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Singapore – An Asian City-State

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Abstract: The various aspects of the physical make-up of Singapore are briefly considered – topography and regional geology, its equatorial climate, and its strongly man-modified pattern of vegetation. An analysis of the Republic's ethnically and linguistically diverse population introduces a consideration of occupational and economic structure. Considered finally are recent changes on the urban scene and the results of a successful governmental policy involving a relative swing away from the traditional entrepot function towards balanced industrialization.

Despite its Sanskritic name, which means Lion City, Singapore is not in India. Despite the fact that three-quarters of its population is Chinese, Singapore is not in China. Rather it is a small country lying at the southernmost tip of the Malay Peninsula to which it is linked by means of a causeway across tide-water. Since 1965 Singapore has been an independent republic and a member of the British Commonwealth. The political system is that of Parliamentary government with a nominated President, a Cabinet headed by a Prime Minister, at present Mr Lee Kuan Yew, and elected members of Parliament, all of whom are members of the ruling Peoples' Action Party.

Topography

The total area of Singapore is only about 588 km² which makes it one of the world's smallest independent countries. This total comprises approximately 540 km² of Singapore island itself, the remainder being made up of some 40 small offshore islands. The main island is of low relief as is shown in the following table.

The main island is lozenge-shaped with its maximum dimensions lying east-west. It is compact in form, having a coast line of 134 km. The offshore islands have a total coast line of 148 km. The highest point is Bukit Timah, 163 m.

Tab 1 Singapore Island: Area at Various Elevations (%) (excluding water bodies)

0 –	15 m	63.7
15 –	30 m	26.2
30 –	61 m	9.2
61 –	122 m	0.8
above	122 m	0.1
Total		100.0

Source: Wong, 1969

Geology

The geology of Singapore is an extension of that of the Malay Peninsula and contains all the major elements of the Peninsula except volcanic rocks and limestone. Four main lithological units may be recognized: the ancient sedimentary rocks, Triassic-Jurassic age; granite and associated sedimentary rocks, post-Jurassic age; the "Older Alluvium" of Pleistocene age; and finally, recent sediments.

Triassic-Jurassic Sedimentary Rocks

These rocks occur mainly in the western and southern parts of Singapore and contain a wide variety of rocks: quartzites, conglomerates, shales and sandstones. Included with the sedimentary rocks are small occurrences of extrusive volcanic rocks. The rocks of this lithological unit are deeply weathered, often to depths in excess of 30 m. The prevailing colours of surface outcrops are dark red, brown, orange, yellow, white and where carbonaceous, black.

The Igneous Complex

The granites and the associated igneous rocks are clearly younger than the old sedimentary rocks and have the form of a batholith from which the overlying cover has subsequently been partly stripped by erosion. Their formation was contemporaneous with the emplacement of tin ores elsewhere in the region, but these are lacking in Singapore. It is granite, not tin, which is of economic value and the granitic core has been gnawed into by quarries which, with the exploitation of sand, like granite, also used for building construction, represent the Republic's only mining industry.

Older Alluvium

The Pleistocene alluvium, often termed Older Alluvium to distinguish it from Recent deposits, was laid down when sea levels stood some 80 m higher than at present, perhaps during the First Interglacial. The base of this formation lies about 50 m below present sea level. The Older Alluvium consists of coarse sand with pebbles and boulders and is used as a source of sand for construction purposes.

Recent Alluvium

This comprises materials laid down since the end of the last Ice Age. They form a superficial layer over much of the coastal area below about 10 m, and exist also as alluvium and colluvium in the valleys. The materials are extremely varied, consisting of unconsolidated clays, silts, sands, gravels, peat and coral. The Recent alluvium is not used directly for any economic purpose.

Climate

Singapore is often taken as the archetype of the humid equatorial climate. In general, however, means tend to mask a considerable degree of variability from day to day and from season to season. The mean daily maximum temperature ranges lie between 30.5 and 32.2° C, whilst



Fig 1 Jungle Fall Stream, Bukit Timah Nature Reserve, Singapore, a tiny remnant of the original landscape

the mean daily minimum temperature lies between 22.2 and 24.2° C. However, during the course of a single day temperatures are likely to range from around 32° C down to 22° C, the change often taking place within half an hour. This is a reflection of strongly localized weather conditions which result from heating and local convection. However, not all precipitation originates from convective showers; rainfall also originates from air stream convergence and from vortices along the edge of air streams. The annual rainfall varies from about 2,000 mm to 3,000 mm per year. There are 175 – 195 rain days per year so that the climate on the whole is fairly sunny with a mean hourly range of bright sunshine per day (reckoned on a monthly basis) of 3.75 hours per day in the north-east monsoon period from October to December, rising to 7.75 hours per day in March and April.

