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**Policies Affecting Indonesia's Industrial Technology Development**

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*Technology and Long-run Economic Growth in Asia*

# **Policies Affecting Indonesia's Industrial Technology Development**

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# POLICIES AFFECTING INDONESIA'S INDUSTRIAL TECHNOLOGY DEVELOPMENT<sup>1</sup>

by

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Indonesia's industrial development before and after the Asian economic crisis: an overview

## a. Industrial development during the Soeharto era

During the 32 years of 'New Order' rule (1966-98) the Indonesian economy experienced rapid and sustained growth, which enabled Indonesia to graduate from the ranks of one of the poorest low income countries in the mid-1960s to one of the eight 'high-performing Asian economies' (HPAEs) in the early 1990s, along with Japan, the four 'Asian Tigers', and Indonesia's two Southeast Asian neighbours, Malaysia and Thailand (World Bank 1993: 1, 37). With the economy growing at an average annual rate of 7.0 per cent over the period 1965-97, Indonesia's real gross national product roughly doubled every 10 years over this period.

Rapid economic growth during this period was driven by the expansion of the three main sectors of the economy, namely agriculture, manufacturing, and services. As the manufacturing sector throughout this period was growing at double digits, much faster than the two other sectors which were growing at single digits, the Indonesian economy also underwent a rapid transformation, as reflected by the rapid decline in the relative importance of agriculture in the economy and an equally rapid rise in relative importance of the manufacturing sector (Table 1). In fact, by 1991 manufacturing's contribution to GDP had exceeded the contribution of the agricultural sector (Aswicahyono 1997: 25).

### Table 1 Economic growth and transformation in Indonesia, 1965-1997

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	Average annual growth rate(%)			% of GDP	
	1965-80	1980-90	1990-97	1965	1997
GDP	7.0	6.1	7.7		
Agriculture	4.3	3.4	2.8	51	16
Industry	11.9	6.9	9.9	13	43
Manufacturing	12.0	12.6	10.8	8	26
Services	7.3	7.0	7.2	36	41

Source: 1. For period 1965-80: World Bank: *World Development Report 1992*, Oxford University Press, 1992, table 2, p. 220; table 3, p. 222;  
For periods 1980-1990 and 1990-1996: *World Development Indicators 1999*, Development Data Center, table 4.1, p. 189; table 4.2, p. 193.

After Indonesia in the mid-1980s shifted to export-promoting policies after the end of the oil boom made a continuation of import-substituting industrialisation no longer feasible, it was able to achieve a rapid growth of its manufactured exports, and thereby decrease its traditional dependence on primary exports, particularly oil and gas exports. For this reason the World Bank study on '*The East Asian Miracle*' classified Indonesia as one of the three East Asian '*newly-industrializing economies*' (NIEs) along with Malaysia and Thailand (World Bank 1993).

During the late 1960s and early 1970s Indonesia's rapid industrial growth was initially fuelled by the liberalisation of economic policies, particularly the liberalization of the trade and foreign investment regimes, and the return to normal economic conditions after the political turmoil and economic chaos of the early 1960s. During the oil boom period (1974-81) rapid industrial growth was also facilitated by the import-substituting policies which enabled domestic producers and foreign investment projects to replace imported light consumer goods and consumer durables.

However, during the oil boom era the liberal economic policies were largely replaced by more interventionist policies, as the Indonesian government, flush with windfall revenues from the oil booms, initiated an ambitious, second phase import-substituting, state-led industrialization after the 'easy' phase of import-substitution had been largely completed by the mid-1970s (McCawley

1979: 13). This second phase of import-substituting industrialization largely involved the establishment of various upstream, state-owned, resource-based basic industries.

Even though many Indonesian and foreign economists were highly critical of this costly and inefficient pattern of import-substituting industrialization, which largely ignored comparison of production costs with border prices (Gray 1982: 41), the large oil boom revenues enabled the Indonesian government to ignore their warnings. However, by 1983 the end of the oil boom forced the Indonesian government to shift to export-promoting policies by introducing a series of deregulation measures to improve the investment climate for private, including foreign, investors to encourage them to invest in export-oriented projects. The government also introduced a series of trade reforms to reduce the 'anti-export bias' of the highly protectionist trade regime. A significant step in the direction of encouraging an export-promoting path of industrialization was the introduction in May 1986 of a 'duty exemption and drawback scheme' which provided export-oriented firms with the opportunity to purchase inputs, whether actually imported or locally made, at international prices.

This scheme turned out to be a crucial factor in facilitating the ensuing rapid growth of manufactured exports.

The various deregulation measures, including trade reforms and the reintroduction of more liberal foreign investment policies, combined with a supportive exchange rate policy aimed at keeping the real effective exchange rate at a competitive level, and facilitated by sound macroeconomic policies, proved to be successful as the manufacturing sector since 1987 generated a rapid surge in manufactured exports. This surge was remarkable, since it was the first broad-based expansion of manufactured exports in Indonesia's modern economic history (Hill 1987: 29).

As a result of the surge in manufactured exports, Indonesia's manufacturing sector, specifically the non-oil and gas manufacturing sub-sector, since the mid-1980s emerged as the country's major engine of economic growth (World Bank 1994: 1). During the period 1985-88 the manufacturing sector grew at an average annual rate of 13 per cent, while manufactured exports grew at an average annual rate of 27 per cent. During the period 1989-92 the manufacturing sector surged at a much faster rate of 22 per cent, while manufactured exports continued to grow at an average of 27 per cent (Dhanani 2000: 28).

Since 1993, however, up to the crisis year of 1997 the growth of

the manufacturing sector slowed down to an average 12 per cent, as the growth of manufactured exports grew only at a sluggish 7 per cent (Dhanani 2000: 28). One major reason why the growth rates were high was that they started from a low base (HIID 1995: 1).

