USF
UNIVERSITY of SAN FRANCISCO

A publication of the
University of San Francisco Center for the Pacific Rim

Asia Pacific: Perspectives
Center for the Pacific Rim
2130 Fulton St, LM202
San Francisco, CA
94117-1080

Tel: (415) 422-6357
Fax: (415) 422-5933
perspectives@usfca.edu

Asia Pacific: PERSPECTIVES
an electronic journal

Volume VII · Number 1 15 July · 2007

Asia Pacific: Perspectives is a peer-reviewed journal published at least once a year, usually in April/May. It welcomes submissions from all fields of the social sciences and the humanities with relevance to the Asia Pacific region.* In keeping with the Jesuit traditions of the University of San Francisco, *Asia Pacific: Perspectives* commits itself to the highest standards of learning and scholarship.

Our task is to inform public opinion by a broad hospitality to divergent views and ideas that promote cross-cultural understanding, tolerance, and the dissemination of knowledge unreservedly. Papers adopting a comparative, interdisciplinary approach will be especially welcome. **Graduate students are strongly encouraged to submit their work for consideration.**

* 'Asia Pacific region' as used here includes East Asia, Southeast Asia, South Asia, Oceania, and the Russian Far East.

The Role of Government in Technology Transfer to SME Clusters in Indonesia: Micro-level Evidence from the Metal Working Industry Cluster in Tegal (Central Java)[1]

by Tulus Tambunan, Ph.D.

Abstract

It is evident everywhere that levels of productivity are higher in large enterprises (LEs) and foreign-owned enterprises than in small and medium enterprises (SMEs), partly because they have higher levels of technology capacity. Thus increasing the productivity of SMEs might be facilitated through improved knowledge or technology. The literature on development of SME clusters in developing countries argues that clusters are an effective means for technology transfer to SMEs and government can play as the main source of technology transfer to the clusters, especially in regions where production linkages between LEs and SMEs are not yet well developed. This study indeed shows that in Indonesia government agencies are currently the largest providers of training and similar assistance. However, these programs are marred by a low level of coverage, a lack of effective evaluation and assessment, and a supply rather than a demand orientation. The case study of Tegal metalworking industry also shows that the most important channels for the transfer of technology to SME clusters not only government agencies but also subcontracting arrangements with LEs.

The Technological Capacity and Productivity of SMEs in Indonesia

Official data from the National Agency for Statistics (BPS) in the manufacturing industry gives some evidence to suggest that the value added-labor ratio increases by the size of an enterprise: suggesting that in larger enterprises the level of technology is higher than that in small ones (Table 1). This is true regardless of whether the enterprises are local or foreign owned. Most small enterprises (SEs) and especially most micro enterprises (MIEs) in Indonesia (as in many other developing countries) are traditional enterprises using manual production techniques with a low degree of mechanization. In contrast, medium and large enterprises (MLEs) are mechanized and computerized, production processes are much better managed and organized and they employ more highly skilled workers. In the food and beverages industry, for instance, MIEs and SEs are very simple processing units producing mostly for local markets, in contrast to LEs such as Unilever and Indofood.

Table 1: **Value added-labor ratio (Q1; 000 Rp) and Manufacturing Total Output Contribution (Q2; %) by Size of Enterprises, 1999-2003**

Size group	1999		2000		2001		2002		2003	
	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2	Q1	Q2
MLEs	115	91	144	92	168	92	166	90	196	91
MIEs & SEs combined	8.4	9.5	9.1	8.4	11	8.5	12	10	14	9.3

Notes: BPS categorizes enterprises in the sector into three groups: MIEs with 1 to 4 workers; SEs with 5 to 19 workers and units with more than 19 workers are defined as medium and large enterprises (MLEs).
Source: BPS

However, many firms do not regard technological capacity as a constraint. Both the 2006 Rural Investment Climate Survey conducted by the World Bank (2006) and BPS Survey on MIEs and SEs in the manufacturing industry in Indonesia show that owners of these enterprises do not regard lack of technological capacity as one of their key constraints. Nonetheless, the evidence suggests that in some industries, MIEs are able to improve their technological capabilities and this benefits their performance. Sandee (1994, 1995, 1996) and Sandee *et al*. (1994, 2000, 2002), amongst others, show that these, the smallest and most traditional enterprises, are in a position to adopt highly technological innovations in products and production process even without the support of government. Moreover, Sandee (1995) shows that technological capability is a major determinant of MIEs and SEs performance. This suggests that there are substantial benefits from improving technological capabilities.

