Working Papers in
Trade and Development

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October 2010
Working Paper No. 2010/09

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Abstract

The fact that most environmental degradation occurs in developing countries shows that they face difficulties in implementing environmental policies. It is hence extremely valuable to take lessons from any instances of the successful implementation of an environmental policy in a developing country. This paper aims to show, from a political economy perspective, why the 1989–1999 Integrated Pest Management program, is an environmentally-friendly policy, worked in Indonesia. It concludes that the requisite conditions included strong national political support, thorough local research linked to international support, appropriate mechanisms to implement the policy, and direct benefit to local people.

Keywords: Agricultural policy, integrated pest management, environmental policy.

1. Introduction

Since the 1980s, various cases of environmental deterioration in developing countries, which ultimately affect the quality of life, have attracted international attention. However, environmental degradation continues remain an endemic issue in developing countries continue, as is demonstrated by various tables available in the *World Development Indicators 2009* showing several environmental quality indicators such as levels of urban air quality, water pollution as well as deforestation and land degradation(World Bank 2009). It is commonly accepted that there are serious difficulties involved in effectively implementing environmental policies in developing countries, with very few successful outcomes.

By the 2000s, climate change due to greenhouse gas—mostly CO_2—emission has emerged as the most serious environmental problem worldwide. Many developing countries, such as China, India and Indonesia, are among the top CO_2 emitters and are expected to take mitigating action. Some developing countries have responded to these expectations. For example, at the 2009 G-20 meeting in Pittsburgh, Indonesia, which is one of the top three CO_2 emitters, if emission from deforestation is included, announced its national target of reducing its CO_2 emission by 26 percent below the Business As Usual (BAU) scenario by 2020 without the financial assistance of other countries, and by 41 percent with international assistance (Resosudarmo and Yusuf 2009). For developing countries, particularly for those like Indonesia which have made a commitment, it is crucially important to be able to predict whether an environmental policy can be

successfully implemented, and in particular, what kind of political economy environment will ensure or at least increase the probability of success.

Most environmentalists agree that one of the few successful implementations of environmental policy in developing countries, was that of the national integrated pest management (IPM) program —an environmentally–friendly agricultural policy— from 1989 until 1999 in Indonesia (Kenmore 1992; Useem et al. 1992; Oka 1991, 1997 and 2003; Winarto 1995 and 2004a). Farmers participating in the program were able to reduce the use of pesticide significantly while maintaining their production levels. The program hence was able to change farmers' belief in the exclusive use of pesticides in pest control in favour of the more environmental friendly technique of IPM. This Indonesian success has encouraged other developing countries, such as the Philippines, Vietnam, Sri Lanka, Cambodia and Nepal, to implement a similar program (Winarto 2004b; Dilts and Hate 1996; Matteson 2000). Unfortunately this program collapsed at the end of 1999 due to lack of government support. Thus the main goal of this paper is to understand the political economy behind the reasons why Indonesia was successful in implementing the IPM program on a national scale from 1989–1999. The lessons learnt from this IPM case will hopefully provide valuable information for Indonesia and other developing countries in formulating their climate change policies.

The outline of this paper is as follows. A review of literature on the political economy of a policy change is presented after the introductory section. This is followed by a short description of Indonesia and its IPM program. Next are five sections discussing the implementation of the Indonesian IPM program and the reasons for its success. These sections cover pest and pesticide problems, local research, national policy

support, bureaucratic breakthroughs, and the second stage of the IPM program. After that is a section summarising the achievements of the IPM program. The last three sections are a section provide some background on the collapse of this program, future challenges in re-implementing it and finally the conclusion drawn.

2. The Political Economy of Policy Changes

Literature explaining the political economy behind successful implementation of environmental policy is rather limited. Most literature focuses on discussing why it is difficult. The conclusions of such literature in general can be grouped into market and agency failure issues. Market failure is a situation where the market mechanism fails to provide information to a profit maximising individual that his/her actions actually negatively affect, or are costly to, others or society. Because these costs to society are external to this individual's cost accounting, they are referred to as externalities and there is no incentive for the individual to reduce these societal costs (Coase 1960; Baumol and Oates 1988).

Agency failure comes about as a result of inappropriate environmental management—where the management tools applied are not appropriate to cope with market failure, monitoring and control procedures are lacking, and information to set appropriate management actions are inadequate. Agency failure can also occur when agency members carry out their functions according to their own interests, rather than according to those of the public. The existence of agency failure is often referred to in the economic literature as being the result of rent-seeking behaviour (Brown 1999; Ross 2001).