Nevertheless, the concern of policy-makers and academic economists alike about the slowdown in the growth of manufactured exports since 1993 was understandable, as it was feared that a sluggish growth of manufactured exports would adversely affect the prospects of continued rapid economic growth, which for the period of the Sixth Five-Year Development Plan (1994/95-1998/99) was projected at 6-7 per cent per annum. In their view, Indonesia could not continue to rely on its traditional resource- and low skill labour-intensive manufactured exports due to the rapid dwindling of domestic supplies of timber, and the sharp competition from lower wage countries.

The slowdown in manufactured export growth since 1993 should not have been surprising to Indonesia's policy-makers as the drive to introduce further deregulation packages, including trade reforms, had since the early 1990s petered out. Despite the stated government objective of promoting non-oil and gas exports, particularly manufactured exports, the trade regime by 1992 still had an '*anti-export bias*'.

Concerned about the sustainability of manufactured export growth, the Indonesian government commissioned some studies to look into this problem. In a study on the '*Prospects for Manufactured Exports During Repelita VI*' conducted by the Harvard Institute of International Development (HIID) in 1995 for the Department of Industry and Trade, the HIID report found that Indonesia was behind its international competitors in laying the foundation for developing skill- and capital-intensive exports (HIID 1995: 7). Based on the experience of other developing countries, the HIID study recommended that Indonesia would have to transform its export base, by moving gradually towards the exports of more sophisticated manufactures and services. Like these countries, for Indonesia the only basis for modernizing the export base was to achieve continued gains in the productivity of workers, capital, and the firms themselves (HIID 1995: 1). Hence, the challenge facing Indonesia's manufacturing sector was to achieve a sustained increase in total factor productivity (TFP).

That TFP growth rates in Indonesian manufacturing are greatly affected by the policy environment is clearly indicated by the

findings of studies by Hill, Aswicahyono, & Bird; and Timmer on TFP growth in Indonesian manufacturing during the 1980s and 1990s (Table 2).

Table 2 Average annual TFP growth in Indonesian manufacturing, 1975-95

Period	Average annual TFP growth (%) (1)	Period	Average annual TFP growth (%) (2)
1976-81	0.7	1975-81	1.0
1982-85	1.1	1982-85	0.1
1986-91	2.1	1986-90	7.9
		1991-95	2.1
		1975-95	2.8

Source: For (1), Hill, Aswicahyono, and Bird (1997), table 3.8; and for (2) Timmer (1999), table 4, p. 87.

Hill's, Aswicahyono's and Bird's study found that TFP growth rates in Indonesian manufacturing varied according to three distinct policy periods, namely the period of import-substituting industrialisation during the oil boom (1976-81), the immediate post-oil boom period when existing policies were reassessed (1982-85), and the period marked by a more decisive shift to export-promotion policies (1986-91). Average annual TFP growth was low during the first period, then rose during the second period, and then rose faster during the third period (Hill, Aswicahyono and Bird 1997: 78). Evidently, the more favourable policy environment since the mid-1980s had a positive impact on TFP growth.

A more recent study by Marcel Timmer on aggregate TFP growth in Indonesian manufacturing came up with largely similar findings. Subdividing the period studied into five-year intervals, Timmer found, like Hill et al., that average annual TFP growth rate was low during the import-substituting phase of the late 1970s-early 1980s. However, after the policy reforms introduced since the mid-1980s TFP growth accelerated steeply in the late 1980s (Timmer, 1999: 84-7). During the first half of the 1990s, however, declined again, although it was still higher than during the import-substitution phase of the late 1970s-early 1980s.

Based on the experience of the successful Asian newly-industrializing economies (NIEs), the HIID study suggested the

following core elements of a strategy for developing Indonesia's manufactured exports, namely deepening the export base, particularly by increasing the domestic content of exports; expanding the number of exporting firms; y encouraging firms oriented towards the domestic market to start exporting; and building a base for more sophisticated exports, by developing the capacity of manufacturing firms to acquire, adapt, and build on new, imported technologies. Developing these technological capabilities would need government support, particularly in ensuring that the necessary scientific and engineering skills are available, in strengthening quality control efforts and in ensuring that property rights are duly protected (HIID 1995: 5-7).

Despite the soundness of these recommendations, the government had on the eve of the Asian economic crisis not yet completed the necessary deregulation of international trade, including further tariff reductions and relaxation of non-tariff barriers (NTBs), which would have reduced the production costs of manufacturing firms and raised their international competitiveness (World Bank 1997: 112). In addition, extensive regulations and restrictions on domestic competition also added to the costs of doing business in Indonesia, thereby further reducing the efficiency of private firms (World Bank 1997: 118).

One major reason why the Indonesian government had by 1997 not yet taken the necessary steps, obvious to economists, to further deregulate international trade and lift the policy-generated barriers to domestic competition, was the influence of Dr. B.J. Habibie, the powerful Minister of State for Research and Technology. Unlike most economists, Habibie, an aeronautic engineer by training, held that Indonesia should no longer depend on labour-intensive industries, which in his view were 'sunset industries', the international competitiveness of which were declining (Thee 1998: 33). To compensate for the decline of these 'sunset industries', Habibie instead promoted the development of 'strategic industries', particularly the state-owned, 'hi-tech' aircraft industry, which in his view would yield considerably more foreign exchange earnings than the 'sunset industries'. To develop these 'strategic industries', these industries needed to be temporarily protected and subsidised (Thee 1998: 133).