The Importance of Clusters

A common industrial characteristic among SMEs is clustering, where SMEs producing similar products concentrate in a certain area. Since the emergence of the "flexible specialization" thesis in the 1980s, initiated by Piore and Sabel's (1984) book on the "second industrial divide" and the adoption of the clustering approach by the United Nations Industry and Development Organization (UNIDO) as its new SME development strategy in developing countries in early 1990s, many articles, seminar papers and books have been written on SME cluster development in developing countries. UNIDO defines a cluster as a local agglomeration of enterprises, producing and selling a range of related or complementary products within a particular industrial sector or subsector (Richard, 1996).

In recent literature on SME clusters in developing countries, increased attention has been focused on the technological capability of enterprises in these clusters. It is suggested that the competitiveness and technical competence of SMEs could be boosted by being a part of an agglomeration of firms engaging in similar or complementary activities. Clustering could stimulate and facilitate improvements in product, process and organizational arrangements, which are crucial for SMEs to achieve the efficiency and flexibility necessary to compete in the globalized market. Being close to each other allows firms to capitalize on economies of scale and scope and transactions arising from closer inter-firm cooperation. Proximity also allows firms to exploit technology or knowledge spillover arising through direct and indirect exchange of information through personal interactions

Experiences in many developed countries show that clusters can be a powerful means for SMEs to overcome constraints in order to succeed in an ever more competitive mar-

ket environment. Based on empirical findings in many European countries, Richard (1996) argues that, "The European experience seems to suggest that SMEs might not be at a disadvantage at all compared to larger firms, as long as they were able to benefit from the advantages of clustering." Through clustering and networking, individual SMEs can address their current problems related to size, production process, technology, marketing and distribution, procurement of raw materials and other inputs in addition to the risks associated with demand fluctuations. Through a co-operation of enterprises in a cluster, SMEs may take advantage of external economies; for example, the presence of suppliers of raw materials, components, machinery and parts, the presence of workers with sector-specific skills, the presence of workshops that make or service machinery and production tools and the presence of providers of technology. A cluster will attract many traders to buy and sell products from distant markets. Buying large amount from many producers in a cluster during a single visit significantly reduces transaction costs (Berry, et al., 2001). Also, with enterprises clustering it becomes easier for the government, LEs, universities and research institutes, and other development supporting agencies to provide services, such as technical development and management training and general facilities like large machinery for raw material drying and processing into half-finished goods. The services and facilities would be very costly for the providers if given to individual enterprises in dispersed locations (Tambunan, 2000)

The importance of clustering is also supported in various case studies throughout Indonesia. According to Weijland (1994, 1999), rural clusters in Indonesia have a seedbed function for the development of rural SMEs. This demonstrates that clustering improves rural producers access to outside markets. Klapwijk (1997) argues that SME clusters are important for the development of rural industries because productivity in clusters appears to be higher than in dispersed enterprises. One of the main reasons is that clustering stimulates active involvement of traders and LEs in the agglomeration of SMEs. A more interesting finding is from Sandee (1994, 1995, 1996), which shows that enterprises in clusters are in a better position to adopt innovations in products as well as production processes than dispersed enterprises.[2]

Types and Development of SME Clusters

In Indonesia, SME clusters are observed in both rural and urban areas, although mostly on the outskirts of big cities. Most clusters in Indonesia were established naturally by local communities with a long history of producing a specific product. Based on the comparative advantages of the products they make, at least with respect to the abundance of local raw materials and workers who have special skills in making such products, many of these traditional clusters have a large potential to grow. Take for example the clusters of batik producers that have long existed in various districts throughout Java: Yogyakarta, Pekalongan, Cirebon, Surakarta and Tasikmalaya.

As shown in Table 2, according to their level of development, clusters in Indonesia can be classified into four types, each with its own characteristics (Sandee and terWingel, 2002). The first type dominates clusters in Indonesia at more than 90%, and indicates that the process of clustering in the country remains in an infant stage. Altenburg and Mayer-Stamer (1999) refer to such clusters as "survival" clusters of MIEs. This type of cluster displays many characteristics of MIEs with a level of productivity and wages much lower than that of SMEs. In these clusters the degree of inter-firm cooperation and specialization is low, reflecting the lack of specialists in the local labor force as well as a fragile social fabric. Cluster development has stagnated in the sense that for many years there has hardly been any development in terms of market expansion, increased investment and size of production, improved production methods, management and organization and product development (ADB, 2001). Sandee and ter Wingel (2002) argue that artisanal clusters are characterized by a lack of change through time; the producers produce the same products with the same technology that are sold to the same local markets. These enterprises remain because there is still a market for their products, mainly local and from low-income households.

