Indonesia’s industrial policy reforms and their environmental impacts

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(Received 9 January 2008; final version received 25 February 2008)

The fast growth of the manufacturing sector in Indonesia during the 1970s and 1980s and its relatively steady growth during the 1990s and early 2000s were argued to be the result of the kind of industrial policy reforms that were implemented. However, another important development since the early 1970s has been the rapidly deteriorating quality of environmental conditions in the country. Thus, the purpose of this paper is to analyse how industrial policy reforms have impacted on the environmental performance of industry, as well as to describe whether the introduction of industrial environmental policies has reduced industries’ environmental impact.

Keywords: Industrial policy; environmental policy; economic development

JEL Codes: L52; Q58; O14

1. Introduction

During 1970–97, Indonesia was able to achieve average annual economic growth of approximately 7%, with the manufacturing sector one of the driving forces behind this. In 1997, the economic crisis hit Indonesia, followed by a major political crisis, causing Soeharto, then president, to step down in 1998. The resulting impact on national economic performance was significant. Economic growth in 1998 was around negative 13.1% and in 1999 the economy grew positively by only 0.8%. Economic growth improved after 1999, reaching and remaining at around 5% since 2003; i.e., 5% in 2004, 5.7% in 2005 and 5.5% in 2006 (Resosudarmo and Kuncoro 2006; World Bank 2007a).

The manufacturing sector in Indonesia started to grow significantly, at around 13% annually, in the 1970s. During the 1970s, the oil booms along with nationalist sentiment induced a more significant government role in developing this sector. The enactment of investor-friendly laws at the end of the 1960s – Law No. 1/1967 on Foreign Investment and No. 6/1968 on Domestic Investment – stimulated...
foreign and domestic investors to start setting up many private manufacturing enterprises in the 1970s (Hill 2000). Although both private and government enterprises contributed to the growth of the manufacturing sector during this period, contributions of government enterprises were probably still more dominant. In the 1980s through to the early 1990s, further significant improvements for the private sector in the investment and trade regime induced further rapid development of private enterprises, so that the domination of state enterprises was significantly reduced. Most manufacturing exports in this period were conducted by private enterprises. Exports and private sectors thus started to become the backbone of economic growth so that by the end of the 1980s, the manufacturing sector contributed around 19% to the national gross domestic product (GDP) and around 50% to total exports (Hill 2000; World Bank 2007b).

In the late 1990s, the role of the manufacturing sector in the economy remained significant in spite of being one of the areas most affected by the crisis. By the early 2000s, the manufacturing sector contributed around 25% to GDP (the largest contributing sector) and around 70% to total exports (Dhanani 2000; Ramstetter 2000; Aswicahyono and Feridhanusetyawan 2004).

Observers have argued that the rapid growth of the manufacturing sector during the 1970s and 1980s and its relatively steady growth during the 1990s and early 2000s were the result of the kind of industrial policy reforms implemented in Indonesia, in particular several policies to reduce the ‘anti export bias’ (Woo et al. 1994; Hill 2000; Aswicahyono and Feridhanusetyawan 2004).

Another important development in Indonesia alongside economic and manufacturing growth since the early 1970s has been the rapidly deteriorating quality of the physical environment (Thee 2002; Resosudarmo 2003; Resosudarmo and Napitupulu 2004). For example, Table 1 shows that by the mid-1990s, the quality of air in several areas was among the worst worldwide. This table also indicates the significant contribution of industries in the manufacturing sector to diminishing environmental quality, i.e. development of the industrial sector was accompanied by the poor environmental performance of industry.

The main objectives of this paper are, first, to assess how industrial policy reforms (broadly defined) have impacted on the environmental performance of industry in Indonesia; second, to characterise how industrial policies have been modified, if at all, to lessen their environmental impact; and finally, to draw some lessons for other developing countries from the Indonesian case.

2. Industrial policy reforms

Indonesian economic policies implemented to boost the development of the industrial sector can, in general, be grouped into four phases: 1966–74, 1975–81, 1982–97 and 1998 onwards. The first phase, 1966–74, was considered to be the first phase of liberalisation of the economy. It is important to note that Indonesia’s economic situation in 1966 was chaotic. At that time, inflation ran at 600% per annum, production and trade were stagnant, and the economic infrastructure was
Table 1. Annual means of ambient air pollution (µg/m³) in several large cities in the world.

<table>
<thead>
<tr>
<th></th>
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<td>China</td>
<td>Beijing</td>
<td>10,839</td>
<td>377</td>
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<td></td>
<td>Guangzhou</td>
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<td>Shanghai</td>
<td>12,887</td>
<td>246</td>
<td>53</td>
<td>73</td>
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<td></td>
<td>Shen Yang</td>
<td>44,828</td>
<td>374</td>
<td>99</td>
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<tr>
<td>India</td>
<td>Calcutta</td>
<td>12,918</td>
<td>375</td>
<td>49</td>
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<td></td>
<td>Delhi</td>
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<td>415</td>
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<tr>
<td>Indonesia</td>
<td>Jakarta</td>
<td>11,018</td>
<td>271</td>
<td>30</td>
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<tr>
<td>Japan</td>
<td>Osaka</td>
<td>11,013</td>
<td>43</td>
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<td></td>
<td>Tokyo</td>
<td>26,444</td>
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<tr>
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<tr>
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<td>New York</td>
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<td>N/A</td>
<td>26</td>
<td>79</td>
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<td></td>
<td>Los Angeles</td>
<td>13,140</td>
<td>N/A</td>
<td>9</td>
<td>74</td>
</tr>
<tr>
<td>WHO standard</td>
<td>&lt; 90</td>
<td>&lt; 50</td>
<td>&lt; 50</td>
<td></td>
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</tr>
</tbody>
</table>


Note: The World Health Organization (WHO) standard shows a threshold level of air pollution below which no impact on human health is expected.

in disrepair. Relations with western countries and with international donor agencies were cut or brought to a very low level. Economic chaos in that year led to a political transition, in which the first Indonesian president, Soekarno, was deposed by the military and his successor Soeharto assumed leadership of the country. Soeharto turned quickly to a group of western-trained economists in the Faculty of Economics at the University of Indonesia to design an economic stabilisation policy that would also aim to induce national industrial development. The economists designed a two-year stabilisation plan with four short-term objectives: to bring down inflation, to secure a moratorium on foreign debts and obtain new credits, and to create a new open policy towards foreign direct investment (FDI) (Thee 2002). Macroeconomic stability was restored by means of a new tight fiscal and monetary policy. The government announced a balanced budgetary policy that eliminated the budget deficit, i.e. the deficit could not be financed through money creation. The shortfall between government revenues and government expenditures was financed by foreign loans channelled through the Inter-Governmental Group for Indonesia (IGGI) and since 1992 through the Consultative Group on Indonesia (CGI). To promote industrial growth, three new policy measures were introduced: first, foreign trade was liberalised by revoking various import and
export controls and also abandoning the multiple exchange rate system; second, new investment laws were decreed, containing generous tax concessions; third, preferential treatment for state-owned companies was reduced, along with introduction of the policy to promote development of the private sector (Dhanani 2000; Thee 2002; UNSFIR 2004; Kim 2005). Closer ties with the international donor community were re-established, enabling Indonesia to borrow concessionary loans to rehabilitate its previously neglected physical infrastructure throughout the nation.

