# THE PRIMARY INFORMATION SECTOR IN SINGAPORE, JAPAN AND THE UNITED STATES

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*This paper attempts a quick analysis of the information sector in Singapore, Japan and the United States using the input-output methodology. An alternative way of computing the scalars to bisect a sector into two, namely information and non-information sectors, is used. From the empirical analysis, it is found that the information sector in Singapore has still some way to go before approaching the levels as found in Japan and the United States. Within Singapore, the information sector is a natural extension of the tertiary or service sector and its dominance and linkages reflect the service orientation of the Singapore economy. The information sector plays a crucial role in the global network of telecommunications and transport affecting economic as well as socio-political welfare. The paper suggests that regional and international co-operation is necessary to tackle the problems of uneven growth and development of various information sectors. Information and its communication is a two-way process. Its effects should be complementary and of mutual benefit rather than purely competitive.*

Keywords: input-output, information/non-information sectors, service-orientation, Leontief multipliers, linkages.

## INTRODUCTION

Information was never a costless and freely available good as assumed in early economic theory. Recognition that information is not zero cost has revolutionised not just the economics of production, consumption, communications, trade and technology, but also brought into focus its socio-political and welfare implications. The literature on the role of information, the information economy, informatisation trends and the like has been prolific.[1] The information sector is widely acknowledged as a distinct sector. Algorithmns using an input-output (I-O) methodology to measure the sector, have been developed.[2] Because of the push of shifting comparative advantage imposed by changes in international and domestic factors and the pull of technology, the information sector in a service economy like Singapore has asserted its importance. Its development has been nurtured and enhanced by the government and numerous statutory boards like the Economic Development Board (EDB), the National Computer Board (NCB), and the Telecommunication Authority of Singapore (Singapore Telecoms).[3]

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The active public sector policies towards information technology stem from the belief that efficient communication and information constitute an important aspect of basic infrastructure, which is a strong comparative advantage for Singapore. While Singapore's level of informatisation under the dimensions of infrastructure and human resources is fairly high[4], it has the constraint of size when compared with larger information economies in the Asia-Pacific region[5].

A comparative analysis is attempted in this paper to study Singapore's information sector relative to those of Japan and the United States, and thereby examine its relative standing as well as to offer some guidance about its prospects.[6] Primary information sectors are first identified for the three economies chosen for this study[7], followed by the standard I-O multiplier and linkage analysis of an aggregated four-sector economy and a more detailed 32-sector economy. From these comparative findings, some policy implications are suggested in the concluding section.

## MEASURING THE PRIMARY INFORMATION SECTOR

An asymmetry in information is synonymous with one in power as such differentials affect organisation, efficiency, productivity and comparative advantage across nations. A thorough understanding of the economic impact of the information sector is thus crucial especially in a service economy like Singapore. The definition of information is as perplexing as its measurement[8]. The I-O approach adopted in this paper to estimate the information sector in the three countries is not without its limitations. The static input structure and assumptions of equally stable price relationships and technology are accepted. For most countries, including the three studied in this paper, I-O tables take a long time to compile and publish. The latest available in Singapore is for 1983 while for Japan and the US, their 1980 and 1981 tables respectively are used.[9] The discrepancy in time period is probably not significant as their economic structures do not change so drastically and rapidly, the more so for matured economies like Japan and the US.

Another methodological limitation is the use of a scalar (ratio coefficient) to bisect a sector into information and non-information components. In the choice of scalar, other studies often make use of supplementary data from other sources, such as censuses of industrial production and surveys of services.[10] The data requirements are onerous and time consuming. In order to overcome this, an alternative method is proposed, whereby the scalars are derived from the I-O tables.[11] Briefly, the method involves two steps. In the first step, the core information industries are identified. In the second step the proportions of purchases from or sales to these core industries for each industry are computed. These proportions are then used as scalars to bifurcate each industry into its information and non-information components. This gives a quick but rough estimate of the information scalars.

All the I-O tables for the three countries are reduced to a 46-sector classification.[12] Using the bifurcation procedure[13] a total of 92 industries, 46 information and 46 non-information, are obtained. To consolidate the table for analysis, the 46 information sectors are aggregated into 13 major sectors and the 46 non-information sectors into 19. The resulting table consists of 32 sectors. This table is then used as the basic table for the computation of various measures of intersectoral dependencies and linkages.