The existence of extensive built up areas has a significant effect on the local climate in the central city areas where temperatures are on the whole approximately 3° C higher than at Singapore airport, the standard meteorological station for the Republic. At the same time in central areas, relative humidities tend to be 10 to 15 % lower than at the standard station. Moreover, sensible climate is also

strongly affected by architectural design of buildings. As would be expected in a country which has the second highest annual income per head of any in Asia, air-conditioning of public buildings is widespread. However, in non-airconditioned buildings, temperatures and to a lesser degree humidity, may be significantly affected by building design. Concrete buildings, which are in the great majority, tend to be less comfortable than simple wooden and thatched buildings of traditional design. Even in high-rise apartment blocks, where, at height, wind speeds tend to be comparatively high, the sensible climate is by no means as comfortable as in buildings of older design.

Coast and Sea Floor

The coast of Singapore is mostly rather flat. Cliffs are few and of no great elevation while considerable stretches have been markedly affected by the building of sea walls and reclamation. The materials of which the coast are made vary considerably often over short distances and a mixture of materials is the rule. On the whole, the coasts of the main island consist of fine sand or mud, coarse sand beaches suitable for recreational use being notably rare though artificially-formed beaches on the south-east coast are proving very popular. Coral is found only in offshore locations and appears to be dead or dying in most cases as a result of increasing turbidity of the water which in turn results from extensive reclamation around the coasts.

For the most part, the coastal waters are not more than 30 m deep, mostly rather less. The sea floor is covered with unconsolidated sand and mud, much of it deposited since the sea level rose at the end of the Pleistocene. No research has so far been undertaken into offshore resources.

Vegetation

The original vegetation of Singapore was largely equatorial rainforest with a margin of mangrove along the estuaries and muddy coasts, probably some strand forest along the sand ridges of the east coast and some swamp forest inland. Most of these communities have now disappeared. A four-fold classification of the existing vegetation may be recognized.

The Urban Desert

This type is characteristic of the central business area where vegetation is limited to a few ornamental parks and other public open space and where various forms of largely epiphytic vegetation, which usually includes some higher plants (notably *Ficus* spp.), is found on walls and rooftops. Again the areas of recently-built multi-storied apartment blocks likewise have limited public open space which is

grassed and contains ornamental shrubs. Finally, are the industrial areas in which any form of vegetation except roadside plantings of grass and shrubs is absent. These various types together occupy about 74 km².

"Urban Savanna"

This term can be used to describe ornamental grounds of the less densely populated parts of the city. In the suburbs extensive lawns, plantings of shrubs and even large trees are common, giving a park-like appearance to the landscape. This type covers an area of about 86 km².

Secondary Vegetations

These have sprung up after the removal of primary vegetation. They consist of forest and scrub, often with a grass component, with simple structures and are confined for the most part to the central portion of the main island which is used as a water catchment and recreational area. Commonly, vegetation consists of trees up to a height of about 10 m. The number of species is very much reduced as compared with virgin tropical rainforests. The total area of these vegetations, including disturbed mangrove, is about 116 km².

Little Modified Vegetation

This includes tiny remnants of mangrove (above 0.13 km²), a rather more extensive remnant of swamp forest (about 0.37 km²) and approximately 1.05 km² of virtually untouched rainforest in the centre of Singapore island. This is a valuable scientific and recreational resource.

Man and Land

Singapore is a classical example of the overwhelming impact of man upon nature, few if any aspects escaping entirely. The land forms have been widely modified by construction, reclamation and erosion resulting from the removal of vegetation. Three broad categories of intensity of change can be recognized. The first category includes all areas where the original topography is unrecognizable and the original soils have been either covered or cut away. This category includes most of the Jurong industrial estate, the Bedok and old Kallang airport reclamations, the many successive reclamations in the harbour and central city area and the airports.

The second class of change includes suburban areas where the original land form is still recognizable but is somewhat modified by cut and fill for buildings, roads, and

playing fields. This category comprises the bulk of the island.

The third category is that in which the terrain is little modified by human action although in some areas significant accelerated erosion exists as a result of deforestation and long-continued burning. The catchment areas and the Mount Faber ridge make up the bulk of this category.