The second type develops rapidly in terms of skill improvement, technological upgrading and successful penetration of domestic and exports markets. The active clusters may still be artisanal in character, and thus face quality-related problems in addition to a limited local or domestic market. Typical examples of these include roof tiles clusters, metal-casting clusters, shuttle-cock clusters, shoe clusters and brass-handicraft clusters. At this stage some enterprises start

Table 1: **Different Types of Cluster in Indonesia**

NO	TYPE	CHARACTERISTICS
1	"Artisanal"	Mainly MIEs; low productivity and wages; stagnated (no market expansion, increased investment and production, improved production methods, and management, organization and production development; local market (low-income consumers) oriented; uses primitive or obsolete tools and equipment; many producers are illiterate and passive in marketing (producers have no idea about their market); the role of middlemen/traders is dominant (producers are fully dependent on middlemen or trader for marketing); low degree of inter-firm cooperation and specialization (no vertical co-operations among enterprises); no external networks with supporting organizations.
2	"Active"	Used higher skilled workers and better technology; supplied national and export markets; active in marketing; the degree of internal as well as external networks is high.
3	"Dynamic"	Trade networks overseas are extensive; internal heterogeneity within clusters in terms of size, technology, and served market is more pronounced; leading/pioneering firms play a decisive role.
4	"Advanced"	The degree of inter-firm specialization and cooperation is high; business networks between enterprises with suppliers of raw materials, components, equipment and other inputs, providers of business services, traders, distributors, and banks are well developed; cooperation with local, regional or even national government, as well as with specialized training and research institutions such as universities is good; many firms are export-oriented (mainly through trading houses or exporting companies).

to influence the development trajectory of the cluster as a whole, and some enterprises produce for export through middlemen or traders or trading houses from outside the cluster.

Examples of the third type are textile-weaving clusters in Majalaya and Pekalongan, furniture clusters in Jepara, wig and hair accessories clusters in Purbalingga, and handicraft clusters in Kasongan. Many producers in these clusters have developed extensive trade networks not only domestic, but also international. Internal heterogeneity within clusters in terms of size, technology, and served market is also more pronounced. Inter-firm specialization and cooperation among firms inside clusters are well developed.

One of the most striking features of this type, and to a certain extent in "active" clusters, may be the decisive role of leading/pioneering firms, which are usually larger and faster growing firms, to manage a large and differentiated set of relationships with firms and institutions within and outside the cluster. Some leading firms even have utilized cutting-edge technologies in production (Supratikno, 2002a). Examples are clove cigarette clusters in Kudus, tea-processing clusters in Slawi, and tourism clusters in Bali. In the case of the clove cigarette clusters in Kudus, their products are able to outperform products from LE like Philip Morris and BAT. Similarly, the tea-processing cluster in Slawi, led by a big company named Sostro, has grown up as the market leader in the Indonesian soft drink market, leaving giant Coca Cola behind (Supratikno, 2002a).

With respect to the fourth type, only a few clusters can be included in this category, namely clusters that are more developed and that become more complex in structure than those in the third type. In the fourth type the degree of inter-firm specialization and cooperation is high, and enterprises in these clusters have developed business networks with suppliers of raw materials, components, equipment and other inputs, providers of business services, traders, distributors, banks and other supporting institutions. This type of cluster has good cooperation with local, regional or even the national government, as well as with specialized training and research institutions. Within this process, the clusters may also expand geographically, e.g. by regularly drawing on inputs from a nearby region, or developing regular cooperation with a university or research institution in another city. Many enterprises in this type of cluster are export-oriented; however, most of them already export indirectly through trading houses or export companies (ADB, 2001).

Moreover, advanced clusters often overlap and interlink with other clusters in the same region. Such cluster agglomerations, or industrial districts, form the most complex form of clustering, where different sectors or sub-sectors mutually depend on and benefit from each other. Prominent examples of cluster agglomerations include North-Central Italy: tourism, food industry, fashion industry, furniture industry and machinery industry, southern Germany: vehicle, electronics, machinery, and software industries and Greater London: banking, insurance, software, publishing, film and music, tourism, fashion industry, advertisement, business services. In Indonesia one example of a cluster agglomeration is the Yogyakarta-Solo area with its tourism, furniture and interior decoration, metal processing, leather goods and textile/clothing clusters, which all mutually benefit each other.

Main Channels for Technology Transfer to SME Clusters

In Indonesia, three main channels for the transfer of technology to SME clusters exist. They are subcontracting with LEs including multinational companies located outside the cluster, interacting with foreign tourists and working with government agencies such as departments, R&D institutes and universities.

Subcontracting

During the Suharto era, the government imposed a system of protection and local content rules in a number of industries including machinery, electronics and the automobiles, as part of an import substitution policy. These local content rules stand as a clear lesson in how government interference does not facilitate the use of subcontracting as a means for technology transfer. The main aim of this policy was to encourage industrialization in the country and also to encourage a pattern of industrial development that followed Japan's industrial pyramid. In this model, SSIs were at the base to support MSIs, which then supported LSIs at the top of the pyramid (TAF, 2000).