Habibie's views on promoting costly 'strategic industries' were strongly criticized by economists, since these industries were imposing high social opportunity costs on the country due to the



high protection, assured government procurement, monopolistic position, and huge explicit and implicit subsidies, without a reasonable prospect of them becoming commercially viable in the foreseeable future (Thee 1998: 134). However, because of Habibie's strong influence on President Soeharto, his views prevailed in spite of the reservations of Indonesia's economic technocrats. Hence, during the 1990s up to the crisis of 1997/98 the Indonesian government pursued a 'dual track' industrialization strategy by pursuing both the 'broad spectrum' policy of outward-looking industrialization, as advocated by a more export-oriented Department of Industry and Trade, and the promotion of the costly 'strategic industries' as promoted by Habibie and his fellow 'technologists' (Thee & Pangestu 1998: 262).

b. Industrial development after the Asian economic crisis

After the onset of the Asian economic crisis, growth of Indonesia's manufacturing sector slowed down sharply. While manufacturing in 1996 grew at almost 12 percent, it slowed to 5.3 percent in 1997 and in 1998 contracted by -11.4 percent. (Table 3)

Table 3 Growth of Indonesia's GDP and Manufacturing Sector, 1997-2004

	1997	1998	1999	2000	2001	2002	2003	2004
GDP	4.7	-13.1	0.8	4.9	3.5	3.7	4.1	6.7
Manufacturing	5.3	-11.4	3.9	6.0	3.1	3.4	3.5	7.2
Oil and gas industry	-2.0	3.7	6.8	-1.7	-3.5	1.2	0.6	
Non-oil and -gas industries	6.1	-13.1	3.5	7.0	4.0	3.7	3.8	8.7

Source: Badan Pusat Statistik (BPS), Jakarta.

Although manufacturing growth recovered to a sluggish 3.9 percent in 1999 and to 6.0 percent in 2000, it grew sluggish from 2001

through 2003. However, in 2004 it rose sharply to 7.2 per cent in line with more rapid economic growth.

To some extent, the sluggish growth of manufacturing after 2000 was due to the lower output of the oil and gas industries, specifically the petroleum refineries. Growth of the oil and gas industries in 2000 and 2001 was negative, and very sluggish since 2002. Hence, lower output of the oil and gas manufacturing sub-sector adversely affected the growth of total manufacturing output (MacIntyre and Resosudarmo, 2003: 139-40). However, it should be borne in mind that the relative importance of the oil and gas industries after the end of the oil boom era in 1982 has steadily declined. In 2002, the oil and gas manufacturing sub-sector accounted for only 11 percent of the non-oil and -gas manufacturing sub-sector.

Looking at the performance of the non-oil and -gas industries, which generated the bulk of the surge of non-oil exports since the late 1980s through 1996, we see that the growth of the non-oil and gas manufacturing sub-sector has also declined steadily from a high of 7.0 percent in 2000 to 4.0 percent or less from 2001 through 2003. However, in 2004 the non-oil and gas manufacturing sub-sector grew at 7.8 per cent, which was the highest rate after the crisis.

Although the current prospects for a recovery of the manufacturing sector seem slightly better than in the past few years, its prospects are still cloudy because of various adverse factors, including the continuing rise in wages due to the mandatory increases in minimum wages that have become binding in most industries; non-wage cost increases caused by the high facilitation costs associated with doing business in Indonesia; the absence of technological upgrading; the emergence of strong competitors in both the domestic and export markets; and the wide prevalence of smuggling, particularly of consumer electronics (Kuncoro, 2003: 2).

As a result of the sluggish performance of Indonesia's manufacturing sector, particularly the non-oil and -gas manufacturing industries, and the recent relocation of scores of FDI-controlled and domestic-controlled plants to other countries in the region, including China and Vietnam, concern has been expressed that Indonesia is facing the danger of 'de-industrialization' if no new substantial FDI and domestic investments are forthcoming. Unfortunately, the Indonesian

government has thus far been unable to improve the country's poor investment climate.

Although Indonesia's rapid industrial growth and transformation during the past three decades have undoubtedly been accompanied by technological upgrading, as reflected by rising TFP levels (table 2), particularly since the mid-1980s, the development of Indonesia's industrial technological capabilities (ITCs) has lagged behind that of the Asian Tigers, particularly Korea and Taiwan. Indonesia's relatively low ITCs have also been confirmed by more qualitative firm-level surveys conducted by, amongst others, international consulting firms (SRI International, 1992) and in a comparative study sponsored by UNCTAD's Technology Program on the link between manufactured exports and technological capabilities in Korea, Taiwan, Indonesia, Thailand, and Vietnam (Ernst, et al., 1998). This comparative study indicated that Indonesia's ITCs, even in export-oriented manufacturing firms, were still limited to the basic production or operational capabilities required for the smooth functioning of the plants and, to a lesser extent, to adaptive or minor change capabilities, specifically in regard to introducing minor changes in process technologies to adapt to local conditions. None of Indonesia's firms, however, had as yet developed the more demanding innovative or major change capabilities that enable firms to make major changes in process or product technologies. Development of these latter capabilities, the study concluded, was essential to the ability of Indonesian firms to achieve and maintain international competitiveness (Thee and Pangestu, 1998).

In a critical assessment made in 1998, Sanjaya Lall also pointed out the relatively low level of Indonesia's ITCs. Lall observed that Indonesia's industrial structure had several weaknesses in terms of technology. These weaknesses, if not overcome, would hamper Indonesia's long-term industrial growth and upgrading (Lall, 1998: 136). Among the technological weaknesses cited were the shallow and backward technological base, particularly compared to that of the East Asian Tigers; weak and narrow domestic capabilities for absorbing and improving upon complex imported technologies; an underdeveloped capital goods sector; and the relatively small amount of technological effort, which was concentrated and distorted (because of the focus on highly subsidized and protected "hi-tech" industries, particularly the aircraft assembling industry, promoted by Dr. Habibie, the then State Minister for Research and Technology) (Lall, 1998: 136).

In the following pages the policies to enhance Indonesia's industrial competitiveness through improved technological capabilities will be discussed.

#### Raising Indonesia's industrial competitiveness through industrial technological development

International experience, particularly of the East Asian NIEs, has indicated that raising Indonesia's export competitiveness requires investments in various kinds of technological capabilities, including procurement, production, design, engineering, marketing, and other kinds of capabilities (Lall, et.al., 2000: 20). Developing these technological capabilities is particularly important for raising Indonesia's export competitiveness, as thus far its manufactured exports has mainly consisted of resource- and low skill labour-intensive products, which generally involve less effort, risk, and externalities. On the other hand, rapid and sustained manufactured export growth requires moving from easy to complex products and processes within activities, and across activities from easy to complex technologies (Lall, et.al., 2000: 20).