Population

The population of Singapore derives almost exclusively from immigrants. In 1819 the island was inhabited in the vicinity of Singapore River by a small group of Malays. Malays remained predominant until about 1850 but from that time Singapore has been substantially a Chinese city. The mid-year population in 1977 was 2,308,200 compared to 1,445,900 in 1957.

The rate of population increase, unlike that in most of the rest of Asia, has recently fallen. In 1958 the crude birth rate was 41.1 ‰, in 1977 it was 16.1 ‰. This has been paralleled by a marked fall in infant mortality from 43.7 ‰ in 1958 to 12.4 ‰ in 1977. At the same time the crude death rate has fallen from 7.0 ‰ to 5.2 ‰ over the same period. The control of mortality has resulted in a tail off in the late 1960s. In 1958 the rate of natural increase was 34.2 ‰, but by 1977 it had fallen to 12.0 ‰, one of the lowest in Asia.

Like other countries, Singapore experienced a post-war "baby boom" and because people born at that period are now beginning to enter the reproductive age groups it may be expected that a further rise of population will take place. However, birth control is widely practised, and the implementation of it has been greatly aided by a high level of literacy. Government policy is strongly anti-natalist. Abortions are freely available and access to certain social services, e.g. choice of school, is affected by the number of children in a family. Accouchment fees and salaries tax rise with increasing family size. Nevertheless, a high proportion of the population is still below the age of 15 years (31 % in 1977, 43 % in 1957) and this has placed a considerable strain upon the provision of employment and education. Education is compulsory from the ages of 6 to 12.

The distinction of urban and rural areas is very blurred in Singapore but at least 90 % of the population could be considered urban. Population densities range from nil in the central parts of the island to as high as 1,772 per ha in an area of high rise public housing. This represents 177,140 per km² at which density the whole of the population of Singapore could be included upon 2 % of the total area. The crude density in 1977 was 3,745 per km².

The population is highly diversified into a number of ethnic and linguistic groups. The major ethnic groups are shown in Tab 2, but each of these can be further subdivided upon the basis of language or upon the basis of origin of the people. The Chinese community for example contains members who speak a wide range of dialects including Hokkien, the language of Fukien province, Teochew, Cantonese, Hylam the language of Hainan island, and Hakka. The second major group comprises the Malays. These may be distinguished by place of origin and include people from Java, Sumatra, Peninsular Malays and Singapore Malays. Malays marry freely with their Islamic co-religionists and there is a considerable group of mixed Indian-Muslim, Arab and Malay groups, all of which may be considered to be Malay in the broadest sense of the term. The third major group comprises persons of Indian origin, 'Indian' here referring to the sub-continent. The great majority of Indians originate from India especially Tamilnadu and Kerala. There are, however, significant minority groups of Bengalis, Sindhis, Sikhs and other north Indian groups. The "Other" group includes a wide range of minority communities of which the largest is the Eurasian community including Anglo-Indians, Anglo-Chinese and other persons of mixed race. There are also small minorities of Armenian, Jewish, Parsee, Persian and European origin.

The immigrant characteristics of the Singapore population are clearly shown by the strong dominance of males though this is less marked than formerly. Male dominance is particularly characteristic of the Indian community, although since 1957 it is clear that for all the sex ratios are approaching normality. The proportion of the total population which is Indian is still falling because of this imbalanced sex ratio but is likely to stabilize in the near future. The proportion of Malays continues to rise for two reasons. Since 1970 considerable numbers of immigrant, largely male, labourers have entered Singapore from neighbouring Peninsular

Ethnic Groups	1957			1977		
	%	(Census) (‰/000)	Sex Ratio (M ‰/00)	%	Estimates (‰/000)	Sex Ratio (M ‰/00)
Chinese	75.4	1,090.6	1039	76.2	1,758.0	1013
Malays	13.6	197.0	1100	15.0	346.9	1033
Indians ¹	8.6	124.1	2257	6.8	158.0	1408
Others	2.4	34.2	1098	2.0	45.3	1050
	100.0	1,445.9	1117	100.0	2,308.2	1039

Tab 2

1. Since 1970, Sri Lankans (Ceylonese) have been included as 'Indians' rather than 'Others'.



Fig 2 Though traditional Malay settlements on the Southern Islands appear to be economically oriented to the sea, the houses are generally not those of fishermen but of urban workers and the boats are used to commute to the mainland
Source: Tourist Promotion Board, Tudor Court, Tanglin Road, Singapore 10.