However, industrial development in Indonesia did not follow the same pattern as in Japan. On the contrary, the local content policy resulted in a vertically integrated production system within LSIs. The Asia Foundation (TAF, 2000) argues that the lack this policy's success in creating strong interdependence between SSIs, MSIs and LSIs was largely due to the government's excessive interference, which aimed at replacing market mechanisms.

The economic rationale behind the local content policy was to create a captive market for domestic products in order to increase the economic scale of production and thereby to increase efficiency. However, government interference went too far. The government decided which products were to get priority in this policy, and introduced fiscal incentives in addition to prioritizing certain important products. The determination of priorities does not always appear to have been based on only economic considerations such as SMEs' capacity for investment and absorption of technology.

Similarly, Thee (1990b, 1997) argues that such production linkages did not develop smoothly during the New Order Era because of market distortions and the lack of skills and low technological capabilities of local firms, especially SMEs. SRI International (1992) found that such linkages between LEs and SME clusters are weak and only a small number of clusters, all located in Java, established subcontracting relationships with LEs. The general impression from other studies is also that subcontracting between LEs and SMEs is weak, mainly because the latter cannot meet the required standard of quality due to their lack of technology and skills.[3]

Although the mandatory deletion programs during the New Order Era were largely unsuccessful in developing viable domestic supplier firms, successful private-led subcontracting networks did arise in some industries with the evidence showing that these arrangements did successfully facilitate technological capacity building. For example, there is the case of Astra Otoparts, part of the Astra International Business Group, Indonesia's largest integrated automotive company. Through Astra Otoparts, Astra International was able to develop several SMEs into efficient and viable suppliers. As a result of the rigorous training, which Astra provided to local suppliers with potential, these suppliers, over time, were able to produce a wide range of parts and components for cars and motorcycles according to the strict quality standards set by Astra, and also to meet its strict delivery schedules.

Foreign Tourists

Since the mid-1970s foreign tourists have represented an important informal channel for the transfer of technology from abroad to many SME clusters in Indonesia. The remarkable export performance of the garment industry in Bali, and of the furniture industry in Jepara, Central Java, since the mid-1970s illustrates the importance of this channel.

The case of Bali's garment industry in particular shows the importance of foreign tourists as an important source of innovation, as they were able to act as marketing intermediates by connecting local producers with retail outlets abroad. These foreign intermediaries also communicated important information on design and production techniques to the inhabitants of the clusters. Foreign tourists as buyers provided information and technical and managerial assistance on plant layout, advocated the purchase of the most appropriate machines and quality control methods, and also often acted as technical consultants to SMEs. As a consequence, these firms were able to achieve higher levels of efficiency and accuracy (Cole, 1998).

Foreign tourists also provided vital information and technical, managerial and marketing assistance during the development of the export-oriented furniture industry in Jepara, Central Java. As a result, the quality of Jepara furniture has steadily improved (Sandee, *et al*. 2000: 5-7). Foreign tourists have also played a crucial role in providing guidance to SMEs on furniture designs popular in the export markets and the quality standards required to penetrate these markets (Berry and Levys, 1994; Schiller and Martin-Schiller, 1997)

These two cases show that non-farm SMEs in Bali and in and around Jepara have benefited from the inflows of technologies through an informal channel, namely foreign tourists. However, an important conclusion from these studies is that local SMEs must have some basic industrial competence in their particular field of activity to be able to absorb the inflow of technology or knowledge. In this regard, Bali and Jepara are still exceptional cases. In general, the capability of Indonesian non-farm firms, especially MIEs and SEs in rural areas to adopt and deploy new technologies, is limited due to the lack of management capacity, access to information, skilled workers and capital.

Knowledge diffusion from universities and research institutes

There is a growing literature on knowledge diffusion from universities and research institutes to non-farm firms, particularly manufacturing firms, through publications, patents and consulting.[4] However, studies focusing on knowledge diffusion from universities or research institutes to non-farm firms in Indonesia are rare.

In Indonesia the public science and technology (S&T) institutes consist of the 12 national-level and several regional-level R&D centers of the Agency for Industrial Research and Development (BPPI), the Department of Industry, and the research centers of the non-departmental government research institutes, particularly the Indonesian Institute of Sciences (LIPI) as well as the Agency for the Assessment and Application of Technology (BPPT). However, BPPI's R&D centers are mostly engaged in product certification, training and testing activities for manufacturing firms, particularly the state owned enterprises (SOEs) and SMEs. Their research staffs are generally not well trained, and are often not aware of the latest technological developments in their fields. Moreover, much of their laboratory equipment is obsolete due to under funding (Lall & Rao, 1995) and even more so after the Asian economic crisis. Hence, in general they are not able to provide adequate technical information or technology support services to Indonesia's manufacturing firms (Thee, 1998). After the Asian economic crisis no new evidence has emerged about the establishment of linkages or cooperation between R&D institutes or universities with non-farm firms, including SMEs.