Meanwhile, works focusing on explaining the success of market-oriented economic reform have been relatively available (Williamson 1994; Wallis and Dollery 1999). More recently, from 2002–2003, the Global Development Network (GDN) conducted studies in 31 developing countries worldwide to understand the motivation, implementation, success and sustainability of market reforms in these countries. The three central questions in this research are: what are the driving forces of reform, what factors affect the shape of reform (breadth, scope of reform, winner, supporter, loser, and opponent), and how good are the results of reform? (Fanelli and McMahon, 2005 and 2006).

The general conclusions of these 31 GDN studies are as follows (Fanelli and McMahon, 2006). A window of opportunity to conduct reform is typically open when a country is facing a major crisis and the reform precisely addresses the crisis. However, at the same time, the crisis can become an obstacle to this society's ability to build institutions to implement and to sustain the reform. In such a case, the role of international factors can be an effective catalyst for reformers to gather collective support to strengthen reformers' institutions, as long as these international factors do not take over the ownership of the reform policy.

The outcomes of a reform, on the other hand, depend on whether or not the conditions of an effective state, consistent institution-building, a polity with a reasonable ability to undertake political transactions and legitimise the reform, and the ability of society and organisations to act and learn collectively can be met or created. The 31 case studies show that creating these four conditions is not an easy task and there is no rule of thumb in creating them.

This paper will also ask three research questions similar to the ones asked in the 31 GDN studies, namely: what were the driving forces, what factors affected it, and how good were the results, to understand the reasons behind the success of Indonesia's IPM program during the 1989–1999 period.

3. Indonesia and its National IPM Program

Indonesia, spread over more than 17,000 islands and with a population of approximately 230 million in 2009, is the world's largest archipelago and the fourth most populous nation. It stretches along the equator for about six thousand kilometres, extending roughly from 6^o N to 10^o S and from 95^o E to 142^o E between the Indian and Pacific oceans and linking the continents of Asia and Australia. The country covers an area of approximately 7.9 million km^2 (including the Exclusive Economic Zone area), of which islands constitute only approximately 1.9 million kms^2. It is one of the most spatially diverse nations on earth in its resource endowments, population settlements, location of economic activity, ecology, and ethnicity. Indonesia is the largest member state of the Association of Southeast Asian Nations (ASEAN), accounting for nearly 40 percent of its population and 36.5 percent of its GDP (ASEAN, 2010). Considering the size and diversity of Indonesia, which is what makes it so challenging to implement any policy, any success story would a valuable lesson for other developing countries.

In Indonesia, rice is a special commodity, as it is the main staple food. Hence a significant number of Indonesian workers are rice farmers. In 2008, there were approximately 102 million Indonesians in the labour force, approximately 43 million of whom were farmers; and of this number, approximately 28 million were rice farmers (BPS 2009). This is why rice policy has always been important to Indonesia.

In 1989, in order to reduce the use of pesticides in the food crop sector, namely in the paddy fields, the Indonesian government launched the national IPM program. The critical activity of this IPM program was to conduct the participatory training of farmers in IPM practice. To achieve this goal nationwide, three steps were taken: training for trainers, training for farmers by these trainers, and training for farmers by farmers. The last two types of training were undertaken at the IPM farmer field school (IPM-FFS, in Indonesian *sekolah lapangan PHT* or SLPHT) (Oka 1997 and 2003).

The main goal of the IPM-FFS was to produce "Farmers as Experts in IPM". Farmers were expected to change their beliefs and practices from exclusive use of pesticides in favour of management of the ecosystem, growing healthy crops, and preserving beneficial natural enemies; as well as being capable of making their own decisions as to the best way to grow their plants and to control pests in their fields, rather than following instructions to use pesticides regularly. Farmers were also expected to develop the habit of regularly conducting observation in their fields, and skills to identify pests and their natural predators (Kenmore 1992 and 2002; Norton et al. 1999).

The main method of learning IPM skills in the IPM-FFS was a 'learning by doing' process. Participants were asked to look, observe and find or discover, by themselves, pests and their natural enemies. Participants discussed their findings with one another. They were free to express their own opinions. Then they were encouraged to derive practical conclusions, and implement them. In this training there was no clear-cut distinction between trainers and trainees. Trainers only acted as facilitators. Most of these activities were conducted in the field, where half of the field was planted using

techniques that farmers had normally practised and the other half following the IPM practices being analysed (Dilts 1985; Useem et al. 1992; Winarto 2004a).