International experience has shown that an industrial technology development strategy requires that certain basic and enabling conditions are met or created (World Bank, 1996:2-5).

The *basic conditions* for industrial technology development in Indonesia are:

1. The pursuit of sound macroeconomic policies, as low inflation encourages firms to make long-term investments in technology development;
2. The pursuit of pro-competition economic policies, as a competitive environment is conducive to drive firms to rapidly adopt, diffuse new technologies, and make an effective choice and efficient use of new technologies;
3. The upgrading of the quality of human resources, as the technical human resource base is a key input into the process of acquiring, using, improving, and developing technologies (World Bank, 1996: ii).

In addition to these basic conditions, a number of *enabling conditions* should be met or created through policies that:

1. Improve the manufacturing firms' access to foreign technologies through foreign direct investment (FDI), technical licensing agreements, capital goods imports, and foreign trade;
2. Improve the availability of adequate finance for technology development;
3. Improve the effectiveness and performance of the technology support services (World Bank, 1996: i).

The policies to meet these conditions are discussed in greater detail below.

a. The basic conditions

1. Pursuing sound macroeconomic policies

From the outset the 'New Order' government under General, later President Soeharto (1966-98) put a high priority on pursuing sound macroeconomic policies. After the reckless deficit-financing policies of President Sukarno which led to hyperinflation in the mid-1960s, the 'New Order' government realized that achieving and maintaining macroeconomic stability was crucial to encourage firms to undertake the long-term capital investments necessary for rapid and sustained economic growth.

Although during the Soeharto era the Indonesian economy experienced several major shocks, such as the debt crisis of Pertamina, the large state-owned oil company, in early 1995, the two oil booms of the 1970s (1973/74 and 1978/79), and the crisis caused by the end of the oil boom in 1982, the Indonesian government took immediate steps to tackle these shocks and restore macroeconomic stability. As a result, during the Soeharto era Indonesia's record on controlling inflation has been fairly good, although Indonesia's inflation during the mid-1980s through the mid-1990s was always slightly higher than that of its East Asian neighbours, except for the Philippines (Hill, 1996: 7).

Macroeconomic stability in 1997/98 was severely disrupted

because of the Asian financial and economic crisis. As a result of the steep depreciation of the *rupiah*, inflation rose steeply to 80 per cent in early 1998. However, in the course of 1998 the hyperinflation was gradually brought under control because of tight monetary policies. As a result, inflation flattened out quite suddenly, and from late 1998 to mid-1999 inflation dropped to only 5.2 per cent (Hill, 1999: 29).

Whatever the political differences between the post-Soeharto governments (Habibie, Abdurrachman Wahid, Megawati Sukarnoputri, and currently Susilo Bambang Yudhoyono), all these governments realized the great importance of sound macroeconomic policies to maintain macroeconomic stability. Under the able stewardship of Dr. Boediono, Minister of Finance in the Megawati administration (2001-04), macroeconomic stability was strengthened, as reflected by a stable inflation rate of 6 per cent in 2004 (World Bank, 2005: ii). In the last two months inflation rose slightly to slightly below the upper bound (6.5 per cent) of the target range 6.5 per cent set by Bank Indonesia (Soesastro & Atje, 2005: 19).

## 2. Pursuing pro-competition economic policies

The experience of the East Asian NIEs has shown that a competitive environment for firms has been an important prerequisite for technology upgrading. In these countries competition has been an important stimulus to drive firms to invest in their technological development (World Bank, 1996: 3).

The overall competitive environment is determined by the foreign trade regime and domestic competition. As noted earlier, the end of the oil boom in 1982 forced the 'New Order' government to introduce a series of deregulation measures, particularly the deregulation of the restrictive trade and foreign investment regimes. These policies played an important role in promoting industrial technological development by encouraging many firms to improve their productivity and efficiency, and product design and product quality. However, many other firms were not able or willing to improve their technological capabilities, which affected adversely their ability to become competitive in the export market or even in the domestic markets (World Bank, 1996: 7).

Since the mid-1980s the 'New Order' government introduced a series

of trade reforms to reduce the 'anti-export bias' of the trade regime. These trade reforms included a gradual but steady reduction in tariff protection and non-tariff barriers (NTBs), specifically quantitative import restrictions, and the above duty exemption and drawback scheme for export-oriented firms. However, by the time the 'New Order' government had introduced its last trade reforms in early 1997, remaining import protection still accounted for a lower, but still significant 'anti-export bias' of the trade regime (Thee, 1998: 118-9).

While the trade reforms from the mid-1980s through 1997 did lead to greater import competition, domestic competition and trade were still subject to extensive regulations and restrictions introduced by the central and provincial governments, and occasionally by officially sanctioned trade and industry associations (Thee, 2002: 332). These restrictions took many forms, including entry controls, price controls, provisions for public sector dominance, the sanctioning of cartels, and ad hoc interventions favouring specific firms or sectors (Iqbal, 1995: 14).

Only after the onset of the Asian economic crisis was the Indonesian government forced, as part of its first assistance agreement with the IMF in early November 1997, to lift the policy-generated barriers to domestic competition and trade. In its second agreement with the IMF in January 1998, a wider range of structural reforms were included, which provided for a further deregulation of the foreign trade and foreign investment regimes as well as the domestic competition regime (Thee, 1998: 332).

Aside from the deregulation policies which were intended to promote competition in the local and national markets, in early 1999 the new Indonesian government under President Habibie enacted a competition law, the Law Banning Monopolistic Practices and Unfair Competition. This competition law was intended to protect and maintain free and open market competition by preventing anti-competitive business practices by firms. With this competition law, Indonesia had in place, at least on paper, a comprehensive competition policy, encompassing both the various deregulation measures and a competition law (Thee, 1998: 333-4).