Malaysia to take up temporary employment. Furthermore, amongst indigenous Malays, families tend to be rather larger than amongst other communities.

Occupations

In Tab 3 the low proportion of persons in primary industries is strikingly low for an Asian country but scarcely surprising for one which is virtually a single city. In other respects the occupational structure markedly parallels that of industrially-developed western countries.

Tab 3 Occupations by Industrial Group (1977)

		%
Agriculture, fishing	19,777	2.2
Mining and quarrying	1,639	0.2
Manufacturing	245,492	27.2
Electricity, gas and water	11,397	1.3
Construction	41,967	4.6
Commerce	212,702	23.6
Transport and communication	105,629	11.7
Finance, insurance etc.	59,676	6.6
Community, social and personal services	204,343	22.6
	902,620	100.0

Primary Production

Although a low proportion of the work force is engaged in primary production including agriculture, fishing, mining and quarrying, Singapore is wholly or partly self-sufficient in a surprising range of commodities. Poultry including eggs, and pigs are amongst the livestock in which Singapore is wholly self-sufficient and indeed at times has an export trade, Approximately half of Singapore's requirement of vegetables is locally produced, these being mainly various Chinese leafy vegetables. The basic staple is of course rice, but this crop was never important in Singapore and has not been grown for about 80 years. Rubber and coconuts are to be found in the rural areas but for the most part rising land values have made the continued production of these commodities uneconomic.

Fishing is being developed, using modern offshore trawlers, but as yet less than half the total fish requirements are landed from Singapore's own trawlers.

There are no economic minerals of importance other than sand and granite. These are almost exclusively used in building construction. Timber is not locally produced, the remaining forests being strictly closed for reserves.

The Republic is not self-sufficient in water though a policy of eventual self-sufficiency is being followed. Perhaps one-fifth is provided from local sources, (the exact proportion is a state secret!) the remainder being brought by pipelines from the adjoining Malaysian Peninsular state of Johor. Steps are actively being undertaken to increase the area of storage and to recycle waste water for industrial use.

The Urban Area and Urban Growth

In general the pattern of land use in the city of Singapore conforms to western models. The Port lies within two miles of the Central Business District and adjacent to it is the railway marshalling area. The Central Business District lies on either side of the governmental and administrative centre focusing upon the Padang (literally "a field"). The older portion of the Central Business District lies to the west and south of the original focus of settlement along Singapore River but within the last 10 years the Central Business District has extended northwards along Orchard Road to replace a former suburban area. Inland from the administrative and central business areas, lies an area of old shop-houses, a typically Chinese settlement form. Most of these were constructed 80 to 120 years ago and these areas are now being redeveloped so that the three-storied shop-house is steadily being replaced by multi-storied blocks of offices, shops and residences. It is planned that the central city areas will still contain considerable population and so remain partly residential.

Flanking this area of old shop-houses now being redeveloped is a large semi-circular zone of low density