4. The Crisis: Pest and Pesticide Problems

In the early 1970s, the Indonesian government established a comprehensive food intensification program as a national priority. Its main goals were to achieve and maintain self-sufficiency in food, increase farmers' income, provide job opportunities and alleviate poverty, and strongly support the rapidly expanding industrial and service sectors (Oka 1997).

This program included the large-scale adoption of high-yielding modern seed varieties, development of irrigation systems, expansion of food crop producing areas, increased use of chemical fertilisers and pesticides, expansion of agricultural extension services, establishment of farmer cooperatives and input subsidies, and stabilisation of national food crop prices (Oka 1991; Pearson et al. 1991; Fox 1993). It was possible for the government to fund these activities due to huge revenues from the oil bonanza in the 1970s.

This food intensification program caused food crop production in the 1970s and 1980s to grow at an annual rate of approximately 3.74 percent — well above the annual population growth of approximately 2.3 percent during this period (BPS 1973–1991). In the rice sector, production reached an average annual growth of 4.7 percent during this period (Oka 1991 and 1997; Pearson et al. 1991; Piggott et al. 1993).

One important feature of the intensification program implemented during the 1970s and 1980s was the intensive use of pesticides. There was a belief that pesticides

were a powerful weapon to protect rice plantations from all pests. Farmers were required to spray pesticides on their rice fields regularly, even if there were no pests. In addition, the government heavily subsidised the price of pesticides by as much as 80 percent of their market price (Tabor 1992).

Despite the remarkable success of the food intensification program, the excessive use of pesticides caused serious environmental problems. In the case of pesticide resistance, brown planthoppers became resistant to pesticides and damaged more than 450,000 hectares of rice fields in 1976/1977. The estimated yield loss was 364,500 tons of milled rice, which could have fed three million people for an entire year. In 1980 green leafhoppers became resistant to pesticides, causing damage to at least 12,000 hectares of rice fields in Bali alone (Oka 1997). Then in 1986, there was another brown planthopper outbreak, destroying approximately 200,000 hectares of rice (Useem et al. 1992).

In the case of human pesticide poisoning, Achmadi (1991) found 1,267 cases of acute pesticide poisoning in 182 general hospitals throughout the islands of Java and Bali in 1988. He also observed that approximately 20 to 50 percent of the farmers who utilised pesticides contracted chronic pesticide-related illnesses. These illnesses included headaches, weakness, insomnia, and difficulties in concentrating. Another scientist, Mustamin (1988), recorded 450 cases of human pesticide poisoning in 1976, of which 26 cases resulted in death. In 1986, he also found a report of 404 cases of pesticide poisoning, with 32 fatalities.[1]

[1] See also a studies by Kishi et al. (1995) and Kishi (2002).

The catastrophes created by pest outbreaks, and human health problems caused by the use of pesticides in agriculture certainly provoked a reaction. Below are the reactions in chronological order that led to a policy change.

5. Local Research[2] and the Struggle for Policy Change

The brown planthopper outbreak in 1976 encouraged Indonesian scientists in various research institutes to investigate the reasons for pest resistance to pesticides and to find more successful methods to control the pest population in rice fields. Examples of this research are recorded in works by Oka (1978, 1979a and 1979b), by Soekarna (1979), and by Soehardjan and Imam (1980). Most of these studies found that planting just a few modern varieties over wide areas made the plants more vulnerable to pest attacks; continual planting of rice in a staggered manner throughout the year increased pest populations; and overuse of pesticides created pest resistance leading to pest outbreaks and severe human health problems (Oka 1997). By the end of the 1970s, Indonesian scientists had also learned from various international agricultural institutions that there were worldwide reports of many more problems relating to the use of pesticides in agriculture (Pimentel et al. 1992; Antle and Pingali 1994).

Based on these findings and information from international agricultural communities, Indonesian scientists[3] concluded that Indonesia had to stop relying solely on pesticides and needed to employ several control tactics, including synchronised

[2] Local research in this instance means research on Indonesian topics conducted by Indonesian scientists.
[3] Among the most important scientists from these institutions are Ida Njoman Oka of the Research and Development Institute-Ministry of Agriculture, Kasumbogo Untung of Gadjah Mada University, and Soemartono Sosromarsono of the Bogor Institute of Agriculture.

planting, crop rotation, natural predators, as well as pesticides; i.e. to adopt the strategy internationally known as integrated pest management (IPM).