Since the appointment of a Business Competition Supervisory Commission in late 1996, many cases, particularly bid rigging or closed tenders, have already been investigated by this Commission. While some of its decisions have been criticized, it has been quite active in pursuing and investigating cases where anti-

competitive business conduct was suspected.

Unfortunately, the deregulation policies of the recent past have been offset by the proliferation of new regulations by local governments since decentralisation was introduced in early 2001. Many of these regulations restrict or tax trade within or between districts (*kabupaten*) and provinces. Obviously, these taxes and restrictions interfere in domestic trade and undermine domestic competition and internal market efficiency (World Bank, 2005: 41). Hence, in terms of domestic competition, the new restrictions on domestic trade and competition have undermined the pro-competition policies of recent years.

### 3. Expanding education and upgrading the quality of human resources

A well-trained labour force, an effective training system, good quality science and engineering faculties of universities, and good management training and development programs are key elements for sustaining Indonesia's industrial technology development (World Bank, 1996: ii). However, despite the good progress which Indonesia has made during the Soeharto era in expanding education at the primary, and to a lesser extent at the secondary and tertiary levels, the quality of education and training at all levels needs to be raised substantially.

Despite the progress in expanding education during the Soeharto era, Indonesia's public expenditure on human resource development by the end of the 20<sup>th</sup> century still ranked below the average low income countries (Table 4)

Table 4 Indonesia's human resource development in comparative Perspective, 1999

	<u>Public expenditure on education</u>		<u>Public expenditure on health</u>	
	% of GNI	Per student % of GNI per capita	% of GDP	Per capita PPP \$
Indonesia	1.4	6	0.7	21
Low income	3.2	16.3	1.2	20



countries				
Middle income countries	4.6	21.2	2.6	144

Source: World Bank: *World Development Indicators*, 2001.

In 1995/96, just before the Asian economic crisis, central government expenditure on education accounted for 15 per cent of total central government expenditure or Rp. 12 trillion in absolute terms. However, in 2004 public expenditure on education accounted for only 10 per cent of central government expenditure or Rp. 25 trillion in absolute terms (Ninasapti, 2005). Considering the tight budget caused by the huge amount of foreign and domestic debt service payments and the large fuel subsidies, there is little possibility that the Indonesian government will be able to substantially increase its expenditure on education.

Aside from the fact that Indonesia's public expenditure on human resource development is even lower than the average low income country, let alone the average middle income country, the current education and training system in general also does not meet the needs of industry. The reason is that the general secondary education system relies on rote learning, and does not develop adequate mastery of basic literacy, basic numeracy, and thinking and creative skills. Hence, high school graduates are not adequately equipped with the knowledge and skills required for a more complex and diversified manufacturing sector, and also cannot take advantage from on-the-job training (Dhanani, 2000: 11).

Moreover, the senior secondary technical vocational schools, two thirds of which are privately-funded and -operated, are poorly staffed and equipped, and thus do not equip the graduates with adequate practical knowledge. Post-secondary vocational technical education, on the other hand, is mainly provided by the government (Dhanani, 2000: 11), which currently lacks the resources to expand education and improve the quality of education, particularly technical education.

Aside from these basic conditions required to promote industrial technology development, enabling conditions should be in place to facilitate technological development. These enabling conditions will be discussed below.

b. The enabling conditions

1. Improving the manufacturing firms access to foreign technologies

Like other developing countries, Indonesia is a net importer of advanced technologies developed in the advanced industrial countries. These advanced technologies are crucial to enhance a country's technological capabilities to produce more efficiently and competitively. The experience of Japan and the East Asian NIEs, particularly Korea and Taiwan, has shown that the acquisition of foreign technologies, the assimilation and adaptation of these technologies to local conditions, and the subsequent improvement of these imported technologies have been crucial to raising these countries' technological capabilities. Hence, the international transfer of technology has been an important source of technical progress in these countries (Chen 1983: 63).

In view of the economic importance of these imported technologies, it is important to identify the major channels through which these technologies have been transferred to Indonesia, particularly to its manufacturing sector. Several studies on international technology transfer in Indonesia's manufacturing sector indicate that foreign direct investment (FDI), technical licensing agreements, capital goods imports and the related transfer of skills by technical experts of foreign supplier firms, and technical and marketing assistance by foreign buyers of some of Indonesia's manufactured exports, have been the major channels for international technology transfer to Indonesia. While several firms have obtained technical and managerial consultancies from foreign experts, no reliable data are available on these consultancies (Thee, 2005).

These major channels will be discussed below.

i. Foreign direct investment (FDI)

While Indonesia since the mid-1980s through 1996 experienced sizable net FDI inflows, after the onset of the Asian economic crisis it experienced net FDI outflows which has persisted through 2003 (Table 4). Even the positive net FDI inflow in 2004 was much smaller than the large net FDI inflows during the late

1980s through 1996. This positive figure was also caused by the fact that Bank Indonesia has recently included privatisation of state-owned enterprises (SOEs), specifically the sale of these SOEs to foreign investors, and bank restructuring, specifically the sale of distressed banks to foreign investors, as part of FDI inflows.

The lack of interest of foreign investors to undertake new Greenfield investments after the Asian economic crisis can be attributed to Indonesia's poor investment climate, which currently ranks among the worst in the East Asian region. Various factors account for this poor investment climate, including the lack of legal certainty, labour problems, mainly caused by a business-unfriendly labour law, confusion caused by the regional autonomy introduced in early 2001, widespread corruption, and crumbling physical infrastructure and traffic congestion from the plants to the harbour. The net effect of these problems is uncertainty, higher costs and many demands for bribes (MacIntyre & Resosudarmo, 2003: 146; World Bank, 2003: 29).

Table 4    Net FDI in- and outflows into and out of Indonesia,  
1986-2004

<u>Year</u>	<u>Net FDI in- and outflows</u> <u>(millions of US\$)</u>
1986	258
1987	385
1988	576
1989	682
1990	1,093
1991	1,482
1992	1,777
1993	2,004
1994	2,109
1995	4,346
1996	6,194
1997	4,667
1998	- 356
1999	-2,745
2000	-4,550
2001	-2,977
2002	145

2003  
2004

- 597  
1,046

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Note: Revised net FDI inflows include privatisation of state-owned enterprises (SOEs), specifically to non-residents, and banking restructuring, specifically the sale of bank assets to foreign investors.