The non-departmental government institutes, particularly LIPI and BPPT, are better funded, better equipped and better staffed with highly-trained researchers, many who have pursued postgraduate training abroad. However, like the Department of Industries R&D institutes, the research centers of LIPI and BPPT have not played a significant role in developing the technological capabilities of Indonesia's non-farm firms, particularly in the manufacturing industry. The reason for this is that they have generally not been able to establish mutually profitable linkages with national industry, particularly private manufacturing firms. Because of their lack of contact with national industry, they are generally not aware of the technological needs of private manufacturing firms and therefore lag behind world technological frontiers (Lall & Rao, 1995). As a result of their failure to establish mutually profitable linkages with non-farm firms, particularly in the manufacturing industry, most, if not all, of their research is supply rather than demand driven (Thee, 1998).

Moreover, the universities and R&D institutes are located mainly in urban areas, with little interest in the problems of rural non-farm firms. The available literature confirms that spillovers from universities or R&D institutes to non-farm firms are positively correlated with geographical proximity.[5]

The Effectiveness of Government and Government Funded Programs to Build Technological Capacity of non-farm SMEs

In Indonesia, almost all known types of government intervention to promote the development of SME clusters have been tried at one time or another. These include subsidized credit, such as credit for small farmers and village cooperatives (KUD), small-scale credit (KIK, KMKP, KUK) and credit for village units (KUPEDES), development of small rural development banks (BKD), human resource development trainings such as in production technique, general management (MS/MUK), management quality systems (ISO-9000), and entrepreneurship (CEFE, AMT) that provide total quality control advice, technology and especially internet access (WARSI), advisory extension workers, subsidized inputs like facilitation in setting up of Cooperatives of Small-Scale Industries (KOPINKRA) in clusters, development of infrastructure, building special small-scale industrial estates (LIK), partnership programs (the Foster Parent scheme), Small Business Consultancy Clinics (KKB), establishment of the Export Support Board of Indonesia (DPE), establishment of common service facilities (UPT) in clusters, and implementation of an incubator system for promoting the development of new entrepreneurs.

The SMERU Research Institute has mapped out most of the important assistance programs to strengthen micro and small enterprises (MIEs and SEs) provided by government and non-government institutes during the period of 1997-2003, showing that most are run by the government (SMERU, 2004). The data in Table 3 show that there were 64 institutions with such programs. A total of 594 programs were identified, two-thirds provided by the government.[6] NGOs (18%), donor agencies (8%), banking institutions (5%), private companies (2%), and other institutions conducted the other

Table 3: **Number of institutions and assistance programs to strengthen MIEs and SEs, 1997-2003**

Institutions	Number of institutions	Number of assistance programs		
		Total	Still continuing	
			Total	%
Government institutions	13	388	127	32.7
Banking institutions	7	31	25	80.7
Private companies	10	12	12	100
Donor agencies	8	46	15	32.6
NGOs	20	109	79	72.5
Others	6	8	8	100
Total	64	594	266	44.8

Source: SMERU (2004)

assistance programs. The government continues to run 127 different support programs.

Table 4 shows the type of assistance provided by these programs. The number of activities within each program also varied, but generally ranged from between one and three. In total, the most common types of activities were the provision of training (22.9%), capital assistance/credit (17.3%), facilitation (16.1%), and the dissemination/introduction of new technology (15.2%).

The data in Table 4 show that government agencies were the most common to introduce new technology (27.9%) and provide training (21.1%), whereas other institutions mostly provided capital assistance. Of all the executing institutions, government agencies played the most prominent role (50.9%), followed by NGOs (29.4%) and donor agencies (10.1%). Based on the type of activity, training was mostly undertaken by government institutions (46.9%) and NGOs (37.2%). Capital assistance was mostly provided by local and international NGOs (50.3%), followed by government institutions

Table 4: **The proportion of assistance programs to strengthen MIEs and SEs based upon the type of activities and the executing institutions**

	Gov't institutions	Banking institutions	Private companies	Donor agencies	NGOs	Others	Total
Capital assistance	5.3	52.9	25	21	29.6	28.6	17.3
Training	21.1	13.7	22.2	19	29	21.4	22.9
Facilitation	11.3	9.8	19.4	7.6	28.7	0	16.1
Information	1.9	7.8	2.8	3.8	1.6	21.4	2.6
Facilities	16.2	2	5.6	8.6	1	0	9.7
Promotion	3	3.9	13.9	6.7	1	7.1	3.3
Dissemination/introduction of new technology	27.9	0	0	6.7	1.3	0	15.2
Guidelines	4.3	0	0	0	0.7	0	2.4
Others	9	9.8	11.1	26.7	7.2	21.4	10.5
Types of activities	531	51	36	105	307	14	1044