At the end of the 1970s, in various governmental policy meetings, Indonesian scientists started to promote the need to implement the IPM program and to reduce the use of pesticides, as well as to abolish pesticide subsidies. These meetings were characterised by heated discussions of the pros and cons of the IPM program. Many officials in the Ministry of Agriculture still believed in the effectiveness of using chemical pesticides alone. They also thought that asking farmers to spray pesticides was easier to implement than teaching them to implement the IPM techniques. Hence, these officials tended to be against the IPM program.

Some newspapers that had covered the national disaster of the brown planthopper outbreak in 1976 were interested in covering subsequent issues related to this outbreak, particularly the pros and cons of the IPM program. Most were sympathetic to the IPM program. With this strong media support, in 1978, Indonesian scientists achieved mention of the IPM program in the Third Five-Year National Plan (1979–1984). Its implementation, however, was limited (Oka 1991 and 1997). The Directorate of Plant Protection in the Ministry of Agriculture (MoA), in cooperation with several directorates in the ministries of Trade, Industry, Manpower, and Health, developed the Safe Use of Pesticides Program to minimise the number of pesticide-related illnesses. The program controlled the types of pesticides that could be distributed in the country, informed workers (including farmers) about standard safety procedures and equipment when working with pesticides, and monitored the impact of pesticides on human health (Resosudarmo and Thorbecke 1998).

Extension workers, however, were not yet trained in the IPM approach so their pest control recommendations to farmers did not change, and pesticides were still highly subsidised. The main reasons for this situation are as follows. First, many officials in the MoA still believed chemical pesticides to be the easiest, most reliable and effective method of pest control. Second, several high officials in the MoA were closely associated with pesticide companies that still wanted to promote the intensive use of their products (Useem et al. 1992; Oka 1997). Third, the supporters of intensive use of pesticides were politically strong; particularly chemical companies that received the most benefit from their intensive use and subsidisation. Several retired generals with strong political influence had vested interests in these companies.

6. Presidential Decree: National Political Support

The second national brown planthopper outbreak in 1986 aroused the concern of the Indonesian National Planning Agency (BAPPENAS) — at that time the most powerful government agency — and, in particular, the head of this agency, J.B. Sumarlin, since the outbreak threatened the self-sufficiency in rice production that had just been achieved a few years earlier; i.e. in 1983. This agency quickly sought advice from scientists in the MoA and leading universities who suggested the implementation of the IPM program at a grassroots level. This led to the establishment of the national IPM program, which trained farmers to implement IPM in their fields (Oka 1997).

In the same year, the world price of crude oil dropped from approximately 27 USD per barrel to approximately 14 USD, causing government revenue to drop significantly. This meant the government, in this case BAPPENAS and the Ministry of Finance, had to reduce expenditure. Eliminating subsidies was the obvious option.

BAPPENAS became very interested in the IPM program, as it offered the possibility of abolishing pesticide subsidies, which at that time amounted to well over USD 100 million, while at the same time affording better pest management and maintenance of national rice production (Useem et al. 1992).

BAPPENAS consulted intensively with the president, the late President Soeharto, concerning the need to implement the IPM program, and this resulted in the launching of the Presidential Decree (*Keppres*) No. 3/1986, supporting the implementation of the IPM. The decree had the following objectives: (1) to develop manpower, both farmers and field personnel, at a grassroots level to implement the IPM program; (2) to increase efficiency of input use of particular pesticides; and (3) to improve the quality of the environment and, by extension, human health (Oka 1997).

This presidential decree provided national political support to establish the IPM program as a national policy that required the support of all government agencies, including the military. It was also a signal from the president to all retired generals to retract their political support of pesticide companies.

Along with this decree, the government decreased subsidies of pesticides from 75–80 percent of the total price in 1986 to 40–45 percent in 1987. Finally, in January 1989 these subsidies were completely eliminated.[4] The government also banned 57 broad-spectrum insecticides, and only allowed the use of a few relatively narrow-spectrum insecticides (Oka 1991; Useem et al. 1992).

[4] Dissatisfaction among farmers regarding the subsidy elimination did occur. However, it did not result in socio-political unrest most likely due to the following reasons: the existing strong agricultural extension networks quickly responded to farmers' various needs during the transition; pest-resistant rice varieties became soon available; and the government started the implementation of the IPM program. Politically, Soeharto's military regime was very strong and typically effective in suppressing any political moves against government policies.

Nevertheless, the IPM training program could still not be implemented, mainly since there were still many high ranking officials in the MoA with doubts that the IPM program would be able to provide better pest management, and many of them also had close relations with pesticide companies (Useem et al. 1992; Oka 1997).