Implementation of these policies enabled a reduction of the inflation rate from 636% in 1966 to 9% in 1970 as well as generating an average annual growth rate of the gross domestic product (GDP) to as high as 6.7% during this period. Real manufacturing output increased by 9% in 1968 and expanded further to 14% in 1969 (Hill 2000). Soeharto was clearly able to turn the economy around and prevent economic disaster (Thee 2003). Foreign investment started to flow into the country, although it was still at a low level and concentrated on large natural resources projects, such as oil and gas mining and logging (Banerjee 2002).

It is important to note that although initially in 1967–68 Soeharto’s economic reforms emphasised economic deregulation, by 1969 the policies were beginning to be more interventionist (McCawley 1984). Thus, despite its open economic policy, Indonesia’s trade policy during this period in essence remained inward-looking (Hill 2000). In fact, the protectionist instruments far surpassed the situation in other Southeast Asian countries. By imposing tariff and non-tariff barriers (NTBs), during the early 1970s, Indonesia pursued an ‘easy phase of import substitution’ in which imported goods were replaced by locally made products (Thee 2002).

The second phase, from 1975–81, was characterised by the oil revenue boom. The country’s oil production increased significantly from the early 1970s onwards, particularly in Sumatra and Kalimantan, and two oil price booms, in 1973 and 1979, intensified the boom. Revenues from oil exports hence accelerated significantly in the 1970s. Exports in general grew at an annual rate of 23.6%. Export earnings from crude oil and petroleum products amounted to only 32.8% of total export earnings in 1970, but increased to approximately 79.8% in 1981. In 1981, the total revenue from oil exports accounted for approximately a quarter of the country’s GDP and 70% of total government domestic revenue.

Recognising that the first stage of import substitution was complete and plenty of revenue from oil was available during this period, the government, particularly the Department of Industry, took an even more active role in developing the country’s industrial sector. State-directed industrialisation was ushered in through a second-phase import-substitution policy. This second phase involved deepening the industrial structure, a process through which the government promoted upstream industry development, in particular basic resource processing such as steel, aluminium and chemicals (Thee 2002). Several ‘local content programs’ were introduced to promote industries making parts and components for the downstream assembly industry.
In 1978, B.J. Habibie became the State Minister of Research and Technology to start the ‘high-technology’ industry program, in particular the development of state-owned aircraft and shipbuilding industries. The government also became more protective by imposing more tariffs and proliferating NTBs. Many argued that this heavy regulation and import substitution strategy resulted in inefficient capital deepening, misallocation of new investment and excess capacity in some sectors (Hill 2000; Thee 2002). Nevertheless, during 1975–81, manufacturing growth reached an annual average of 8% (Dhanani 2000), which was slightly higher than the overall annual growth of the economy at around 7%.

At the end of the 1970s, the government, particularly the Ministry of Finance and the National Development Planning Agency (Bappenas), realised that the oil revenue boom would not last forever. In November 1978, the government devalued the national currency by 50% to restore the purchasing power of the rupiah vis-à-vis the USS, to promote a higher growth of non-oil export oriented industries, and to shelter the infant manufacturing sector from import competition. Other limited efforts included offering tax and other incentives to increase non-oil exports and foreign investment in non-oil sectors. However, the main aim of the tariff policy was still to protect the import-substitution manufacturing sector (Dick, 1979). Thus, development of non-oil industries, particularly those that were privately owned, was still limited by the end of 1970s.

The third phase, 1982–97, started when the world price of crude oil dropped in 1982 and kept declining until 1986 – from around U$37 per barrel in 1981 to only around U$13 per barrel. Earnings from oil exports dropped from U$10.6 billion in 1981/82 to U$7.2 billion in 1982/83. Other adverse factors affecting the Indonesian economy were a worldwide recession that adversely affected the demand for Indonesia’s traditional exports, and the weakening of the USD versus the yen in the mid-1980s. Appreciation of the yen exacerbated Indonesia’s debt burden, as a significant part (around 40%) of national foreign debt was in yen whereas export earnings were in USS (Thee 2002; Resosudarmo and Kuncoro 2006). The GDP growth rate dropped to only around 1% in 1982. Clearly, 1982 was a turning point from a regime of high, oil-fed growth to a new rhythm of decelerated growth and stabilisation of the economy, to reduce the national economy’s vulnerability to external shocks.

The drop in revenue, particularly from oil exports, after 1982, led to deterioration in the fiscal balance and pressured the government to pursue a broad-based adjustment programme throughout the remainder of the 1980s. The core of the policy was to restore macroeconomic stability and diversify the economy by removing various bottlenecks so as to reduce dependence on the oil and gas sector. The government cut its expenditure, and suspended, and then cancelled, several large projects. A new series of tax laws was passed to adjust the pattern of revenue and expenditure to the dire situation. The rupiah was devalued by 28% in March 1983 and by 45% in September 1986. Other reform packages included simplification of investment and export/import licensing, deregulation of the banking and financial sectors, significantly reducing tariffs across the board, and, in May 1986,

The economic reform of the 1980s worked together with the pressure on companies in Japan and East Asia’s new industrial countries (NICs) – South Korea, Taiwan, Hong Kong and Singapore – to relocate their factories to Southeast Asia due to the rising wages and sharp currency appreciation in these countries. These circumstances boosted the annual growth rate of Indonesia’s manufacturing sectors, particularly the non-oil and gas sectors, from around 8% at the end of the 1970s to approximately 13% during the 1985–88 period and then to around 20% during the 1989–93 period (Dhanani 2000; Thee 2002). The manufacturing sector’s share of GDP increased from around 11.4% in 1983 to 19.4% in 1990 (Kim 2005). The share of non-oil exports as a percentage of total exports increased to 56.9% in 1990 from 17.8% in 1981. Garments and textiles were becoming the mainstay of manufacturing exports. Hence, GDP growth bounced back from as low as 2.5% in 1985 to 7.2% in 1990.

However, the 1980s reform was still accompanied by continued industrial deepening. Both proliferation of NTBs and protection of heavy industries – by this time state-owned high-tech companies such as aeroplane, ship, and weapon companies were also protected – continued, as well as the tight requirement of joint-venture for foreign investment (Hill 2000; Thee 2002; UNSFIR 2004). Hence, overall, the industrial policy in the early post-oil boom era was still a mixture of providing strong incentives for more foreign investment in the country’s manufacturing sectors and heavily protecting the development of state-owned manufacturing companies.