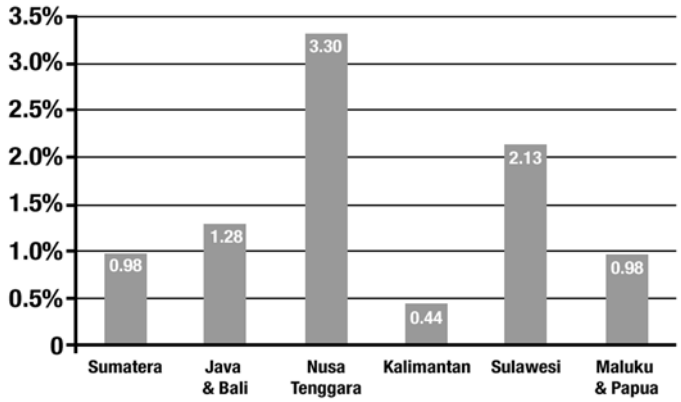
Source: SMERU (2004)

(15.5%) and banking institutions (14.9%). NGOs (52.4%) and government institutions (35.7%) mainly provided facilitation.

Despite their large number, the level of coverage of assistance programs is very low, reaching 1% or less of eligible MIEs and SEs (Figure 1). Also, coverage is heavily skewed towards Java and Bali, i.e. of 481,714 non-farm MIEs and SEs that received support in 2003, 71% were located in Java and Bali.

Despite this low level of coverage, those enterprises that do receive assistance appear to benefit from it. To assess the effectiveness of assistance programs, SMERU (2004) studied 172 MIEs and SEs in six Kabupaten/Kota. These firms were mostly informal, non-legal entities whose turnover and employees fluctuated overtime, and which operated without any or with only simple technology. A large number of MIEs (58.6%) and SEs (63%) stated that by obtaining assistance their businesses had improved and increased revenues. Unfortunately, it was not determined whether there had been

Figure 1: **Proportion of SEs and MIEs receiving assistances from government by region, 2003 (% of total SEs and MIEs in the region).**



Source: BPS (SUSI 2003)

an increase in knowledge or technological capability as a result of the training or technical assistance received.

Typically, government programs are evaluated according to the number of enterprises who participate. The actual outcome of the program is generally not assessed. Thus, it is impossible to tell for most government programs whether they are effective or not in improving technical ability. Moreover, program benefits should be compared with program costs to determine the net benefits, but this is generally not done (van Dierman, 2004).

The few studies conducted suggest that most SME development programs have not been very successful.[7] For instance, the Foster Parent (FP) program attempted to create productive linkages between large and small firms, but levels of participation were low and very little training and technical assistance was supplied.[8] Furthermore, the emphasis was on the provision of capital and marketing assistances. SUSI data 2003 (BPS) show that only 11% of MIEs and 3% of SEs received training and technical assistance from the program.

The general impression is that the FP was essentially a non-market mechanism to pressure LEs and the SMEs into a "forced marriage." International evidence shows that dense patterns of linkages and partnerships are not established through mandatory requirements, rather, they are established when they offer commercial benefits to both parties.

Low participation is a common feature of such programs. For example, SUSI data (BPS) shows that the majority of MIEs and SEs were not members of KOPINKRA. The reason mentioned by Klapwijk (1997) states:

> "In view of the wide definition of small industry employed by the Ministry, much of the promotion efforts may have bypassed the smallest enterprises that are most in need of assistance … The extension officers generally have little technical or business experience, and training or other technical facilities have been largely provided according to the directions of central planners, rather than having been adapted to local needs."

Another more comprehensive technical assistance program has involved the development of technical service units (UPT)) in existing SME clusters of similar industries across provinces. These units provide extension and technical services and training courses, and are staffed by government technical officers who have received special training. Van Diermen (2004: 51) concludes that the UPT extension service program has achieved poor results. It has failed to deliver efficient services, to target appropriate recipients or to address the important criteria of providing a net benefit to society and/or effectively addressing equity or fairness objectives. In particular, van Dierman notes that: [1] Types of services are highly supply-oriented rather than demand-driven; [2] Most of the machines and equipments are outdated. Originally, these units were supplied with modern technological machines and equipments. However, over the years, especially after the economic crisis 1997/1998, budget constraints have prevented the replacement of the existing equipment; [3] Services have been delivered indiscriminately to clusters; [4] The staff of the UPT had not had the appropriate training to respond to entrepreneurs' needs; [5] There was not great enough flexibility in the system to respond to the changing needs of SMEs, possibly due to the bureaucratic structure of the UPT.