## EMPIRICAL EVIDENCE

The traditional three-sector classification, namely, primary, secondary and tertiary, is appended by an additional sector, the quaternary sector or the information sector. This four-sector framework is to provide a bird's eye view of the information sector in each economy, before going more in-depth into the 32-sector analysis. Table 1 shows the sectoral shares of total intermediate demand, imports and value-added in the three countries. In both Japan and the US, the contributions of their information sector to gross domestic product have risen, from 18.8 per cent in 1970 to 23.0 per cent in 1981 for Japan and from 24.8 per cent in 1979 to 28.3 per cent in 1981 for the US.[14] In Singapore, the information sector output constitutes one-third of total output, second only to its secondary sector. Its information sector's contribution to value-added (37.5 per cent) is the highest both within Singapore and relative to Japan (23.0 per cent) and the US (28.3 per cent). This reflects its importance with Singapore being an international communication centre. Its strategic geographical location provides the comparative advantage and is likely to continue to provide further impetus for growth. For Taiwan in 1976, one study shows that its information sector contributed 20.0 per cent in value-added.[15] In comparison, the information sectors in Indonesia, Malaysia, the Philippines and Thailand contributed 8.8 per cent, 16.0 per cent, 12.8 per cent and 9.9 per cent respectively to value-added as against 23.6 per cent in Singapore, all for the year 1975.[16]

The information sector in Singapore is second to the secondary sector in terms of import share (29.2 per cent) and the highest among the three countries reflecting the country's high import dependency. This is quite atypical of the share of other services in the tertiary sector (8.9 per cent) which do not appear to have such a high import reliance. The share of the information sector in total intermediate demand (33.1 per cent) is the second highest in Singapore and the highest among the three countries.

The ratio (A/B) of the sectoral value-added (A) to total output (B) in Table 1 provides a useful measure of sectoral productivity. This ratio (A/B) can be interpreted as the ratio of the sectoral value-added per unit output to the economy-wide value-added per unit output. A value

greater than unity indicates productivity performance in excess of the national average.

**Table 1**

**Percentage sectoral shares in 4-sector economy, Singapore, Japan and US**

| | Primary | Secondary | Tertiary | Info | Total |
|---|---|---|---|---|---|
| Singapore | | | | | |
| Total Intd Demand | 1.59 | 35.53 | 29.81 | 33.07 | 100.00 |
| Imports | 0.66 | 61.22 | 8.94 | 29.19 | 100.00 |
| Gross Value-Added (A) | 1.29 | 25.63 | 35.59 | 37.50 | 100.00 |
| Total Output (B) | 1.10 | 42.47 | 23.37 | 33.06 | 100.00 |
| Rel VA/Output (A/B) | 1.17 | 0.60 | 1.52 | 1.13 | |
| Japan | | | | | |
| Total Intd Demand | 2.66 | 61.65 | 20.37 | 15.32 | 100.00 |
| Imports | 53.43 | 29.76 | 10.79 | 6.02 | 100.00 |
| Gross Value-Added | 3.95 | 34.13 | 38.94 | 22.98 | 100.00 |
| Total Output | 5.25 | 52.19 | 24.40 | 17.16 | 100.00 |
| Rel VA/Output | 0.75 | 0.65 | 1.53 | 1.34 | |
| USA | | | | | |
| Total Intd Demand | 5.76 | 55.94 | 18.67 | 19.62 | 100.00 |
| Imports | 22.78 | 60.73 | 5.46 | 11.03 | 100.00 |
| Gross Value-Added | 8.07 | 28.67 | 35.00 | 28.25 | 100.00 |
| Total Output | 7.74 | 43.28 | 25.72 | 23.26 | 100.00 |
| Rel VA/Output | 1.04 | 0.66 | 1.36 | 1.21 | |

Source: Singapore I-O tables 1983, Japan I-O tables 1980 US I-O tables 1981.[17]

In all three countries, only their secondary sectors have sectoral productivity thus defined below the national average. In Singapore, all sectors except the primary sector have a relative productivity measure above unity. It is noted that the agriculture sector in Singapore constitutes only about 1.6 per cent of gross domestic product. Scarcity of land space and competition for land use from other economic and social needs have led to a very small but highly productive agricultural sector. The agricultural sector makes use of the latest techniques and technology. For all the three countries, the tertiary sector tops the list in productivity comparison.