7. The Role of Bappenas: The Bureaucratic Breakthrough

Realising that it was still very hard to expect the MoA actively to implement IPM training to extension workers and farmers, BAPPENAS undertook this role. This was unusual, since BAPPENAS is supposed to be concerned only with planning, not with implementation. It is also important to note that BAPPENAS by that time was very powerful, since it controlled the budgets of all other sectoral ministries and regional governments. Some even called BAPPENAS a super ministerial agency. With this power, BAPPENAS was able to effectively 'force' sectoral ministries, including the MoA, to participate in the implementation of the national IPM program.

In 1989, BAPPENAS established the IPM Advisory Board, which consisted of high-ranking officers from BAPPENAS, the MoA, and the Ministry of Home Affairs. The Board was the supreme policy-making body, responsible for the success of the IPM program. Under the Board, a Steering Committee was formed to direct program activities, and to ascertain the need for policy improvement. The Committee consisted of IPM experts from various government agencies, universities, and international institutions, such as the regional office of the Food and Agriculture Organization (FAO). Certain members of the Committee formed a Working Group, which conducted the day-to-day tasks of the Committee.

The central activity of this national IPM program was to educate farmers in IPM using the "learning by doing" method. The collaboration between Indonesian scientists and international scientists, in particular those at the FAO, was important in developing this method (Pincus 2002). The Working Group first trained extension workers and field pest observers to teach farmers. By the end of 1991, 2,000 extension workers and 1,000 field pest observers had trained approximately 100,000 farmers. By 1992, approximately 200,000 farmers, most of them rice farmers, were trained in IPM practice. Approximately ten percent of these 200,000 farmers were chosen to receive further training to become trainers (Oka 1991 and 1997). The IPM training activities from 1989 until 1993 can be referred to as the first stage of the IPM program in Indonesia.

Funding for the first two years of this activity, 1989–1991, was mainly from USAID and they extended their funding until 1992. In 1992/1993, the program also received some support through a World Bank loan for other existing agricultural training projects; i.e. not particularly designated for IPM training (SEARCA 1999).

8. The Second Stage of the National IPM Program

The second stage of the IPM program ran from mid 1994 until mid 1999. The main way in which it differed from the first stage was that the principal organiser was the MoA, no longer BAPPENAS. As mentioned before, BAPPENAS is a planning agency, and not a program implementation agency. This agency would only implement a program nationally on an ad-hoc basis and only when strongly supported by its head and with presidential permission . Ginandjar Kartasasmita who became the head of BAPPENAS 1993 did not have much interest in the IPM program so it was left without BAPPENAS support.

Meanwhile, although MoA support for the IPM was still limited, by 1994 new officials more in favour of the IPM program had replaced many — but not all — of those in the MoA who had close relationships with the pesticide industry. The transfer of the program from BAPPENAS to the MoA was slow, reflecting the struggle of those supportive of the IPM within the MoA to run the program.

The second stage of the IPM program was mostly — by approximately 75 percent — funded through a loan from the World Bank that was specifically targeted to support the IPM program. The Indonesian government provided the other 25 percent, as the matching fund for the World Bank loan. The total cost of the second stage of the program was approximately Rp. 112 billion (MoA 1999), reflecting the intention to up-scale the previous program.

The foundation of the second stage of the IPM program was the Agricultural Ministerial Decree No. 390/1994, containing provisions for the administrative structure of the IPM program in the MoA. The decree provided strong political support within the MoA for the implementation of the IPM program, so that all officials in this Ministry were expected to support the program. The MoA then formed an IPM Advisory Team, whose members and tasks were similar to those of the previous IPM Advisory Board. Under the Advisory Team, there was the IPM Technical Team whose members and tasks were also almost the same as those of the previous IPM Steering Committee. Instead of a working group, the team that conducted the daily activities of the IPM program under the MoA was called the Working Team, which consisted mostly of staff from the MoA. A project team called the IPM project team, headed by a project leader from the MoA, undertook the administrative and financial management of this program.

Table 1 shows the number of farmers attending the FFS (Farmer Field School) during the second stage of the IPM program (MoA 1999). Geographically the FSS conducted its program in 13 out of 27 provinces in Indonesia; i.e. the major food crop — particularly rice — producing provinces. Table 2 shows the provinces in which FSS for rice were conducted and the number of farmers involved. Despite a growing number of farmers attending the program and a larger coverage of the program, a negative view of the second stage of the IPM existed. It never received the strong political support accorded to the first stage of the program. The program had to face problems such as funding delays and other bureaucratic obstacles that would have been overcome had top leadership been strongly supportive of the policy. It was suspected that the training quality declined during the second stage of the program. Hence, there were some doubts that up-scaling and sustaining the efforts of the IPM program would ever be successful (Pincus 2002).