Based on his analysis of the effects of macro-and micro-policy environments on rural industries in Indonesia, van Dierman (2004: 53) comes to the following conclusions: (i) few of the micro-policies implemented by the government have had a lasting impact on improving rural SMEs, (ii) a significant number of macro-and micro-policies placed additional costs and burdens on rural SMEs' compliance, which led to most operating outside of the formal economy and (iii) macro-policies that created a favorable economic environment, as reflected by consistently high growth rates in GDP, and not biased in favor of LEs, provided the best stimulus for SME growth.

Based on their study on a furniture cluster in Jepara, Central Java, Sandee *et al* (2000) concludes that public intervention is likely to have contributed to the success of this cluster. A comprehensive development package, including technical upgrading through the provision of a common service facility for wood drying, export training, support for participation in trade fairs and investment in improvement of the regional infrastructure: container facilities, roads, telephones, helped the cluster to gradually develop and enter export markets.

On the other hand, Sato's (2000) field study of several clusters in the metalworking and machinery industry in Java concludes that the successful development of these clusters has been achieved without significant government supports. Her impression about the effectiveness of government programs on development of SMEs is also supported by Tambunan's (1998) findings on rattan industries in Padang, West Sumatra. They conclude that the government's efforts to support the clusters have not yielded positive results. One reason appears to be the lack of coordination between the various government agencies. In many clusters, local gov-

ernment agencies such as regional offices of the State Ministry for Cooperatives and SME, the Ministry of Information, state universities, and workers skill training centers (*Balai Latihan Kerja*) from the Department of Manpower provided some supports. However, sometimes different agencies provided similar schemes/programs and there was little attempt to coordinate their efforts.

While the government is the largest supplier of training programs (see Table 4), the evidence suggests that the quality and relevance of the training provided is poor. Most of these programs do not appear to have been very effective in upgrading the technological capabilities of the firms trained. For example, Sandee (1994) notes that training materials and other information do not always match the needs of the producers:

> "In practice, direct assistance frequently concerns brief training sessions of one or two days for a selected group of producers. Such sessions are characterized by a great deal of theory and little attention paid to how to improve the actual running of the business of particular activities."

The evidence shows that universities and research institutes can also contribute to the diffusion of knowledge to domestic firms, particularly manufacturing firms, through publications, patents and consultancy services (Agrawal, 2001).

In Indonesia, the public science and technology institutes consist of the 12 national-level and several regional-level R&D centers of the Agency for Industrial Research and Development (BPPI), the Department of Industry, and the research centers of the non-departmental government research institutes, particularly the Indonesian Institutes of Sciences (LIPI) and the Agency for the Assessment and Application of Technology (BPPT). However, BPPI's R&D centers are mostly engaged in product certification, training and testing activities for manufacturing firms, particularly state-owned companies and private SMEs. Their research staffs are generally not well trained, and are often not aware of the latest technological developments in their fields. Moreover, much of their laboratory equipment is obsolete because the centers are under funded, particularly since the economic crisis in 1997/98 (Lall & Rao, 1995). Hence, in general they are not able to provide adequate technical information or technology support services to Indonesia's manufacturing firms (Thee, 1998).

The non-departmental government institutes, particularly LIPI and BPPT, are better funded, better equipped and better staffed, with highly-trained researchers, many of whom have pursued postgraduate training abroad. However, like the Department of Industry's R&D institutes, the research centers of LIPI and BPPT have not played a significant role in developing the technological capabilities of Indonesia's non-farm firms, particularly in manufacturing industry. The reason for this is that they have generally not been able to establish mutually profitable linkages with national industry, particularly private industry. Because of their lack of contact with national industry, they are generally not aware of the technological needs of private industry and therefore lag behind the world frontiers of technology (Lall & Rao, 1995). As a result of their failure to establish mutually profitable linkages with non-farm firms, most, if not all, of their research is supply rather than demand driven (Thee, 1998).

Moreover, the universities and R&D institutes are located mainly in urban areas, with little interest in the problems of rural non-farm firms. The available literature confirms that spillovers from universities or R&D institutes to non-farm firms are positively correlated with geographical proximity (see e.g. Anselin, *et al.*, 1997).