Source: Bank Indonesia: *Indonesian Financial Statistics*, successive issues through February 2005.

The fact that a small amount of FDI only flowed into the country since 2004, while Korea and Thailand, the two other East Asian countries worst affected by the Asian economic crisis, already flowed into these two countries since 1999 meant that these countries experienced not only a strengthening of their currencies, but also an accelerated of much needed corporate restructuring, and important infusions of new technologies and modern management methods (World Bank, 2000: 6). Indonesia, on the other hand, was much less able to obtain these benefit, as FDI instead flowed out of the country.

ii. Technical licensing agreements

In Indonesia a major 'unpackaged' (non-equity) mode of technology transfer from advanced country firms to Indonesian firms has been technical licensing agreements (TLAs). Although no quantitative data are available on the number of these TLAs, circumstantial evidence indicates that these TLAs often involve the transfer of older and mature technologies that do not offer the recipient country a long-term competitive advantage in the global market (Marks 1999: 6). However, for a late-industrialising economy like Indonesia, acquiring and mastering these older technologies first is a good way to develop the important basic industrial technological capabilities (ITCs), namely the production, investment and adaptive capabilities.

iii. Imports of capital goods and the transfer of skills by technical experts of foreign supplier firms

Imports of capital goods provide another way of acquiring the means of production without the transactional costs involved in FDI or TLAs (Dahlman, Ross-Larson & Westphal 1987: 768). Capital goods imports are actually embodied technology flows entering a country. They introduce into the production processes new machinery, other capital equipment and components that incorporate technologies which do not necessarily incorporate high or frontier technologies, but are nevertheless new to the recipient firm (Soesastro 1998: 304).

These imported capital goods can be a cheap way of developing local TCs if they can be used as models for reverse engineering to produce the machines locally (Dahlman, Ross-Larson & Westphal 1987: 768). However, Indonesian firms have in general not engaged in 'reverse engineering' on a large scale to develop their ITCs.

Historically, there has been a close association between capital investment in Indonesia and the import of capital goods. This close association is caused by the fact that Indonesia's capital goods industry is still relatively small and backward, not only compared to the other large Asian countries, such as China and India, but even compared to Malaysia. (World Bank 1994: 26-27). As a result, the bulk of capital goods required in production processes still needs to be imported.

#### iv. Technical assistance by foreign buyers

Since the mid 1970s an important informal channel of international technology transfer for Indonesian firms, including small and medium-scale enterprises (SMEs), has been provided by their participation in world trade, specifically through exporting their products. This informal channel was utilised effectively by local firms, particularly electronics firms, in the four East Asian NIEs, including Korea, Taiwan, Hong Kong and Singapore which, based on low wage rates, were able to build up basic operational (production) capabilities through simple assembly of mature products for exports, often developed through technical assistance provided by foreign buyers (Hobday, 1994: 335; World Bank 1996: 4). These local NIE firms successfully coupled export and technological development, allowing export market needs (the needs and design and product specifications of their overseas buyers) to focus their investment in technological upgrading and to provide a channel for them to acquire foreign

technologies from their overseas buyers. This process of coupling exports with technology development was called 'export-led technology development' (Hobday, 1994: 335).

Although not as technologically advanced as the East Asian NIEs's 'export-led technology development', the remarkable export performance which the garment industry and other export industries in Bali and Jepara, Indonesia, have experienced since the mid-1970s is somewhat similar to the experience of these East Asian firms. The remarkable growth of Bali's export industries, starting with the garments industry in the mid-1970s, and subsequently the silver jewelry, wood carving, quilting, leather products, bamboo furniture, ceramics, and stone carving industries, was based on vital information flows which these Balinese firms, received through strategic business alliances with foreign firms and businessmen (Cole 1998: 257).

Through the vital information transfer and technical and managerial assistance (for instance in plant lay-out, advice on the purchase of the most appropriate machines), including strict quality control, provided by the foreign buyers (who often acted also as technical consultants) to the largely small Balinese firms, these firms were able to achieve high levels of efficiency and accuracy. This assistance was provided on a for-profit basis, as it was specifically tied to tangible product output results (Cole 1998: 275; Thee & Hamid 1997). The ongoing interaction of these two parties started a virtuous cycle of technological improvements and learning that was self-replicating and largely self-financing, which led to rapid and sustained export growth (Cole 1998: 275).

## 2. The availability of finance for technology development

Another important element of industrial technology development is the availability and access to finance. The availability and access to term finance for investments in technology upgrading would be facilitated if the capacity of the banking system to appraise such investments could be strengthened. In Indonesia the government during the late Soeharto era also attempted to improve the tax treatment of venture capital funds (World Bank, 1996: iv).

Unfortunately, even before the Asian economic crisis, finance for investments in technology development was scarce. Indonesia never had a financing firm for technology development Korea had,

namely the Korea Technology Development Corporation (KCTC) (World Bank, 1996: 29). There was a state-owned venture capital firm, the PT Bahana Pembinaan Usaha Indonesia (Bahana PUI), but this venture capital firm was mainly entrusted to guide and development small-and medium enterprises (SMEs) (FIAS: 1996: 54).

After surviving banks had recovered from the Asian economic crisis, the bulk of their loans has been provided for private consumption, which indeed has been the main driver of economic growth during the past few years. At present banks and non-financial institutions have provided large amounts of loans for housing loans and credit card lending. In fact, bank consumer credit has been growing rapidly since 2000, and in 2004 grew at an average year-on-year rate of over 30 per cent (Soesastro & Atje, 2005: 35). Under these conditions little is left to finance technology development, even if banks were willing to overcome their risk aversion. Under these conditions, it is not surprising that the bulk of R&D activities in the manufacturing sector is financed by the private firms themselves (Table 5).

