank will lend some US$4.3 billion to poorer countries in the region for environment-related projects (*The Economist*, 1992). The MoE's private company provides consultancy services in waste water treatment, solid waste management and pollution control, offering clients 'tropical environmental engineering solutions [as] many current solutions are tailored for temperate countries' (Leow, 1991, p. 1) and has won consultancy and training contracts in Indonesia, Malaysia and Vietnam.

Singapore's construction industry has not taken initiatives nor prepared plans to address environmental issues although environmental considerations should permeate every stage of the construction process (Ofori, 1992). Environmental awareness among the public and, hence, construction clients, end-purchasers and users, is rapidly increasing, as is evident in the interest of building owners and users in energy conservation (*The Straits Times*, 1993). As indicated in the *Green Plan*, the government's construction-related environmental regulations will also become more stringent. These trends will affect the nature of constructed items, materials used and techniques adopted. Thus, demand conditions in Singapore and abroad will soon compel the local industry to pay greater attention to the environment. This issue should be considered in the formulation of a sectoral strategy.

Developing and managing the strategy

The programmes for construction industry development adopted in Singapore have generally followed the prevailing principles of planning. While the latest adopts the novel concept of strategic planning, some refinement of the approach is required. The development of the construction industry in Singapore should be more closely synchronized with that of the leading clusters and with the nation's overall plans: it should endeavour to use all the nation's 'resources'. Figure 5 presents an approach to the formulation of a strategy for the industry.

A committee representing all relevant parties in the construction industry, led by the CIDB, should be entasked with the formulation of the strategy and action plans. It should, thereafter, be maintained to undertake periodic review and refinement of the strategy and preparation of subsequent action plans. The formulation of the strategy will not necessarily guarantee success: its implementation is even more important than its formulation. The strategy and related action plans should form the basis of the CIDB's operations.

The critical areas of success and success factors should be clearly stated. Wherever possible, measurable targets should be set and ways of assessing them indicated. Research on the formulation of a set of indicators for assessing and monitoring progress in construction industry development (highlighted in the CIDB's 'corporate plan') is urgently required. The strategy should be widely publicized to generate support from practitioners. It should be constantly monitored: a system of annual audits could be followed. Success in any area should be built upon incrementally.

In addition to the government's efforts to improve the industry's factor and demand conditions, rivalry among enterprises has helped improve construction performance in Singapore. This should be further encouraged. Internal reorganization of the industry and fine-tuning of practices to achieve the strategic objectives should be promoted and facilitated.

Synthesis and lessons

Singapore has successfully integrated the planning of and policy formulation for its construction industry with those relating to its national economy. Whereas much remains to be done, Singapore's experience offers lessons in the planning of construction industry development to the emergent countries. Salient features of Singapore's experience include:

(a) realistic long-term planning for the nation, outlining broad national objectives (economic, social, cultural, political and so on) and providing the framework for other plans and programmes;
(b) long-term planning of the national economy in which construction, recognized as a distinct sector of the economy and a determinant for socio-economic development, features prominently;
(c) medium-term planning for the construction industry, including resource planning;

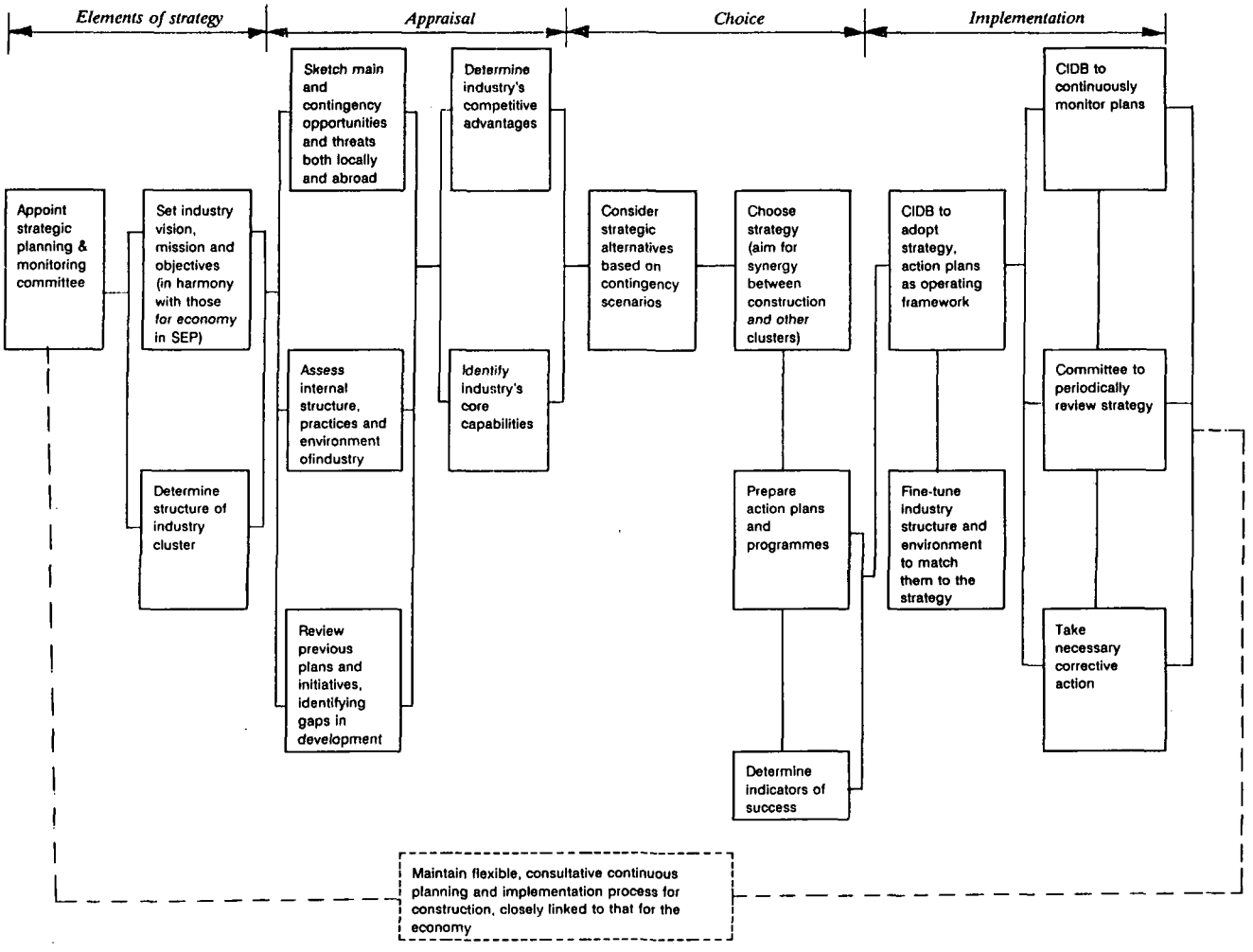

Figure 5 Process for formulating a strategy for the construction industry of Singapore

(d) central direction of construction industry development including monitoring and review of policies, regulations and programmes to assess their progress and ensure their continuous relevance; and
(e) efforts to improve the industry's factor and demand conditions with incentive schemes and project opportunities.

Conclusion

The construction industry in Singapore has undergone several radical changes during the last generation. Under the framework of strategies and policies initiated by the government, the performance of the industry has been improved. However, the problems which will confront the Singapore construction industry in future will be more complex and can only be effectively addressed with a long-term strategy utilizing the most sophisticated concepts. The development of the construction industry in Singapore should be approached in a 'comprehensive' manner and effort should be made to utilize positively all the construction-related 'resources' available in the country in seeking to improve its performance.

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