Table 2 provides the familiar Leontief multipliers for output, income and import for the three countries to assess intersectoral dependency. The income multiplier of a sector shows the sum of income generated in all supplying sectors as a result of an increase of one unit in final demand of that sector. For all sectors in all three countries, the income multipliers are less than unity. Except for its primary sector, all other sectors in Singapore have income multipliers lower than in Japan and

the US. Its quaternary sector has a higher income multiplier than its secondary sector but is less than two-thirds of those in Japan and the US. Compared with Taiwan in 1976, only the primary and tertiary sectors in Singapore have higher income multipliers (0.470 and 0.634 respectively in Taiwan).[18] Taiwan's secondary and information sectors have income multipliers of 0.426 and 0.642 respectively in 1976 which are larger than those in Singapore in 1983.

The output multipliers or backward linkages are the column totals of the Leontief inverse matrix. The output multiplier of a sector shows the total increase in output of all sectors given a one unit increase in the final demand of that particular sector. Forward linkages which are the row totals of the Leontief inverse matrix show what an individual sector will increase if a unitary increase in the final demand of every sector occurs. Singapore's forward linkages in its information sector are second to the tertiary sector and above the economy average. These values reflect the high linkage of both the tertiary and information sectors to the rest of the economy which is essentially very service oriented. However, in terms of the order of magnitude, they are the smallest among all the three countries. Its information sector's output multipliers or backward linkages are the lowest compared with Japan and the US. Compared with Taiwan, Singapore's output multipliers are all lower by as much as one-half (2.747, 2.971, 2.916 and 2.762 for the four sectors respectively in Taiwan in 1976).[19]

Both Japan and Singapore have very high import multipliers with the information sector in Singapore almost half that in Japan but higher than its own national average. A measure of the import leakage obtained by the ratio of import multiplier to the output multiplier gives a value of 0.280 for Singapore's information sector and 0.403 for Japan. In the case of the US, the value of this ratio is 0.036 which is very low in comparison, reflecting the low import requirements of its information sector.

## DISAGGREGATED ANALYSIS

Moving to more in-depth analyses of a 32-sector classification, various Leontief multipliers for the three countries respectively are computed. The multipliers derived will be considered in turn.[20] Of the thirteen information sectors, all of them in Japan have income multipliers above the national average compared to nine in the US and eight in Singapore. For the output multipliers there are five each above the national average in both Japan and the US while Singapore has four. There seems to be relatively more information sectors in Singapore with forward linkages above the national average than in the other two countries. This may be due to the supporting and facilitating nature of information services in a very service-oriented, urban economy. In terms of import

multipliers, Japan's dependency seems to be the greatest with all of the information sectors having multipliers above the national average.

**Table 2**

**Leontief multipliers in 4-sector economy, Singapore, Japan and US**

| | Income | Output | Forward linkage | Import |
|---|---|---|---|---|
| Singapore | | | | |
| Primary | 0.6385 | 1.4716 | 1.2397 | 0.3609 |
| Secondary | 0.3215 | 1.2673 | 1.4873 | 0.6802 |
| Tertiary | 0.7490 | 1.4118 | 2.1761 | 0.2602 |
| Information | 0.5600 | 1.3314 | 1.6243 | 0.4553 |
| Economy-wide | 0.5685 | 1.3951 | 1.3951 | 0.4423 |
| Japan | | | | |
| Primary | 0.5034 | 2.0592 | 2.3954 | 0.5034 |
| Secondary | 0.8351 | 3.4856 | 2.6530 | 0.8351 |
| Tertiary | 0.9523 | 2.6917 | 3.5585 | 0.9523 |
| Information | 0.9080 | 2.8456 | 2.2543 | 0.9080 |
| Economy-wide | 0.8254 | 2.9272 | 2.3186 | 0.8254 |
| US | | | | |
| Primary | 0.8065 | 1.7078 | 3.1851 | 0.1935 |
| Secondary | 0.8283 | 2.2228 | 2.5676 | 0.1717 |
| Tertiary | 0.9669 | 1.6548 | 3.0470 | 0.0404 |
| Information | 0.9374 | 1.7452 | 1.8336 | 0.0626 |
| Economy-wide | 0.8707 | 1.9879 | 1.9879 | 0.1293 |

*Computed as the row total of Leontief inverse matrix.

Source: As in Table 1.