Table 5 Spending on R & D in Indonesian manufacturing by source of funds, 1994 and 1999  
(billions of rupiah)

<u>Source of funds</u>	<u>1994</u>	<u>1999</u>
Government	38.79	0.68
Other firms	27.56	1.04
Own firm	159.61	228.92
Overseas	17.59	7.57
Other	1.29	9.52

Source: LIPI and Office of the Minister of State for Research and Technology, 2004, based on surveys by the Central Agency for Statistics, held in 1994 and 1999.

The above data show that even before the Asian economic crisis, the bulk of R & D funding was financed by the manufacturing themselves. After the crisis both in absolute and relative terms, R & D funding by the firms themselves became even more important

### 3. Improve the performance of technology support services

To assist firms to improve their technological capabilities, effective technology support services are needed. These technology support services include effective metrology, standards, testing and quality support services (MSTQ services). These services include the dissemination of information on international standards and assistance to firms to get ISO 9000 certification. It also includes industrial extension services to assist firms to improve productivity, quality, product designs and delivery times. Other important technology support services include technology information services to provide firms with information on best practice, that is globally competitive technologies (World Bank, 1996: v).

During the Soeharto era the performance of the available technology support services, particularly the MSTQ services, was rated as inadequate by many firms. To some extent this was caused by the fact that many firms did not realise that their products needed to conform to strict standards (e.g. technical and sanitary standards) and performance requirements (e.g. ISO 9000), both national and international, particularly if they wanted to enter export markets (Thee, 1998: 127).

The available technology support services, including the important MSTQ services, are public institutes. If these services were rated as inadequate before the Asian economic crisis, the range and quality of these public institutes have likely declined further after the crisis, as public funds to upgrade these services have been reduced. It has been suggested that these technology support services should be privatised, but it appears unlikely that at present the private sector would be willing to take charge themselves of these services.

## Conclusion

The above overview of the basic and enabling condition which would encourage firms to invest in industrial technological development have in general not been met in Indonesia, safe for the sustained adherence to sound macro economic policies. During the late Soeharto era (1985-1996) pro-competition policies were introduced, particularly the liberalisation of the trade and the foreign investment regime. After the fall of Soeharto in 1998 bans on various restrictions on domestic competition and trade introduced, as was an anti-monopoly and fair competition law introduced in



March 1999. Unfortunately, these pro-competition policies have recently been undermined by new restrictions on domestic competition and trade introduced by various regional governments after the introduction of regional autonomy in early 2001.

Human resource development in Indonesia has generally lagged behind its East Asian neighbours before the Asian economic crisis, and have lagged even farther behind after the Asian economic crisis. Technical education at the secondary and tertiary level have been inadequate in imparting to the students the necessary technical skills to improve industrial technological development.

Indonesian firms have access to foreign technologies mainly through foreign direct investment (FDI), technical licensing agreements, capital goods imports, and exporting. However, in the past Indonesia has not been able to take sufficient advantage from the presence of foreign firms to promote industrial and technological upgrading. At present the lack of interest of foreign investors to invest in Indonesia because of the country's poor investment climate has prevented Indonesia from benefiting from the infusions of new technologies and advanced management methods. Technical licensing agreements have been a good means to get access to foreign technologies, even though often these technologies are older, mature technologies. The import of capital goods has also been a good channel to get new embodied technology, the use of which can be enhanced by technical assistance provided by the foreign suppliers of these capital goods. Gaining access to new product designs, technologies and export markets through the advice and assistance of foreign buyers/consultants of Indonesian products has also been helpful to several exporting firms, including SMEs, in upgrading their technical performance. The downside of this development is the continuing reliance on foreign buyers/consultants for the introduction of new product designs, technologies, and access to foreign markets.

Although finance for industrial technological development is important to firms willing to invest in this development, the performance of the financial sector in providing loans to firms willing to invest in technology development was disappointing before the Asian economic crisis. After the crisis the prospects for getting more finance from the financial sector have become worse, as risk-averse banks prefer to provide loans for consumption purposes.

To assist firms to improve their technological capabilities, effective technology support services are needed. These technology support services include effective metrology, standards, testing and quality support services (MSTQ services) as well services disseminating of information on international standards and best practice technologies and providing assistance to firms to get ISO 9000 certification. It also includes industrial extension services to assist firms to improve productivity, quality, product designs and delivery times.

The available technology support services, including the important MSTQ services, are public institutes. If these services were rated as inadequate before the Asian economic crisis, the range and quality of these public institutes have likely declined further after the crisis, as public funds to upgrade these services have been reduced. For this reason some people have suggested privatise these technology support services. However, it appears unlikely that at present the private sector would be interested in running these services themselves.

The above overview of the state of basic and enabling conditions for industrial technology development in Indonesia indicates that in general these important conditions have not been met during the Soeharto era, and even less so after the Asian economic crisis. The Indonesian government will therefore have to focus its industrial and technology policies on attempting to meet the above conditions for industrial technological development, if it is serious in raising Indonesia's industrial competitiveness.

## References

- Aswicahyono, Haryo, 1997, *Transformation and Structural Change in Indonesia's Manufacturing Sector*, in : Pangestu & Sato (editors), 1997, pp. 1-28.
- Aswicahyono, Haryo & Pangestu, Mari, 2000, *Indonesia's Recovery: Exports and Regaining Competitiveness*, Jakarta, mimeo.
- Bank Indonesia, *Indonesian Financial Statistics*, successive issues.