In 1993, as FDI approvals declined significantly, a widespread apprehension concerning Indonesia’s ability to attract foreign capital emerged. Concern for the apparent slowing down of non-oil exports also grew, with fear that this might lead to an economic crisis. The government then imposed various serious economic reforms from mid-1993 to 1995. The reforms simplified approval procedures for investments, allowed foreign companies to set up their own input suppliers and relaxed customs and import administration procedures, including a reduction of several import tariffs and lowering or even abolishing several tariff surcharges (van der Eng 1993). Since 1994, foreign investors were given the flexibility to either form a joint venture with up to 95% majority equity ownership with no further divestment required, or form a fully owned subsidiary with the requirement of divestment to a local partner or member of the public of as little as 5% of their shares within 15 years (Pangestu and Azis 1994). There was also a pre-announced schedule of further tariff reductions through to 2003 in response to GATT/WTO, AFTA and APEC agreements. The remaining NTBs were replaced by the use of tariff surcharges. The number of industries protected was also significantly reduced, although the businesses of Soeharto’s cronies and families that rapidly grew at the end of the 1980s still received special treatment (Nasution 1995; Thee 2002).

Due to these reforms, the period 1994–97 was characterised by a surge of foreign investment (Dhanani 2000). The Indonesian economy was still able to
grow by more than 7% annually. However, the prospect of industrial development still seemed to be uncertain. The growth of market value added (MVA) reduced by almost 50% from 20% in the 1989–93 period to 12% in the 1994–97 period (Dhanani 2000). The reason was the slow-down of manufacturing-exports growth and stagnation of four major export products (plywood, textiles, garments and footwear) during 1994–97 (Dhanani 2000; Aswicahyono and Feridhanusetyawan 2004).

The fourth industrial policy phase was during and after 1998 (probably until the mid-2000s). It is well known that Indonesia was hit by an unprecedented economic crisis in 1997. It started as a currency crisis, when Thailand’s economic crisis triggered doubts concerning Indonesia’s economic stability. As the direction of capital inflows started to reverse, the external value of the rupiah plummeted between June and November 1997, depreciating by 35%. It then became apparent that the monetary authority did not have sufficient reserves to defend the rupiah. Instead, after increasing interest rates, it opted first to enlarge the band and finally, in August 1997, to move to a free float system. Despite high interest rates, capital outflows continued to accelerate and, as a result, the currency continued to weaken. The move toward a free float created panic among domestic corporations with large exposure to overseas loans, and also international investors with Rupiah-denominated assets. As both scrambled to buy US dollars, it put further pressure on the currency, which collapsed from 2300 rupiah in June 1997 to more than 17,000 rupiah per US$ by January 1998. Following this collapse, the inflation rate jumped to 78% (Resosudarmo and Kuncoro 2006) in 1998.

Due to this economic crisis, domestic and foreign investments dropped significantly, so that by 1999 gross domestic capital formation dropped to only 19% of the GDP from the original 32% (Dhanani 2000). The FDI inflows took a sharp downfall from US$6.5 billion in 1996/97 to US$1.6 billion in 1997/98 and nil in 1998/99 (Dhanani 2000). Furthermore, there were signs of deindustrialisation; the relative importance of the industrial sector declined compared with the period before the crisis (Banerjee 2002). Within industry, labour-intensive export-oriented industries proved to be more resilient to the crisis. This also applied to small and medium enterprises (SME), since they had less exposure to foreign debts than large enterprises (UNSFIR 2004). Overall, the growth in GDP dropped to 4.6% in 1997 and even −13.1% in 1998 (Resosudarmo and Kuncoro 2006).

During and after the crisis, Indonesia continued to liberalise the economy, but this time it did so to comply with the IMF recovery programme as well as AFTA and WTO agreements. Protection was no longer given to any state-owned enterprise nor any enterprise of Soeharto’s cronies or family. The attempts to revive the industrial sector after the crisis were generally as follows. First, divestment and privatisation policies aimed to improve industrial competition and to reduce wealth inequality nationwide (UNSFIR 2004). However, so far, various kinds of resistance to privatisation endeavours have created an inevitable stagnation of these efforts (UNSFIR 2004). Second, decentralisation permits, taxes and other industrial regulations also aimed to induce a better distribution of
regional growth. This approach happened to add further complexities to conducting business, particularly in the regions (UNSFIR 2004).

In a more sectoral approach, in 2005, the Trade and Industrial Department created a new blueprint for Indonesia’s industry for 2025. The Department conducted a competitiveness assessment to determine which prospective industries were to be developed. Based on the assessment, the Department came up with ten core clustering industries that will be supported to improve their competitiveness. These ten are: (1) food and beverages, (2) fisheries processing, (3) textile and textile product, (4) footwear, (5) palm oil products, (6) wood product (including rattan and bamboo), (7) rubber and rubber product, (8) pulp and paper, (9) electrical machineries and equipment, and (10) petrochemical (DEPERIN 2005). Despite all these efforts, the growth rates of manufacturing sectors from 1998 till the mid-2000s have still been far below their growth in the 1970s and 1980s.

3. Industrial environmental policy

Concern for environmental problems caused by economic development was demonstrated in the late 1970s when President Soeharto appointed Emil Salim as the first Minister of the Environment. The first law concerning the environment, Law No. 4/1982 on Basic Provisions of Environmental Management, was enacted in 1982 (Koesnadi 1989). The first serious attempt to control industrial pollution was made in 1989 when the Ministry of Population and Environment started to require firms to submit an environmental impact assessment report related to their new economic activities. In June 1990, through the Presidential Decree No. 23, a national environmental impact management agency (Badan Pengendalian Dampak Lingkungan or BAPEDAL) was established (Hardjono 1994). Since then several industrial environmental policies have been launched.

3.1 Environmental impact assessment (AMDAL)

As previously mentioned, since 1989, through the Government Regulation No. 29/1986, every development project is required to submit a report on the expected impact of its activities on the environment, its proposed actions to avoid or minimise this impact, and what environmental impact monitoring activities it will undertake. The report is called an environmental impact assessment (Analisa Mengenai Dampak Lingkungan or AMDAL). The report is assessed by whichever government agency has the authority to permit the activity. If the project is expected to have a serious environmental impact, the report needs to be assessed by an inter-sectoral team involving the Ministry of Population and Environment.

Since 1989, most development projects have provided this kind of report to the relevant authorities. However, it is considered that assessment and enforcement have been weak. Almost no control, monitoring or re-checking has been conducted to ensure the accuracy of the reports. In general, people consider AMDAL as just
a formal report required to conduct a development project without this reporting process affecting the intended activities of the project.

3.2 Clean river program: PROKASIH

The Clean River Program, also known as PROKASIH (Program Kali Bersih), was started in 1989 in response to the declining quality of rivers in Jakarta. It is based on a consensual approach to control wastewater effluents by targeting selected industrial polluters in priority river basins. The goal is to improve river quality by setting a specified standard for the river water based on some parameters – usually biochemical oxygen demand (BOD) and total suspended solids (TSS) – established by government (Resosudarmo et al. 1997; ADB 1997). This programme also attempts to strengthen human and institutional abilities in the management of river water quality and of riverbanks (Resosudarmo 2003).