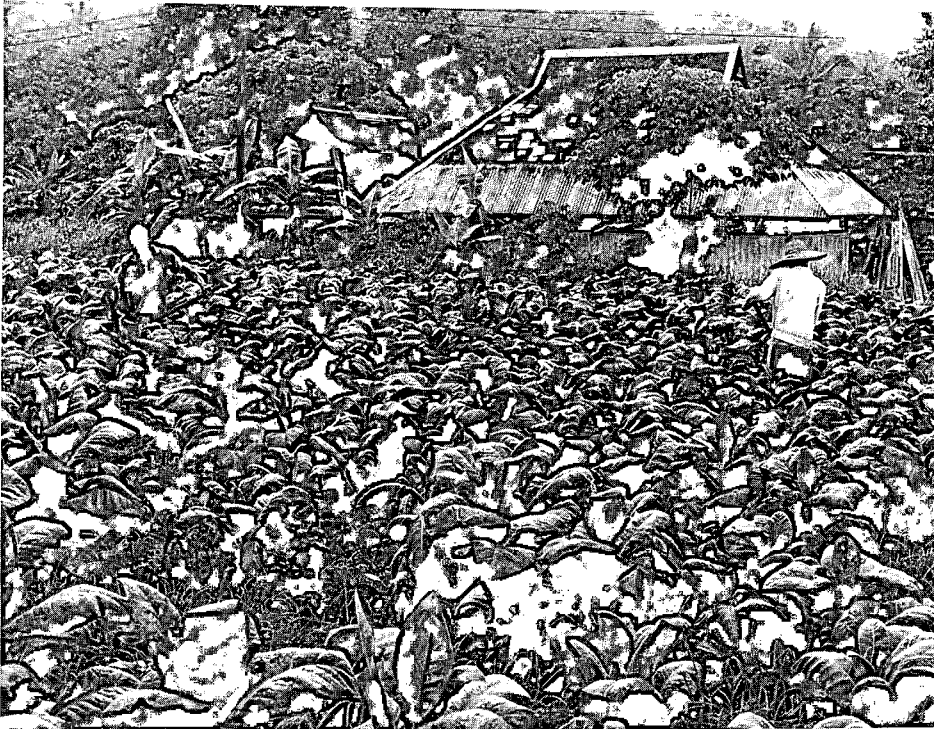


Fig 3 Agricultural Singapore – tobacco is a significant cash crop
Source: Tourist Promotion Board
Tudor Court, Tanglin Road, Singapore 10.

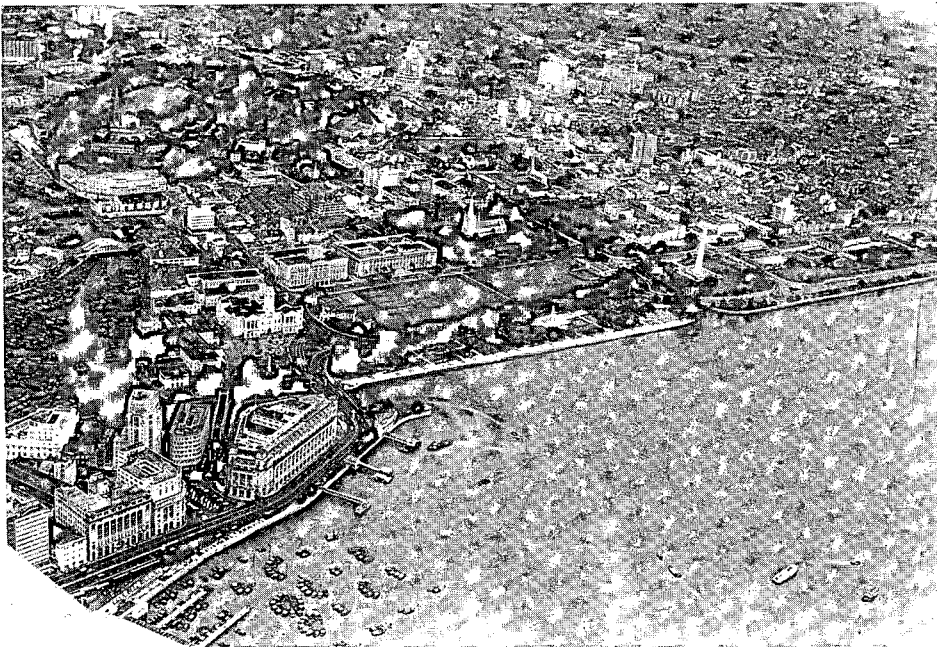


Fig 4 Singapore river and the administrative centre clustered around the Padang

surburbia. Here population densities range from about 10 per ha up to perhaps 100 per ha. At various points within this zone, however are nuclei of public housing, high-rise apartment blocks, in which densities may rise to as much as 1,700 per ha. Notable amongst these recently-built high density areas are Queenstown, Toa Payoh, Macpherson.

Beyond the continuously built up area lie a series of minor settlement nodes, some of them coastal, such as those at Bedok and Changi, some along the arterial highway to

Johor, such as Bukit Timah and Bukit Panjang. To the north, northwest and northeast of the island the areas are largely agricultural and rural in character though with here and there scattered industrial enterprises.

The older industrial areas are located either adjacent to or within Housing and Development Board (the public housing authority) areas such as Queenstown, Redhill and Toa Payoh, or are located along the main north-south arterial highway as at Bukit Timah. However, the largest

Fig 5 Colonial era remnants (foreground: YMCA and National, formerly Raffles, Museum) and the extending CBD skyscrapers, mostly less than 5 years old.

Source: Tourist Promotion Board Tudor Court, Tanglin Road, Singapore 10.



and newest industrial area is that at Jurong in the southwest of the island. This area was in 1960 a mangrove swamp interspersed with a number of low hills. The hills were levelled, the swamps filled in and the area converted into a large industrial estate totals of which the area is now 5,085 ha. The Jurong industrial area is a fine example of central planning and government initiative. The plan involved the construction of a new port, the leasing of areas at low rentals, the provision of tax exemptions for certain desirable types of industries for periods up to 5 years and government-financed construction of factories for lease. Government also provided basic services such as roads, drainage, water, electric power.