- Chen, Edward K.Y., 1983, *Multinational Corporations, Technology and Employment*, The Macmillan Press, London.
- Cole, William, 1998, Bali's garment export industry, in: Hill & Thee (editors), 1998, pp. 255-78.
- Dahlman, Carl; Bruce Ross-Larson & Larry Westphal, 1987, Managing technological development: lessons from the newly-industrialising countries, in: *World Development*, no. 15, pp. 759-75.
- Dhanani, Shafiq, 2000, *Indonesia: Strategy for Manufacturing Competitiveness, Vol. II, Main Report*, Jakarta, United Nations Industrial Development Organization, November.
- Ernst, Dieter; Ganiatsos, Tom & Mytelka, Lynn (editors), 1998, *Technological Capabilities and Export Success in Asia*, Routledge, London and New York.
- FIAS, 1996, *Indonesia - A Pilot Project to Promote Backward Linkages - A Private-Public Partnership*, Foreign Investment Advisory Service, Washington, D.C., June.
- Frank, Isaiah, 1980, *Foreign Enterprise in Developing Countries*, John Hopkins University Press, Baltimore and London.
- Gray, Clive S., 1982, Survey of Recent Developments, in: *Bulletin of Indonesian Economic Studies*, Vol. XVIII, no. 3, November, pp. 1-51.
- HIID, 1995, *Prospects for Manufactured Exports During Repelita VI*, Report to the Department of Industry and Trade, Republic of Indonesia, Jakarta.
- Hill, Hal, 1987, Survey of Recent Developments, in: *Bulletin of Indonesian Economic Studies*, Vol. 23, no. 3, August, pp. 1-33.
- , - , 1996, *The Indonesian Economy Since 1966 - Southeast Asia's Emerging Giant*, Cambridge University Press, Cambridge and Melbourne.
- , - , 1997, *Indonesia's Industrial Transformation*,

- Institute of Southeast Asian Studies, Singapore.
- , - , 1999, *The Indonesian Economy in Crisis - Causes, Consequences and Lessons*, Institute of Southeast Asian Studies, Singapore.
- Hill, Hal, Haryo Aswicahyono & Kelly Bird, 1997, What Happened to Industrial Structure during the Deregulation Era, in: Hill, 1997, pp. 55-80.
- Hill, Hal & Thee, Kian Wie (editors), 1998, *Indonesia's Technological Challenge*, Research School of Pacific and Asian Studies, Australian National University, Canberra & Institute of Southeast Asian Studies, Singapore.
- Hobday, Mike, 1994, Export-Led Technology Development in the Four Dragons: The Case of Electronics, in: *Development and Change*, Vol. 25, no. 2.
- Iqbal, Farrukh, 1995, *Deregulation and Development in Indonesia*, Paper presented at the Conference on 'Building on Success: Maximising the Gains from Deregulation, Jakarta, 20-28 April.
- Lall, Sanjaya, 1998, Technology Policies in Indonesia, in: Hill & Thee (editors), 1998, pp. 136-68.
- LIPI & The Office of the Minister of State for Research and Technology, 2004, *Buku Saku Indikator IPTEK Indonesia* (Pocket book of Indicators on Science and Technology in Indonesia), Jakarta, December.
- MacIntyre, Andrew & Budy P. Resosudarmo, 2003, Survey of Recent Developments, in: *Bulletin of Indonesian Economic Studies*, Vol. 39, no. 2, August, pp. 133-56.
- McCawley, Peter, 1979, *Industrialization in Indonesia: Developments and Prospects*, Occasional Paper no. 13, Development Studies Centre, The Australian National University, Canberra.
- Marks, Stephen, 1999, *Foreign Direct Investment in Indonesia and its Management through Governmental Policy*, Partnership for Economic Growth, Department for Industry and Trade, Jakarta, March.

- Ninasapti Triaswati, *Human Resource Development Since the 1997 Crisis*, Presentation in Jakarta, 16 February.
- Pangestu, Mari & Sato, Yuri (editors), 1997, *Waves of Change in Indonesia's Manufacturing Industry*, Tokyo: Institute of Developing Economies.
- Soesastro, Hadi, 1998, *Emerging Patterns of Technology Flows in the Asia-Pacific Region; The Relevance to Indonesia*, in: Hill & Thee (editors), 1998, pp. 303-25.
- Soesastro, Hadi & Raymond Atje, 2005, *Survey of Recent Developments*, in: *Bulletin of Indonesian Economic Studies*, Vol. 41, no. 1 (April), pp. 5-34.
- Thee, Kian Wie, 1998, *Determinants of Indonesia's Industrial Technology Development*, in: Hill & Thee (editors), 1998, pp. 117-35.
- , - , 2002, *Competition Policy in Indonesia and the New Anti-Monopoly and Fair Competition Law*, in: *Bulletin of Indonesian Economic Studies*, Vol. 38, no. 3 (December), pp. 331-42.
- , - , 2005, *The Major Channels of International Technology Transfer to Indonesia: An Assessment*, in: *Journal of the Asia-Pacific Economy*, Vol. 10, no. 2, pp. 214-36.
- Thee Kian Wie & Ahmad Hamid, 1997, *Perkembangan Industri Garmen di Bali sesudah tahun 1990* (The development of the garment industry in Bali after 1990), Paper presented at the Conference of the Association of Indonesian Economists (Ikatan Sarjana Ekonomi Indonesia), Malang, 19 December.
- Thee, Kian Wie & Pangestu, Mari, 1998, in: Ernst, et.al. (editors), 1998, pp. 211-65.
- Timmer, Marcel, 1999, *Indonesia's Ascent on the Technology Ladder: Capital Stock and Total Factor Productivity in Indonesian Manufacturing, 1975-95*, in: *Bulletin of Indonesian Economic Studies*, Vol. 35, no. 1 (April), pp. 75-89.
- World Bank, 1994, *Indonesia - Industrial Policy - Shifting*

*into High Gear, Washington, D.C.*

- , - , 1996, *Indonesia - Industrial Technology Development for a Competitive Edge*, Report no. 15451-IND, May 29, Washington, D.C.
- , - , 1997, *Indonesia - Sustaining High Growth With Equity*, Report no. 16433, Washington, D.C., May 30.
- , - , 2000, *Indonesia: Accelerating Recovery in Uncertain Times*, Report no. 20991-IND, Jakarta, 13 October.
- , - , 2005, *Indonesia - New Directions, CGI Brief*, Report no. 31335-IND, Jakarta, January.

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