In identifying key sectors, Rasmussen[21] has suggested the use of two indices: the index of dispersion (beta) and the index of sensitivity (alpha).[22] The index of dispersion for an industry is simply the ratio of the sector's output multiplier to the average of all sectoral output multipliers. Similarly, the index of sensitivity is computed as the ratio of the sector's forward linkage to the average of all sectoral output multipliers. Similarly, the index of sensitivity is computed as the ratio of the sector's forward linkage to the average of all forward linkages.

Computations to analyse their ranking for the three countries respectively are also made. The sector with the top index of dispersion in Singapore is quarrying (1.1705) compared with paper in Japan (1.5899) and textile in the US (1.3464). For the sensitivity index, the top sector in Singapore is commerce (1.7142), printing in Japan (2.3609) and chemical in the US (2.3481). Both Singapore's top indices of dispersion and sensitivity are small compared to those in Japan and the US.

Table 3 Provides the comparison of these indices and the multipliers of the ten top sectors in each country. In Singapore, four of the top ten key industries are information industries. The corresponding figures for Japan and the US are three and zero. The only key sector comon in all three countries is for non-metallic products. Printing appears on the top ten list for both Singapore and Japan. There is a higher correlation for the index of sensitivity where all the three countries share five common sectors in the top ten list, namely commerce, transport service, other services, chemicals and fabricated metallic products. In addition, Japan and the US have paper in common, while between Singapore and the US, the additional common sectors are utilities and professional services.

The concordance becomes even more perfect for income multipliers where all three countries have seven common sectors in the top ten list. Also each country has seven of the ten industries belonging to the information sector. As professional services in Japan are included in the category of other services, this actually constitutes another common sector in all three countries. Nonetheless, it is noted that Singapore's income multipliers are still smaller than those in Japan and the US.

The only common sector in all three countries in the top ten list for output multipliers is non-metallic products, while none is observed for import multipliers. Except for import multipliers, there are more information sectors in Singapore falling within the ten top sectors than in Japan and the US.

The rank correlation between Japan and the US in terms of their backward and forward linkages appears larger than comparing Singapore with each of these more advanced countries as shown in Table 4. In terms of backward linkage, that between Singapore and Japan is 0.0899, falling to 0.0051 with the US. In contrast, Japan's backward linkage with the US is 0.6932. On the other hand, the rank correlation improves for forward linkage, being 0.6876 and 0.6415 for Singapore with Japan and the US respectively. These are even higher in magnitude than for that between Japan and the US at 0.5899.

## CONCLUSION AND POLICY IMPLICATIONS

While noting the slight discrepancy in time period for the I-O tables used in Singapore, Japan and the US, the most obvious finding from the above analysis is that the information sector in Singapore has much to catch up when compared to that of the two more developed countries. Singapore's information sector in 1983 is still a developing one though it is relatively large compared with other service sectors in the tertiary category. The government's effort to consciously promote the information sector in line with the "informatisation" of other sectors in the Singapore economy is however clear.[23]