During the first four years of the programme, the target was to reduce industrial discharges. In particular, the programme was aimed at the worst industrial polluters with the goal of reducing industrial pollution by 50% (World Bank 2003). It was planned that the second four years would target the regulation of commercial discharges, followed by management of domestic wastes. The programme was conducted on 19 rivers in Indonesia, three of which are located in Jakarta (Resosudarmo et al. 1997).

Implementation of the programme relies heavily on moral suasion where participating industries are given a timetable to lower their effluent concentrations of specific pollutants according to the prescribed level. Failure to satisfy the requirement within a certain time limit invokes a penalty on the polluters, ranging from a warning to a suspension of operating permits. Regional governments are responsible for implementing PROKASIH in their regions. PROKASIH-related activities vary from one region to another. Nationally, BAPEDAL provides general guidance and coordinates all regional activities related to PROKASIH.

In terms of the number of participants, PROKASIH was a relative success. First, the number of industries participating in the programme increased from 381 factories/plants in 1989/1990 to 1395 factories/plants in 1994/1995. Second, the number of rivers included in the PROKASIH programme increased from 18 rivers in 1989/1990 to 31 rivers in 1994/1995 (PPSDML-UI 1991; NRMP 1996; Resosudarmo et al., 1997).³

After five years of implementation, the government announced that the programme was successful and that the desired effluent levels from industrial discharges had been achieved. However, the World Bank (2003) indicated that due to the voluntary nature of the programme and the limited capacity of the government to monitor activities, its general perception of the programme impact was mixed. A study conducted by Resosudarmo et al. in 1997 also cast some doubt on PROKASIH’s success. The research demonstrates some of the programme’s failings. First, the people who live near river areas think that the physical quality of the river has worsened even after the implementation of the programme.
Second, these people also believe that the PROKASIH’s role is almost negligible in conserving river quality.

### 3.3 PROPER programme

The PROPER programme was started in June 1995 as an alternative environmental policy developed by the Ministry of the Environment. PROPER is basically an environmental rating programme that acts as a simple environmental certification. Its main objectives are to increase compliance with environmental regulations, promote adoption of clean technologies, create incentives for polluters to strengthen their in-house environmental capabilities, and prepare companies in Indonesia for International Standards Organization (ISO) 14001 certification (Wheeler and Afsah 1996; ADB 1997).

Implementation of this programme was conducted by BAPEDAL. Each year BAPEDAL evaluated companies participating in this programme regarding their environmental abatement activities. Based on their success in reducing waste discharges, mainly water effluents – hence the programme was also called PROPER PROKASIH – these companies were given one of five different colour scores (ADB 1997). The results were published in newspapers and other media to make them known publicly. The five different colour scores were as follows:

- **(a)** Gold was for factories that potentially pollute a river, but were able to treat their waste so that the amount discharged was less than 10% of their total waste.
- **(b)** Green was for factories that were able to treat their waste so that less than 50% of their waste was discharged into the river.
- **(c)** Blue was for factories that were able to comply with BAPEDAL’s wastewater discharge standard.
- **(d)** Red was for factories conducting wastewater treatment activities, but which were not able to comply with BAPEDAL’s wastewater discharge standard.
- **(e)** Black was for factories without any wastewater treatment facilities. All their waste was discharged directly into the river.

In June 1995, 187 plants were given prior notice of their initial ratings and were informed about disclosure to the public media. In March 1997, of 187 plants, 173 plants continued to be rated in the programme. The 14 factories that dropped out of the programme did so either because they closed down or were considered insignificant polluters. Table 2 the result of this programme. It can be seen that more factories monitored under this programme received green and blue labels in March 1997 than in June 1995. PROPER PROKASIH, hence, was considered to be successful (Afsah et al. 1996; Wheeler and Afsah 1996; Afsah 1998; Lopez et al. 2004).

Over time new plants in addition to the initial 187 joined the programme. By June 1998, the number of firms assessed had increased to 324 plants. BAPEDAL
Table 2. Results of the PROPER PROKASIH program.

<table>
<thead>
<tr>
<th></th>
<th>Factory</th>
<th>Jun 1995</th>
<th>Mar 1997</th>
<th>Mar 2004*</th>
</tr>
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<tr>
<td>Gold</td>
<td></td>
<td>0 0%</td>
<td>0 0%</td>
<td>0 0%</td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td>4 2%</td>
<td>7 4%</td>
<td>8 9%</td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td>59 32%</td>
<td>81 47%</td>
<td>51 60%</td>
</tr>
<tr>
<td>Red</td>
<td></td>
<td>118 63%</td>
<td>82 47%</td>
<td>22 26%</td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td>6 3%</td>
<td>3 2%</td>
<td>4 5%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>187 100%</td>
<td>173 100%</td>
<td>85 100%</td>
</tr>
</tbody>
</table>


Note: * = the New Proper program.

tried its best not to alienate or provoke industries by giving accurate and timely advice to industries as to how to improve their ratings, and claimed that the programme was able to reduce the industrial effluent charges (Lopez et al. 2004). Despite this claim, however, due to the economic crisis in 1997–98 and lack of funding, the programme was halted at the end of 1998 (Resosudarmo 2003).

3.4 The new PROPER programme

In 2002, the Ministry of Environment revived the PROPER programme with a more comprehensive goal. The goal is multimedia management, where the programme is targeted not only to control water, air, and toxic waste discharges, but also as a part of environmental impact assessment (AMDAL). It is also equipped with new regulations such as Government Regulation No. 27/1999 on environmental impact assessment (AMDAL), Regulation No. 18/1999 on toxic waste management, Regulation No. 82/2001 on air and water pollution, Ministerial Decree No. 113/2003 on waste water discharge and Ministerial Decree No. 129/2003 on emission (Ardiputra 2004). PROPER ratings were again conducted in March 2004 with only 85 participating factories/plants. Here, none of the companies was rated gold and four companies were rated black (Table 2). The main problem for most firms was inappropriate management of their toxic wastes. Most firms complained that no landfill was available in their areas and transporting to other areas where limited landfill was available was considered expensive.

A very interesting development is that, since 2005, Bank Indonesia has required all firms to report their PROPER rating as part of their financial report. The plan is that Bank Indonesia will consider firms with a bad PROPER rating to be bad financial performers. Most firms, through their associations, are currently negotiating with Bank Indonesia not to take into account their PROPER rating in the analysis of their financial performance and argue that the Ministry of Environment needs to provide more facilities for dumping toxic wastes before including in the PROPER evaluation how a firm handles its toxic wastes. It is not
yet clear whether Bank Indonesia and the Ministry of Environment will be willing to accept the firms’ requests.