While Singapore was a member state of Malaysia development was slow but with independence in 1965, development, based upon both imported and local capital, proceeded apace. Industries are of many types and range from the heaviest types of oil refining, chemical manufacturing, ship breaking, ship building and ship repair, iron and steel manufacture, based on scrap, to light industries such as making of gramophone records and printing. These industries have been based upon an abundant and skilled labour-force. Labour resided away from Jurong at first. This problem has been partly solved by the building of a dormitory town though something of commuter problem, common to other industrial areas as well as Jurong, still exists. Such has been the success of the Jurong venture, that the government Corporation responsible now is responsible for a number of other estates where land is being prepared for industrial purposes. The Corporation



Fig 6 Housing Development Board apartments with adjacent light industry, Redhill

now has 1,750 establishments on its estates and these employed about 62% of the total labour force in manufacturing.

Industrial production in 1976 reached an output of S\$15,317 million* of which the added value was S\$3,962 million (26%). This proportion is rather low (though it has risen substantially in the last decade) because manufacturing is still partly dominated by industries such as rubber remilling and oil refining, in which the finished products are re-exported in relatively unfinished form. Future plans are to increase the proportion of added value and to this end the Singapore government has a vigorous programme of technical education.

* S\$2.40 = US \$1.00



Fig 7 Water-oriented industry. Milling of hardwoods imported from the adjoining region. Kallang Basin

External Trade

Singapore was founded upon trade, upon the import of goods and their subsequent export, without significant manufacturing or other processing in between. This entrepot trade is still important in the Singapore economy. In 1977, total imports reached S\$25,522 million and the total exports S\$11,652 million. This entrepot trade is likely to continue to be of importance although its relative importance has fallen greatly and will continue to fall in future. There has always been a considerable visible trade deficit but this has been more than compensated by invisibles, resulting in a favourable net income. Some of the invisibles that may be mentioned include provision of banking, insurance, and other commercial services, tourism, which has rapidly developed in the last five years, and in the past, defence expenditure by the United Kingdom.

The Port of Singapore

The Port of Singapore is amongst the world's largest on the basis of shipping tonnage. It has already displaced London as the fourth. Port facilities are controlled by a government Authority. The main focus of the port lies along the south coast and comprises Keppel wharves and the Teluk Ayer basin, the latter catering for coastal trade via lighters, with between them, the container terminal. Further to the west lie the Pasir Panjang wharves, opened in 1974 and the Jurong Port directly serving the Jurong Industrial Estate. To the north, Sembawang Port, the former British naval base is used mainly for low-value, high-volume cargoes such as timber. In addition, oil tankers berth directly at the various refineries.

The total cargo discharged in 1977, for example, totalled 39.8 million, of which 28.5 million t was mineral oil in bulk. The total cargo loaded was 24.3 million t of which oil in bulk comprised 16.3 million t. The great bulk

of this cargo is not handled across the wharves but direct to the oil refineries. Of the remaining non-oil cargoes, some two million tons of general cargo still finds its way from ships anchored in the roads to lighterage points in Teluk Ayer Basin and to a limited degree the Kallang Basin and along the Singapore River. The two latter were the original port foci in Singapore. The total amount of cargo handled by the Port of Singapore Authority both discharged and loaded comprises about 15 % of the total. Port facilities are reckoned to be extremely good and the opening in June 1972 of the container port further increased Singapore's importance as a port centre, handling some 200,000 containers annually.

The Future

Singapore's past achievements in the economic field are undoubtedly impressive. Unemployment has been largely reduced and those who remain unemployed are virtually only the unemployable. Indeed labour has already begun to be imported from the adjoining areas of Peninsular Malaysia. At the political level Singapore remains a prosperous Chinese enclave in a Malay region and it thus has the task of cementing good relations with surrounding countries. On the social plane it is likely that westernization will continue. This is already evident in such diverse fields as dress, language, (a considerable majority of the young people are reasonably fluent in English), in architecture and in general way of life. Rapid social changes have their attendant problems. Sociologists have warned that the breakdown of traditional family values coupled with ever-present crowding, noise and lack of privacy may lead to increased levels of delinquency, mental disorder and other forms of social trauma. On the whole, however, prospects for Singapore look very fair indeed.

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