**Table 3**
**Top sectors in Singapore, Japan and US ranked by linkages & multipliers**

| | Singapore | Japan | US |
|---|---|---|---|
| Backward linkage (Indices of dispersion) | | | |
| 1 | 28 Quarry | 18 Paper | 15 Textile |
| 2 | 26 Commerce | 21 Fab Met | 15 Food |
| 3 | 7 Distribution | 24 Tpt Eqpt | 20 Non-Met |
| 4 | 1 Printing | 22 Machine | 20 Paper |
| 5 | 30 Construction | 15 Textile | 17 Wood |
| 6 | 6 Info Bldg | 5 OthInfoM | 16 Clothing |
| 7 | 11 Prof Svc | 1 Printing | 19 Chemical |
| 8 | 20 Non-Met | 23 Electrical | 21 Fab Met |
| 9 | 29 Utilities | 2 Off Mach | 29 Utilities |
| 10 | 24 Tpt Eqpt | 20 Non-Met | 27 Agric |
| Info sectors | 4 | 3 | 0 |
| Forward linkage (indices of sensitivity) | | | |
| 1 | 26 Commerce | 1 Printing | 19 Chemical |
| 2 | 11 Prof Svc | 12 OthInfoS | 21 Fab Met |
| 3 | 31 Tpt Svc | 19 Chemical | 28 Quarry |
| 3 | 5 OthInfoM | 21 Fab Met | 26 Commerce |
| 5 | 32 Oth Svc | 18 Paper | 11 Prof Svc |
| 6 | 19 Chemical | 32 Oth Svc | 29 Utilities |
| 7 | 9 Finance | 7 Distribution | 21 Oth Svc |
| 8 | 21 Fab Met | 26 Commerce | 27 Agric |
| 9 | 29 Utilities | 28 Quarry | 31 Tpt Svc |
| 10 | 20 Non-Met | 31 Tpt Svc | 18 Paper |
| Info sectors | 3 | 3 | 1 |
| Income multipliers | | | |
| 1 | 10 Real Est | 10 Real Est | 10 Real Est |
| 2 | 9 Finance | 8 Comms | 32 Oth Svc |
| 3 | 7 Distribution | 9 Finance | 9 Finance |
| 4 | 32 Oth Svc | 26 Commerce | 11 Prof Svc |
| 5 | 26 Commerce | 7 Distribution | 13 Educ/Med |
| 6 | 13 Educ/Med | 13 Educ/Med | 8 Comms |
| 7 | 28 Quarry | 21 Oth Svc | 7 Distribution |
| 8 | 11 Prof Svc | 1 Printing | 26 Commerce |
| 9 | 12 OthInfos | 6 Info Bldg | 1 Printing |
| 10 | 1 Printing | 30 Construction | 30 Construction |
| Info sectors | 7 | 7 | 7 |
| Output multipliers | | | |
| 1 | 28 Quarry | 18 Paper | 15 Textile |
| 2 | 26 Commerce | 21 Fab Met | 14 Food |
| 3 | 7 Distribution | 25 Tpt Eqpt | 20 Non-Met |
| 4 | 1 Printing | 22 Machine | 18 Paper |
| 5 | 30 Construction | 15 Textile | 17 Wood |
| 6 | 6 Info Bldg | 5 OthInfoM | 16 Clothing |
| 7 | 11 Prof Svc | 1 Printing | 19 Chemical |
| 8 | 20 Non-Met | 23 Electrical | 21 Fab Met |
| 9 | 29 Utilities | 2 Off Maeh | 29 Utilities |
| 10 | 24 Tpt Eqpt | 20 Non-Met | 27 Agriculture |
| Info sectors | 4 | 3 | 0 |

**Table 3 Continued**

| | Singapore | Japan | US |
|---|---|---|---|
| Import multipliers | | | |
| 1 | 19 Chemical | 10 Real Est | 28 Quarry |
| 2 | 5 OthInfoM | 8 Comms | 16 Clothing |
| 3 | 3 Electronic | 9 Finance | 24 Tpt Eqpt |
| 4 | 15 Textile | 26 Commerce | 3 El'tronic |
| 5 | 25 Miscell. | 7 Distribution | 19 Chemical |
| 6 | 2 Off Mach | 13 Educ/Med | 25 Miscell. |
| 7 | 14 Food | 32 Oth Svc | 21 Fab Met |
| 8 | 22 Machine | 1 Printing | 5 OthInfoM |
| 9 | 17 Wood | 6 Printing | 4 Precision |
| 10 | 20 Non-Met | 30 Construction | 22 Machine |
| Info sectors | 3 | 7 | 3 |

**Table 4**

**Rank Correlation of backward and forward linkages in Singapore, Japan and US**

| | Backward Linkage | | | Forward Linkage | | |
|---|---|---|---|---|---|---|
| | S'pore | Japan | US | S'pore | Japan | US |
| S'pore | 1 | 0.80899 | 0.0051 | 1 | 0.6876 | 0.6415 |
| Japan | 0.0899 | 1 | 0.6932 | 0.6876 | 1 | 0.5899 |
| US | 0.0051 | 0.6932 | 1 | 0.6415 | 0.5899 | 1 |

The information sector is first of all, a very natural extension of the service or tertiary sector. For a resource-lacking economy suffering from labour shortage and with growth spurred by productivity gains, the information sector is a good choice. There is no real competition for resources with the manufacturing sector which is the other main sector in the economy. In fact, the information sector complements the upgrading and diversification of the manufacturing sector very well, enabling both the manufacturing sector and the economy as a whole to latch on to the latest technology and information. In fact, there is a more dynamic spread effect from the information sector across-the-board in Singapore and less of a technology drag which may be observed in other advanced countries. In the latter, the manufacturing sector may be more entrenched and resistant to changes or incur greater adjustment costs when new technology appears. In Singapore where the manufacturing structure is newer and relatively dynamic, changes are more easily and rapidly absorbed. This further enables some short-circuiting or leapfrogging on the technological frontiers which may explain in part the surge of the service economies in the newly-industrialising economies (NIEs) like Singapore. In fact, developed countries are feeling the threat of NIEs in services and information as much as in manufacturing.