3.5 Hazardous waste management

Besides PROPER, limited monitoring activities are conducted for hazardous waste disposal. Only a small number of industries dispose of their hazardous wastes at the existing treatment facilities. On the other hand, the number of hazardous waste treatment plants and the type of facility available in a treatment plant are limited. In fact, the Cileungsi Hazardous Waste Treatment Plant near Jakarta (operational in 1994) is the only treatment facility capable of processing the waste and providing a secure storage area and a lined landfill for the disposal of stabilized and low level toxins (World Bank 2003).

In 2002, the Minister of Environment granted around 220 hazardous waste generator licenses to industries to treat their own waste. Furthermore, several treatments such as solvent recycling, acid and alkali treatment, tin, silver and copper recovery as well as hazardous waste water treatment with evaporation can now be conducted on a small scale.

3.6 Wastewater effluent charges

Prior to the 1997–98 crisis, a wastewater effluent charge programme was under serious consideration to be implemented in Indonesia. The plan was that before adopting this programme as a national policy, it would be implemented in East Java, specifically for the Brantas River (ADB 1997; Rock 2000; Harnanto and Hidayat 2004). The main reason for using the Brantas River as a case study was that a company, Jasa Tirta, had been operating there for a while to control the water quality of the Brantas River.

Jasa Tirta built several water reservoirs along the Brantas River. When it was observed that the level of pollution in the Brantas River was high, usually during the dry season, the company released water from several reservoirs to dilute the pollution (Harnanto and Hidayat 2004). The company was funded by the East Java government, hence it was expected that having a wastewater effluent charge for the Brantas River would cover the cost of supporting Jasa Tirta. Aiming for a full cost recovery, including the cost of water treatment, a fee of Rp 3000/m³ was suggested in 1996 (ADB 1997; Rock 2000).

As well as the case of Jasa Tirta, the government had also been able to develop throughout the country around 20 industrial estates equipped with centralised wastewater treatment (WWT) facilities, (ADB 1997). The authorities of these industrial estates were expected to implement the wastewater effluent charge programme. PROKASIH and PROPER programmes were among the initial programmes planned to be linked to wastewater effluent charges as part of national policy (Rock 2000).
The programme failed to be implemented due to several legal and institutional obstacles at that time. Law No. 18/1997 on Regional Government Taxes and Charges, aiming to eliminate various regional taxes, also forbids the levying of emission charges. In addition, since PROKASIH and PROPER are managed jointly by BAPEDAL, provinces and districts, linking water-emission fees to those programmes would create jurisdictional problems on the division of fees (ADB 1997; Rock 2000).

3.7 User charges

Several user charges have been levied throughout Indonesia. These are particularly related to municipal services such as drinking water, wastewater treatment, solid waste collection and disposal, and to road/transportation services (ADB 1997; Rock 2000). Several examples related to industrial pollutants are as follows.

For water management, in most provinces a surface or raw water use licence is required for withdrawing surface water, with the license fee starting at US$43 in 1996. For six main classes of customers, a volume-based fee is added, ranging from zero for households to Rp 150/m$^3$ for industrial users (ADB 1997; Rock 2000). These prices are considered low, particularly for industrial users, and hence it is expected that these prices do not really affect people and industrial behaviours in using water.

Furthermore, there are around 300 PDAMs (state-owned municipal water companies) providing access to treated pipe water for around 36% of the urban population throughout the country, with fees averaging Rp 350–2000 per m$^3$. These prices are considered too low, and so many of these PDAMs are in financial difficulty. In 2004, the government enacted a new law allowing private enterprises to manage the water supply in various regions across the country (PERPAMSU 2004).

For sewage disposal, in 1989 the Ministry of Public Works decided to use a levy for sewage disposal. This levy covers five categories of users and in 1997 was set according to the floor space of a building, office or house. The rate in 1990 was from Rp 28 per m$^2$ for households to Rp 182 per m$^2$ for commercial high rise buildings (ADB 1997; Rock 2000). Local governments are responsible for the management of sewage disposal collection, which is generally conducted either by contractors or residents themselves. Only a miniscule portion of the solid waste is recycled and most of it is conducted by the informal private sector such as scavengers in many large cities in Indonesia (World Bank 2003).

The user charge was less effective in managing solid wastes than in the case of water management. The main reason was that the agency that managed the solid waste did not collect the charge. The management of solid wastes was funded through a Presidential Instruction Decree (Inpres) by provincial governments, while local/district financial offices or Dinas Pendapatan Daerah (Dispenda)$^6$ collected the fees (Rock 2000). There was not much collaboration between Dispenda and the provincial government. Due to the lack of an effective user charge
system, solid waste collection in urban areas ranges from 40 to 85% of total wastes, including the share attributable to scavengers (ADB 1997; Rock 2000). In several areas though, due to financial strain, the government privatised some collection services and most of these were considered to be more successful (Rock 2000).

### 3.8 Performance bonds

Implementation of performance bonds in Indonesia has been rather limited. One case of their implementation was in 1996 when the Directorate General of General Mining obliged all mining operators to provide a reclamation guarantee. The guarantee was made based on an estimate of the potential of environmental damage and could take the form of time deposits in a state-owned bank, an irrevocable letter of credit, or surety bonds. The reforestation fund of the Ministry of Forests and Estate Crops was another case of performance bonds (ADB 1997; Rock 2000). Nevertheless, reclamation and reforestation activities have been very limited so far. This is partly since the funding received was also used to fund activities other than reclamation and reforestation, and partly since the reclamation and reforestation were not properly conducted.

### 3.9 Fuel tax

Since the 1980s, a fuel tax of as much as 5% was introduced in Indonesia. The main goal, though, was to raise the revenue of local governments. Of the total fuel tax revenue, 10% is for the central government, and the rest is distributed to provincial, district and municipal governments. Since 1997, however, the government has subsidised domestic fuel prices by much more than 5%, so this fuel tax has not been effective in controlling its use.

### 3.10 Tradable permits

As far as is known, there is no systematic tradable permit in Indonesia. However, there has been much discussion advocating this kind of permit to manage water in a river basin. Law 22/1982, Law 39/1990 and Law 48/1990 mention that the river basin should be the management unit for water management in an area. Introducing tradable water rights hence seems to be natural in this situation. This would appear to be consistent with developments in the irrigation sector that make provinces responsible for operating and maintaining irrigation networks, and that introduce cost recovery (irrigation user fees) and management transfer (water users associations) into the overall management of irrigation (ADB 1997; Rock 2000).

### 3.11 Environmental certification

Voluntary environmental certification has been implemented for quite some time in Indonesia and some Indonesian firms have sought ISO certification. Most of
the firms sought the ISO 9000 series that certifies management soundness and the ISO 14000 series that certifies whether the company has addressed environmental issues in a systematic way and thus has improved its environmental performance. ISO 14001, an upgrade of ISO 14000, was adopted in September 1996 (ADB 1997). This voluntary certification served several purposes, among which is a command and control form of environmental performance, and it is also a cheaper tool to achieve compliance. Furthermore, the certification may also facilitate and reduce the cost related to pollution accident insurance. The number of plants granted ISO 14001 increased from 45 in 1997 to 199 by 2001 and to 266 by 2004.