<< insert Figures 1 and 2>>

9. Achievements of the IPM Program

The following summarises the achievements of the IPM program recorded in many studies. It is important to note that most of these studies not only recorded what the researchers observed, but also farmers' testimonies of the impact of the program on them, such as those documented in the work of Deybe et al. (1998) and Winarto (1995 and 2004a).

- **Improvement in farmers' knowledge and attitude towards insects**: Before enrolling in the IPM-FSS, almost all farmers thought of most insects as pests that therefore should be killed. After the IPM-FSS, farmers realised that there are harmless insects and, most importantly, there are natural predators for most pests (Hate and Triyanto 1991; Kartaatmadja et al. 1991; Deybe et al. 1998; and Winarto 1995 and 2004a). Furthermore, after joining the FFS, farmers understood that there is an economic threshold of pest population, below which the pests won't have any significant impact on the amount to be harvested.
- **Change in farmers' attitude toward pesticides and pest control**: One of the first important lessons gained by farmers joining the IPM-FSS was the understanding that the inappropriate and excessive use of pesticides is dangerous and harmful; i.e. pesticides not only kill the pests but also their natural enemies and all other animals in the fields; overuse of pesticides leads to pest resistance to pesticides; and pesticides are poisons that are also very harmful to humans. Hence to control pests below their economic threshold, farmers preferred to implement synchronised planting and crop protection, field sanitation, and the use of resistant plants as the first action. Further action involved conducting a physical control activity and preserving natural enemies, before, if circumstances necessitated, as a last resort, using the least dangerous pesticides (Oka 1991; Pincus 1991; Useem et al. 1992; Winarto 1995 and 2004a).
- **Enrichment of farmers' general cropping skills**: In addition, studies indicated that the IPM-FSS also improved farmers' general knowledge as to how to grow healthy crops; i.e. maintaining land quality, choosing the best crop variety, appropriate seeding techniques, proper synchronisation and rotation, as well as applying proper

types and amounts of fertiliser. Farmers also improved their ability to conduct proper field observation and understood the need to perform this regularly (Deybe et al. 1998; Winarto 2004a).

- **Enhancement of farmers' confidence in decision-making**: One of the most important impacts of the IPM-FSS on farmers was their increased confidence in making their own decisions as to how to control pests in their fields without instructions from agricultural extension workers or field pest observers. Furthermore, farmers understood the need to activate farmer groups, since collective actions in controlling pests are much more effective than individual efforts. As a result, there was an increase in the quantity and quality of discussions in farmer groups concerning pest control (Oka and Dilts 1993).
- **Increase in women's participation in crop management**: Several studies show that after attending the FFS, the women's role in managing the crop tended to increase, generally in financial areas. They generally increased the efficiency of crop production. The IPM women were usually more selective in managing expenses, especially expenses for pesticides because they had learned of the potential dangers of using them (Susianto et al. 1998). However, relatively few women participated in the FFS (see Table 2).
- **Health impact**: The decreased use of pesticides by farmers had a positive impact on their own health as well as that of consumers. The farmer avoided contamination from spraying (Achmadi 1991; Kishi et al. 1995 and 2002). The consumer ate less pesticide contaminated food (Ardiwinata et al. 1997).

There were, however, several targets that the IPM program should have achieved, but there has been so far no clear evidence that it actually did. Among others are the following:

- **Increase in farmers' income?** Farmers' income was expected to increase because implementing the IPM enabled them to reduce the use of pesticides and increase their yields. However, there was some debate on this issue. Various case studies in Sumatra, Java, Bali and Lombok reported that IPM farmers had been able to increase yields by approximately 10 percent and to reduce the use of pesticides by approximately 50 percent, resulting in a reduction of cost by approximately 11 percent (Oka 1997; Kuswara 1998a and 1998b; Paiman 1998a and 1998b, Susianto et al. 1998; and Van der Berg 2004). However, a study by Feder et al. (2004), using a panel data system, argued that there is no evidence that the IPM-FFS induced increases in yield and a reduction in the use of pesticides. It is important to note that all case studies observed farmers who had recently graduated from the FFS during the early period of the IPM program. They observed a small group of FFS graduates and compared their performance with a small adjacent group of non-FFS farmers. Meanwhile, Feder et al. (2004) observed a larger sample of farmers (around 320 observations) and their performance throughout a medium period of time, namely comparing their performances in 1991 and in 1999. The potential advantage of the Feder et al. (2004) work over various other case studies is that it utilises data from a large household panel survey. However, it is also well known that data from any household survey in Indonesia is relatively unreliable. Another possibility is that yield did increase quite considerably in the period immediately following the farmer's

graduation; particularly during the early solid implementation of the IPM-FSS program, while the IPM technique was still being applied appropriately. However, over time, farmers tended to neglect the IPM procedures and go back to their pre-FFS practice, causing their yield to decline. Furthermore, it was also reported that the quality of the FFS program declined over time (Pincus, 2002). Hence, in the medium term, whether or not a solid IPM program increases farmers' income remains inconclusive.