Compared with Japan and the US, the information sector in Singapore is nonetheless a budding one. One policy implication from the above analysis is that Singapore cannot afford to play a passive, dormant role in any international development or negotiation related to informatics and the information sector. Information and knowledge through the information sector is transmitted together with the technology and, as such, can be used to bridge the development gap between Singapore and the more advanced nations. Singapore needs to be vigilant not only of new technologies, but also of policies and strategies in other nations which may impinge upon the growth of its information sector. The wave of reforms in telecommunications as in privatisation of telecommunications carriers, the introduction of competition and deregulation, originating in the US, the United Kingdom and Japan has by 1987, spread to the European Community and parts of Asia and the Pacific. These have profound effects on service and information-based economies in areas of production, dissemination and trade.

Moreover, the information sector is vitally supported by technologies and capabilities in international telecommunications and communications. In these areas, there are international resources as in extra-terrestrial space, air bands and sea which currently lie outside the sovereign rights to be allocated or used. These issues are now being actively debated and negotiated and Singapore must get into the picture right in the beginning even though it may not have the influence and clout of larger information economies. It must be aware and alert in order to keep its interest represented.

In the Pacific region, other information sectors are also growing fast and the global network system is developing on many fronts. These comprise unilateral approaches as by individual countries putting up their own communication satellites, for instance, as well as bilaterally or on a regional basis. Indonesia is the first ASEAN country to have its own satellite and Malaysia is also planning to have one. Currently in the Pacific region, three of the INTELSAT V satellites are stationed with a capacity of 12,000 telephone circuits and two television circuits with some hook-up with marine communications via INMARSAT. A total of five INTELSAT VI satellites with a capacity of 30,000 telephone lines and four television circuits are expected to be launched in 1989. None of these are expected to be stationed in the Pacific region until 1992. Among the Association of SouthEast Asian Nations (ASEAN), the development of the submarine cable link is an important area of regional co-operation. Singapore can play a leading role with the co-operation of other ASEAN countries.

In particular, it must be recognised that international telecommunications are natural extensions of domestic telecommunications or a high degree of interdependency exists. There must be comparable standards between the domestic and international communications before an information sector can emerge. Singapore as an information centre has to rely and depend on other information sectors in the region

to provide useful international link-up services. There is a need to develop a fine mesh in communications networks which is essentially two-way and requires relatively comparable sophistication and development between the sender and receiver. Co-operation again becomes the operational criterion rather than competition. In this regard, the resources, be they financial, infrastructural or technological, of the advanced countries like Japan and the US are important to engender a truly international information network.

Another policy implication is that the uneven development of information technology in the region must be upgraded for information to get across space and time more efficiently for the benefit of all parties. In short, the information sector offers a rich ground for regional and international co-operation. Besides technology diffusion, improved information generation, collation and dissemination have profound implications on the conveyance of physical goods or transportation and people as in travel and tourism. Borders will shrink and spatial and time dimensions will no longer be the hindrance that they used to be before the information technology revolution.

## NOTES AND REFERENCES

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4. Kuo, *op. cit.*
5. Kuo Eddie Cy, Toh Mun Heng and Linda Low, 'The Singapore telecommunications sector and issues affecting its competitive position in the Pacific region', *Columbia Journal of World Business,* XXIV, 1, Spring 1989, pp. 59-71.

6. Japan and the US are selected, first, because they are highly informatised economies which Singapore can look up to and secondly, due to the availability of their input-output tables. Wherever literature permits, other countries in the Asia-Pacific regions will be drawn in for comparison.
7. The secondary information sector covers the planning, co-ordinating, managerial and organisational functions of public and private bureaucracies which are not marketed. Such in-house transactions are thus not reflected in national accounts and not attempted in this paper. For a discussion of the difficulties in measuring the secondary information sector, see Hans-Jürgen Engelbrecht, (1985), 'An Exposition of the Information Sector Approach with Special Reference to Australia', *Prometheus,* 3, 2, December 1985, pp. 370-386.
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