4 Impact of industrial policy on the environment

Consistent time series monitoring data on industrial pollution from 1970 for Indonesia are not available. Hence, in analysing the impact of industrial policy on the environment, observation may be made of three factors: (1) the composition of industrial activity; i.e. high or low polluting industries; (2) the scale of industrial activity; and (3) the demand and supply of pollution abatement efforts. Sectoral composition influences the quality of the environment since a shift from an agriculturally dominated to an industrially dominated economy results in an increase in the level of pollution. A shift from an industrially dominated to a services dominated economy reduces the pollution intensity. Large-scale industrial development tends to be accompanied by a rapid increase in the level of pollution. However, when strict environmental regulations exist, large scale industrial development will have economies of both scale and scope not only for production but also for pollution abatement activities. Meanwhile, a higher supply and demand of pollution abatement efforts will most likely reduce the level of pollution.

During the 1975–81 period, industrial policies focused on allowing extensive extraction of natural resources and using the revenues from these activities to support and protect the development of large state-owned enterprises. These policies were able to promote the development of the industrial sector, inducing a large share of the industrial sector in the economy, while the share of the agricultural sector declined. However, industrial development was concentrated in several large companies in relatively few sectors, mostly in the heavy basic metal and chemical industries such as steel, chemicals, cement and paper. Looking at the composition of industrial activity, most of the industries were relatively high polluting industries (Table 3). In terms of industrial environmental performance, it can be seen that the government chose the wrong kind of industries to receive its support. It is highly likely that during this period there was almost no demand and supply of pollution abatement efforts. Hence, naturally, rapid environmental deterioration, in terms of both the level of industrial pollutants and the rate of natural resource degradation, took place during this period (Resosudarmo 2003; Resosudarmo and Napitupulu 2004).

The 1982–96 period of industrial policy was characterised by various efforts to promote the development of labour-intensive, export oriented and non-oil and
Table 3. Shares in industrial output by pollution potential category.

<table>
<thead>
<tr>
<th>Absolute Value (Mil. US$1990)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>More polluting industries</td>
<td>2,764</td>
</tr>
<tr>
<td>Somewhat polluting industries</td>
<td>2,446</td>
</tr>
<tr>
<td>Less polluting industries</td>
<td>1,312</td>
</tr>
<tr>
<td>Total</td>
<td>6,522</td>
</tr>
</tbody>
</table>

Source: Aftab et al. (2000).

Note: More polluting industries are ISICs 341 (Paper & Paper Products), 351 (Industrial Chemicals), 353 (Petroleum Refineries), 369 (Other Non-metallic Mineral), 371 (Iron & Steel), and 372 (Non-ferrous Metals). Somewhat polluting industries are ISICs 311 (Food Products), 313 (Beverages), 321 (Textiles), 323 (Leather Products), 342 (Printing and Publishing), 352 (Other Chemicals), 381 (Fabricated Metals), 283 (Machinery, Electrical), and 384 (Transport Equipment). Less polluting industries are ISICs 314 (Tobacco Products), 322 (Wearing Apparel), 324 (Footwear), 331 (Wood Products), 332 (Furniture), 354 (Misc. Petroleum & Coal Products), 355 (Rubber Products), 356 (Plastic Products), 361 (Pottery), 362 (Glass), 382 (Machinery, except Electrical), 385 (Professional & Scientific Equipment), and 390 (Others).

gas manufacturing sectors. The economy was liberalised further, although various protections were kept at the micro level in heavy and hi-tech industries. This round of liberalisation was designed particularly to attract FDI. At this time, many companies in Taiwan, South Korea, Singapore, Hong Kong, Japan and some other developed countries were looking for new places to relocate their factories, and Indonesia was one of the countries chosen. One of several motivations to find new locations was tighter environmental regulations in their own countries. Hence, although there was a relatively large amount of new FDI, a significant share of it was in the form of relatively high polluting industries, such as paper, chemical, and metal products.

The labour intensive, export-oriented and non-oil and gas manufacturing industries developed rapidly during this period. Some were also among the high polluting industries. It is important to note here that large-scale state-owned enterprises continued to grow during this period, even though at a rate lower than its growth in the 1970s. Until the end of the 1980s, the government conducted almost no environmental regulation. Hence, along with the increase in the contribution of the industrial sector to GDP through the 1980s and up to the early 1990s, the percentage of higher polluting industries also kept increasing (Table 3). Therefore, it should not be surprising that the level of pollution in Indonesia, particularly in industrial cities, became one of the highest in the world and had begun to cause human health problems (Resosudarmo 2003).

Contributions of industrial pollution to the overall level of pollution in the country by the end of the 1980s have been estimated as follows. The discharge of large industries revealed that industrial pollution constituted from 25 to 50%
of the total pollution load in different rivers in Java. The food industry sector accounted for around 55% of this total industrial pollution load, around 35% of the effluent was from textile, chemical, and pulp and paper industries, of which the textile industry accounted for around 21%. Monitoring in the Brantas River in Surabaya in the early 1990s showed that industrial effluents accounted for 38 tons per day (tpd) of biochemical oxygen demand (BOD) out of 120 tpd. By 1997, industrial contribution had increased to 125 tpd. In the Jakarta area, industrial pollution accounted for 84 tpd of BOD out of a total of 171 tpd in the early 1990s (World Bank 1994, 2003).

The total amount of ground water pollution attributable to industrial discharge was unknown. Nevertheless, the presence of typical industrial effluents such as phenol, detergents and nitrates had been observed in shallow aquifers in various large cities in Java (World Bank 2003).

As for air pollution, industrial emissions accounted for 15 to 30% of the Total Suspended Particulate (TSP), 15 to 45% of the total oxides of nitrogen (NOx), and 60 to 90% of sulphur dioxide (SO2) in various large cities in Java (World Bank 1994). The transportation sector in general contributes more than the industrial sector, particularly in the cases of lead, carbon monoxide (CO) and NOx. By that time various studies had also indicated the impact of air pollution on health in urban areas. For example, in 1987, Tri-Tugaswati et al. carried out blood and urine tests on 30 public bus drivers and 27 farmers living in the environs of Jakarta. The tests showed that the level of lead in the blood and urine of public transportation drivers was twice as high as that of the farmers (Tri-Tugaswati et al. 1987).

In 1989, Achmadi performed a survey on the occurrence of health problems related to CO and lead among residents of Jakarta. Based on survey findings, Achmadi argued that public transportation drivers, street vendors, and people who live in high traffic areas have 12.8 times the risk of contracting health problems associated with air pollutants than people who live in suburban areas (Achmadi 1989).