- **High rate of diffusion?** The program was designed for rapid diffusion of IPM techniques. However, it does not seem that this was the case. In 10 years of implementation of the IPM-FFS, only 0.5 per cent of rice farmers had the opportunity to join the FFS and learn the IPM method. The expansion of the IPM-FFS program was slow. Availability of funding seems not to have been the main reason. It was reported that the MoA was not able to spend all available funding for the IPM-FFS program during the period of mid 1994–mid 1999 (MoA 1999). Natural diffusion—i.e. farmers graduated from the FFS sharing their knowledge of the IPM with their neighbours—seemed insignificant. Given the complexity of the information and the farmers' limited ability to convey complex decision-making skills effectively to other farmers through informal communication, the diffusion process was possibly limited and curtailed (Quizon et al., 2000).
- **Sustainability of the IPM practices?** There is evidence that farmers who graduated from the IPM-FSS returned after a while to the old method of routinely spraying pesticides and conducted field observations less often. There are reasons for this. First, routine pesticide spraying seemed much easier than conducting observations

and making a decision to develop a strategy to control pests without using pesticides. Second, pesticide companies kept finding ways to influence farmers to use more pesticides. One of their strategies was to develop a program named IPM Plus which involved routinely spraying pesticides. Third, many field extension workers did not master the IPM method. When a 'crisis' eventuated, they quickly resorted to spraying pesticides. Fourth, as mentioned before, the quality of the FFS program declined over time (Pincus, 2002).

10. The Collapse of the IPM Program

Tragically, despite the claim of success of the implementation of the national IPM program between 1989 and 1999, the Indonesian government terminated its national IPM program at the end of 1999, for the following reasons. The transfer of the IPM program from BAPPENAS to the MOA in mid 1994 was arguably because it lost support within Indonesian cabinet and so was no longer a top national priority. One of the main reasons for this loss of support was the departure of Sumarlin from the cabinet in 1993; i.e. leaving no influential high ranking officers supporting the program (Pincus 2002).

In 1997, the economic crisis hit Indonesia, resulting in a huge drop in the country's GDP in 1998. Of all sectors in the economy, the financial sector was hit the hardest. During this period, the number one priority of the government, including foreign donors, was to restructure the financial sector to prevent it bringing down the national economy even further and to soften the impact of this crisis on poor people. Suddenly, the IPM program was no longer a national priority and it lost all of its now only moderate political support.

Indonesian agricultural scientists whose research outcomes in the early 1980s initiated the establishment of the IPM program were either retired or close to retirement age by the end of the 1990s. The new generations of scientists have not been able to produce significant enough works in this area to attract the attention of policy makers away from the issue of the financial crisis to that of proper pest management. Various implementation problems in the field such as funding delays, various bureaucratic obstacles and the declining quality of the IPM training during the 1994–1999 period made it even more difficult for the IPM program supporters to defend the achievements of their program. In this very difficult situation, the supporters of the IPM program could not come up with any new institutional breakthroughs. Hence, when the programs to restructure the financial sector and provide a safety net for the poor, as well as local development programs, absorbed most of the funding from both domestic and foreign sources, including loans from the World Bank, nothing was left for the IPM.

11. Future Challenges

The question remains as to whether or not Indonesia will be able to reestablish its IPM program, and specifically what challenges the reestablishment of this program in the near future would entail. In general, challenges will come from the two important recent developments in the country's political and administrative systems. First, since the fall of Soeharto[5] in 1998, the Indonesian political environment has rapidly transformed from an authoritarian to a much more democratic one. Second, since 2001, Indonesia has implemented a "big bang" administrative decentralisation process. Most functions of the government have been transferred from central to regional (district/city) governments,

[5] Soeharto was the president of Indonesia from 1967 until 1998.

including the transfer of a huge number of government employees. Now all agricultural extension workers and field pest observers have become employees of district governments, which no longer have a structural relationship with the MoA (World Bank 2003). In this new democratic and decentralised era, the Presidential Decree does not have its former strong political power, and the fact that the central government, including the MoA, has less authority/control over activities in the regions makes it much more difficult for the MoA to coordinate a program such as the IPM program of 1989–1999 at a national level.