For hazardous and toxic wastes, exact information on the contribution of industrial sectors to the total was not available. Nevertheless most of Java’s rivers undoubtedly contained a variety of hazardous and toxic substances. Some of the evidence was as follows. Quantities of toxic and hazardous wastes were found in several landfills, dumped in rivers along with other industrial wastes, and in some cases, spread to agricultural areas by irrigation water and wind. Significant mercury contamination in sediments and marine biota of Jakarta had already become public knowledge. A study of hazardous waste by Dames & Moore, Inc. (1993) estimated that around 2.2 million tonnes per year of such waste were then being generated in West Java and Jakarta. It was unclear whether or not this toxic waste was properly dumped.

Early concern about the impact of economic growth on the environment began in the late 1970s with the appointment of Emil Salim as the first environmental minister. Concerns about the alarming level of Indonesia’s industrial pollution were not significantly magnified until the end of the 1980s. The media drew attention to
the demands of various NGOs and communities for serious implementation of an environmental programme. More serious implementation of several environmental programmes hence started in the early 1990s. BAPEDAL was established in 1990. PROKASIH and PROPER were probably among the most important programmes for mitigating the environmental impact of industrial development.

Several studies conducted in the mid-1990s show that although the coverage of these environmental programs was mostly limited to Java, these programmes did affect plant managers’ behaviour. Rock and Aden (1999), who conducted a survey of 121 manufacturing plants in four polluting sectors (chemicals, food and beverages, textiles, and other – primarily wood processing) in the Semarang area from December 1997 to January 1998, found that plants did respond to environmental regulatory, community and market pressures as well as to government financial incentives to abate pollution. However, their study also shows that pollution in Semarang has not yet abated significantly. More than 60% of the plants in their sample had not invested in any pollution control. Of those that had, the mean level of expenditure as a percentage of plant sales was almost zero.

Another example is a study by Lopez et al. (2004). They observed the levels of biochemical oxygen demand (BOD) in water discharges from 76 plants, and the level of chemical oxygen demand (COD) in water discharges from 82 plants, participating in the PROPER programme from 1995 until 1998. They found that the policy was indeed responsible for a reduction in emissions intensity as measured by BOD and COD, and that reduction was particularly rapid and strong among firms with poor environmental compliance records prior to implementation of the policy. However, these observers also admitted that evidence of the effectiveness of this policy to deliver emission reductions is still very limited.

The level of pollution by the mid-1990s had still increased, though not at the pace of that during the 1970s and 1980s. Nevertheless, there were doubts that this reduction of pollution growth was due to environmental programs such as PROPER. Many thought that it was due simply to the fact that the percentage of more polluting industries in the total industrial output had declined (Table 3).

The situation after 1998 presented doubt about possibilities. The 1997 economic crisis was expected to cause deindustrialisation in Indonesia as the economy contracted. The manufacturing sector was one of the hardest hit and potentially this could have reduced the level of pollution. On the other hand, the crisis induced a situation in which environmental requirements were considered less important than economic growth, in which case the level of industrial pollution could have been expected to increase. Hence, although the crisis might have had some effects on industrial environmental performances, those effects, overall, were not considerable.

Figure 1 illustrates what might have been happening during 1997 and 1998. This figure shows average annual ambient levels of several pollutants in Jakarta. It indicates that concentrations of suspended particulate matter (SPM) dropped significantly, concentrations of SO₂ increased slightly, and concentrations of NOₓ increased significantly. One explanation regarding the drop of SPM is that
construction activities declined during the 1997–98 period. Meanwhile, the lack of priority for reducing pollutants caused a significant increase in the level of NO\textsubscript{x} from cars and factories in Jakarta.

Afsah (1998) conducted a study on the impact of the crisis using the data set available from the PROPER programme. He found that although outputs of most plants participating in the PROPER programme declined, the average pollution intensity of these plants, in terms of the levels of BOD and COD in their water discharges, was increasing.

The various economic reforms, including industrial policies, conducted after the crisis, were able to restore the Indonesian economy to the pre-crisis situation by around 2004. GDP per capita at that time returned to the pre-crisis level and the economy achieved a growth rate of around 5%. Pollution intensity was expected to increase during the early 2000s. In 2004, the Indonesian government launched a new PROPER programme and coordinated the implementation of this programme with Bank Indonesia. Many consider that this is an appropriate strategy. However, at present, it is a little too early to predict what the status of the country’s industrial environmental performance had become by around the mid-2000s, although indicative data will be available soon.

5. Summary of industrial environmental performances in 1990s

In general, Indonesia’s industrial performance during the 1990s can be summarised by the indicators available in Table 4. This table shows that the amount of energy used in the manufacturing sector increased from around 15.2 million tonnes of oil
### Table 4. Summary of major environmental indicators, 1990 and 2002.

<table>
<thead>
<tr>
<th>Source code</th>
<th>Environmental Indicator</th>
<th>Year/s</th>
<th>Value</th>
<th>%change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy use in manufacturing sector (10^6 toe per year)</td>
<td>1990</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2002</td>
<td>31.3</td>
<td>106</td>
</tr>
<tr>
<td>1/2</td>
<td>Energy intensity (toe per 10^6 US$ of MVA)</td>
<td>1990</td>
<td>517</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2002</td>
<td>518</td>
<td>0.2</td>
</tr>
<tr>
<td>1</td>
<td>CO₂ emissions by the manufacturing sector (10^6 tonnes per year)</td>
<td>1990</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2002</td>
<td>72</td>
<td>157</td>
</tr>
<tr>
<td>1/2</td>
<td>CO₂ intensity (tonnes per 10^6 US$ of MVA)</td>
<td>1990</td>
<td>933</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2002</td>
<td>1181</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>BOD effluent from the manufacturing sector (10^9 tonnes per year)</td>
<td>1990</td>
<td>163.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2001</td>
<td>248.7</td>
<td>52</td>
</tr>
<tr>
<td>2</td>
<td>BOD intensity (tonnes per US$ of MVA)</td>
<td>1990</td>
<td>5.54</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2001</td>
<td>4.27</td>
<td>−23</td>
</tr>
<tr>
<td>2</td>
<td>Water use by industry (10^9 m³)</td>
<td>1990</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>0.56</td>
<td>51</td>
</tr>
<tr>
<td>2</td>
<td>Water use intensity (m³/10^6 US$ of MVA)</td>
<td>1990</td>
<td>12745.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>10020.1</td>
<td>−21</td>
</tr>
<tr>
<td>3</td>
<td>Percent of MVA produced by most pollutant-intensive sub-sectors</td>
<td>1990</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>15</td>
<td>−25</td>
</tr>
</tbody>
</table>

**Sources:**
1 — EIA (2005).

equivalents (toe) in 1990 to around 31.3 million toe in 2002; i.e. by approximately 102%. Meanwhile, the energy intensity in the manufacturing sector has remained about the same since 1990; i.e. around 517 toe per million US$ MVA in 1990 and around 518 toe per million US$ MVA. The fact that energy intensity in the manufacturing sectors did not decline during the 1990s and actually increased by approximately 0.2% is not that bad considering that the total primary energy intensity of all sectors increased by approximately 32% during the 1990s; i.e. from approximately 22,000 British thermal units (BTU) per 2000 US$ of GDP in 1990 to approximately 29,000 BTU per 2000 US$ of GDP in 2002 (EIA 2005). Hence, the manufacturing sector has been able to maintain its energy intensity compared with other sectors in the country.
Other encouraging aspects of this situation are these. First, on water use, although the total amount used by the manufacturing sector increased by approximately 51% in the 1990s, or from around 370 million m³ in 1990 to 560 million m³ in 2006, water use intensity declined by as much as 21% during this period, meaning the industrial sector was able to increase its efficiency in using water. Second, the percentage of MVA produced by most pollutant-intensive sub-sectors declined from 20% in 1990 to 15% in 2000, meaning that, since industry grew during this period, the growth of the industrial sector was mostly due to the growth of the less polluting sub-sectors.

The fact that industry has been able to be more efficient in using water reflects the level of its water pollution intensity, which, reflected by the BOD intensity, has been reduced by as much as 23% from 1990 to 2001. However, it is important to note that total water pollution from the industrial sector has still increased by as much as 52%; i.e. from 163.7 billion tonnes in 1990 to 248.7 billion tonnes in 2001. The ideal situation is that total water pollution by industry could be reduced; since most firms dump their pollution in surrounding rivers, most rivers in industrial areas have been heavily polluted.

In terms of air pollution, the story is rather discouraging. As mentioned above, industry has more or less maintained its energy intensity. However, its pollution intensity, measured by tonnes of CO₂ per 10⁶ US$ of MVA, increased by 20% in the 1990s; i.e. from 993 tonnes of CO₂ per 10⁶ US$ of MVA in 1990 to 1181 tonnes of CO₂ per 10⁶ US$ of MVA in 2002.

It is also important to compare the amount of CO₂ emitted by industry and the total CO₂ caused by all types of hydrocarbon energy sources. The total amount of CO₂ emitted was 150 million metric tons in 1990 and 310 million metric tonnes in 2002, or in other words it increased by around 106% (EIA 2005). Meanwhile, for the same period, the amount of CO₂ emitted by industry increased by 157%; i.e. emission by industry increased faster than the average of other sectors. However, the CO₂ intensity for all sectors, measured in metric tons per 2000 US$ of GDP, increased by around 31% from 1990 to 2002; i.e. higher than the CO₂ intensity of industry. In this case, one can say that in terms of loss of effectiveness in controlling air pollution emission, the situation in other sectors was worse, on average, than in the industrial sector.

6. Conclusion
This paper reviews the pattern of industrial policy (broadly defined) in Indonesia, offers assessment of how industrial policies have impacted on the environmental performance of industry, and describes how industrial policies, paralleled by industrial environmental policies, have been modified to lessen industries’ environmental impact.

Since systematic monitoring of industrial pollution has been limited so far, in observing the impact of industrial policy on the environment in general, this paper focused on observing (1) the composition of industrial activity; i.e. high or low
polluting industries; (2) the scale of industrial activity; and (3) the demand for and supply of pollution abatement efforts.

During the 1975–81 period, the dominant industrial policy was one of import substitution. The government allowed extensive extraction of natural resources and used the revenue thus obtained to support and protect the development of large state-owned enterprises in heavy basic metals and chemicals. These policies were able to promote the development of the industrial sector, inducing a large share of the industrial sector in the economy. However, since most of these industries were relatively large and high polluting, in the absence of environmental regulation, levels of industrial pollution intensities increased significantly.

During the 1982–96 period, industrial policy was characterised by various efforts to liberalise the economy – although various protections at the micro level in heavy and hi-tech industries did exist – to attract industrial FDI and stimulate development of the labour intensive, export-oriented and non-oil and gas manufacturing sectors. At the same time, many companies in Taiwan, South Korea, Singapore, Hong Kong, Japan and some other developed countries looked for new places to relocate their factories. One of several motivations to find new locations was tighter environmental regulations in their own countries. Hence, although there was a relatively large amount of new FDI, much of it was in the form of relatively high polluting industries. Furthermore, no significant industrial pollution policy was implemented. Hence, levels of industrial pollution intensity during this period continued to increase.

Serious efforts to reduce the increase in the level of industrial pollutants were begun only in the early 1990s, even though the concern for environmental degradation began to develop in the late 1970s. Various industrial environment policies were then enacted. Although many argued that the implementation of these environmental policies was effective, their scale was too small. Efforts to up-scale them were either not conducted or were not conducted successfully.

The economic crisis hit the country in 1997–98, causing the government and private sector to focus on efforts to help industries survive the crisis and ignore the need to control their pollution. Many argued that industrial pollution intensity might have increased significantly during the crisis. However, the crisis also slowed down industrial activity, so that the levels of pollution intensity in the early 2000s were more or less the same as in the early 1990s.

Current industrial policy, at the macro level, is characterised by various reforms to liberalise the economy even further to attract new FDI. At the micro level, industrial policy focuses on various efforts to improve the competitiveness of the country’s industrial activities. To avoid attracting new capital investments mostly in the high polluting industries, as was the experience in the 1980s and 1990s, it is recommended that strict nationwide environmental regulations should be implemented. Efforts were made to re-establish industrial environmental policies in the early 2000s but their scale has so far been relatively limited. The results of
these policies need to be monitored carefully to maximise the chance of successful outcomes for both industrial development and protection of the environment.

Acknowledgements
The authors would like to thank the UNIDO for partly funding this research and Fajar B. Hirawan for contributions as a research assistant. Any mistakes in this paper are the authors’ responsibility.

Notes
1. Environmental policies discussed in this section are those that relate to industrial pollution. Other environmental policies have been implemented, such as promotion of unleaded gasoline and restricted areas for cars in the case of urban air pollution, the integrated pest management programme in the case of pesticide, no smoking policies in public buildings in the case of indoor air pollution, eco-labelling in forestry, etc.
2. The regulation was re-issued by the enactment of Government Regulation No 51/1993, specifically to clarify which agencies should assess and approve the environmental impact assessment report of a particular project.
3. The number is still relatively very small compared with the total number of rivers in Indonesia, or even to the number of rivers in Java.
4. Note that BAPEDAL was abolished that year and all of its staff were moved to the Ministry of Environment.
5. In 2000, the new regional government taxes and charges Law No. 34/2000 was enacted, which actually provides an opportunity for regional government to implement pollution taxes. However, regional governments do not seem to have used this opportunity yet.
6. Dispenda is a regional body responsible for collecting income (from tax, etc) for the region.
7. A surety bond is a contract agreement between at least three parties. The principal is the primary party who will carry out obligations specified by the contract. The obligee is the recipient of the contract obligation. The surety is the party who guarantees the principal's performance of the obligation.
8. For the East Asian NICs, the main push factors were the rising wages in, and the sharp appreciation of, the currencies of these countries (Thee 1991).

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