The reestablishment of the IPM program will certainly require some new form of strong national political support and solid initiative from local governments. The development of the program will most likely have to take a bottom-up approach to fit the decentralisation policy currently adopted, instead of the top-bottom approach of the 1989–1999 IPM program. Hence, even if some funding as well as new scientific evidence for the need of such a program were to be available in the future to conduct another IPM program nationally, a new model of coordinating the program among local governments and the MoA would be needed. However, no serious research has yet been conducted to design a new model.

12. Conclusion

The Indonesian experience in implementing the IPM program during the 1989–1999 period provides us with some insights as to why the country could well succeed in conducting this environmentally–friendly policy. First of all, for such a scheme to succeed, there should be solid local research — possibly in collaboration with international scientists —providing a strong basis for a policy change. In Indonesia,

agricultural research institutions and facilities have been available since the colonial era and have a relatively strong relationship with various international agricultural research organisations. For example, local capacities in agricultural research were relatively available when the planthopper outbreak crisis occurred in 1976. Hence, in the case of the 1989–1999 IPM program, local scientists had the answer as to why such a huge pest outbreak could have occurred.

Second, national political support of the policy is crucial, requiring the support of all agencies in the country. In the Indonesian 1989–1999 IPM case, Presidential Decree No. 3/1986 explicitly showed the president's support for the IPM program. At the time, Suharto was politically very strong. No individual, group or agency would have dared to challenge his policy openly.

In the new decentralisation era, national political support should take a different form. One option is for national political support to come from local people in the majority of regions in Indonesia, by urging their local environmental authorities to develop the IPM program in their regions as well as to coordinate with other regions and the Ministry of Agriculture in implementing this program.

Third, an institutional breakthrough might be needed to overcome problems created by excessively bureaucratic procedures. Although the Ministry of Agriculture should have been conducting the program from the outset, it was difficult to organise the first stage of the IPM program within this agency because most of its senior officials were closely associated with pesticide companies and hence opposed to it. Instead, BAPPENAS became the leading agency in organising the national IPM program. A

powerful agency such as BAPPENAS[6] at that time was able to 'force' sectoral ministries to support the implementation of the program as well.

Fourth, strong international support is important. Staff at the FAO regional office worked closely with Indonesian scientists in developing the learning-by-doing IPM by Farmer training. Foreign donor agencies, in this case USAID and the World Bank, made a strong commitment to finance the IPM program.

Finally, an appropriate mechanism is needed so that the people affected by the policy can benefit directly. The choice of farmer field schools and the implementation of the learning-by-doing method in introducing the IPM techniques to farmers were very effective. Farmers quickly absorbed the knowledge as well as being able to feel and see the impact of the new knowledge in their fields and daily activities.

Sadly, the Indonesian IPM program also demonstrates that when almost no new quality local research is produced, strong networks with international agencies cannot be maintained, no new institutional breakthroughs are initiated, declining quality of the program causes weaker program impacts and, finally, political support and strong funding commitment disappears, so that environmental programs break down.

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[6] Since the implementation of the decentralisation policy in 2001, BAPPENAS has become weaker. Many of its mandates have been transferred to the Ministry of Finance (MoF); making the MoF the most powerful ministry in the country.

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Table 1. Attendance numbers at Farmers Field Schools

	93-94	94-95	95-96	96-97	97-98	98-99
a. Rice	50,050	115,050	166,950	232,175	130,575	119,975
b. Palawija	3,172	4,875	8,575	23,000	6,575	5,325
c. Vegetables	3,885	1,000	1,800	10,550	4,375	2,275

Source: Ministry of Agriculture, 1999.

Table 2. Geographic scope of the IPM FSS in 1996/1997

Province	Number of Farmers	Participation of Women
Aceh	11,489	28.9%
North Sumatra	14,177	31.9%
West Sumatra	13,034	36.1%
South Sumatra	10,193	16.9%
Lampung	18,647	16.3%
West Java	40,717	16.3%
Central Java	35,508	23.3%
Yogyakarta	3,150	29.9%
East Java	53,005	12.1%
South Sulawesi	15,603	15.7%
Bali	8,113	64.0%
West Nusa Tenggara	8,538	23.4%
TOTAL	232,175	19.2%

Source: Kingsley and Siwi, 1998.

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