Evidence on Knowledge Diffusion in the Tegal Metal Working Industry Cluster

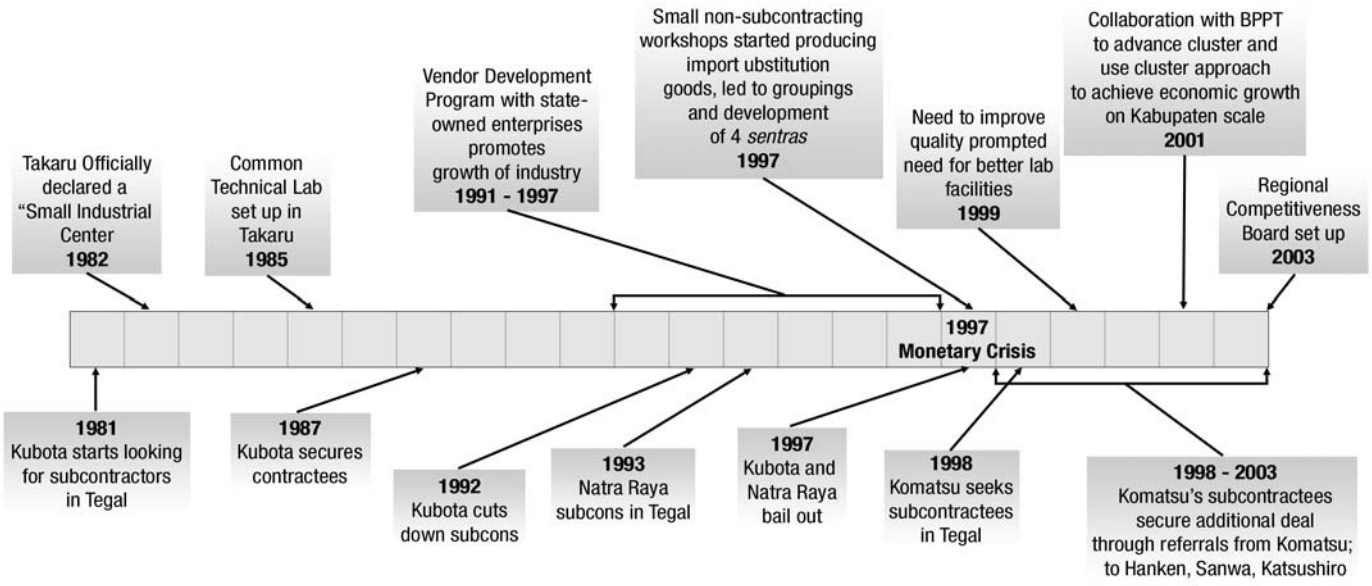
Tegal district is located near the north coast of Central Java on key trucking and rail routes. Major industries in the area include processed food, textiles and furniture. The district generates 22.09% of its annual income from the industrial sector, compared to those in trade and agriculture sectors at 24.24% and 24.62% respectively. These three sectors are the largest contributors to the district economy (Bappeda and BPS Tegal 2005).

Tegal district is among few areas in Indonesia that has a metalworking industrial cluster. The Tegal metalworking industry has about 30,029 workers out of 118,820 workers or approximately 25% of the total workers employed in the district's industrial sector. There are around 2,811 metal workshops in the district. Among these are seven clusters, i.e. groups of geographic agglomerations of metal enterprises producing the same metal products such as components or spare parts for ships and vehicles. Since the New Order Era, clusters have become the focus of government development strategies for SMEs in all manufacturing sub sectors, including the metalworking industry in Tegal district. The majority of metal workshops are small, employing less than 20 workers, mainly men.

Most of Tegal's metal workshops rely on the same basic metalworking technologies, e.g. casting, cutting, bending, drilling or stamping depending on product, machining, welding, and finishing and painting or electronic plating depending on product and assembly. Their comparative advantage has been in filling small orders for simple metal products or components. The small size of workshops gives them greater flexibility and Tegal's abundant cheap labor can outweigh the productivity advantages of more capital-intensive production. There is often intense price competition between workshops.

Tegal district has been a metalworking center since the mid-1800s when it was the locus of several sugar processing factories and related enterprises including locomotive repair shops and metal processing factories. The industry continued, thriving particularly under the New Order's massive infrastructure and development agenda. In the beginning of the 1980s, the first subcontracting activity started in the district, sparking government activity to develop the metal working industry. An overview of the history of the industry in Tegal district is illustrated in Figure 2

Figure 2: **The History of the Tegal Metalworking Industry from Early 1980s**



Types of Workshops

The structure of the Tegal metalwork value chain is illustrated in Figure 3. According to the size of production and level of production sophistication, there are two types of workshops in the Tegal metalworking industry: MSIs and LSIs as one type, called *inti*, and SSIs and CHIs called *plasma*. *Inti* workshops receive orders for metal components from large private companies (LEs) outside the district. Especially large *inti* workshops with up to 100 employees derive a majority of their income from sub-contracting work. During the survey in 2005, there were several large private companies that subcontracted work to Tegal metal workshops, including PT Komatsu Indonesia Tbk, Daihatsu and some divisions of the Astra Group such as PT, Sanwa and Katsushiro. These companies often source metal components from several parts of the country, mostly in West Java. Among these companies, the most prominent one is PT Komatsu Indonesia Tbk, which is a subsidiary of a Japanese company that has established subcontracting production linkages with the Tegal metal workshops since 1998. This company produces various equipment like hydraulic excavators, bulldozers, motor graders, frames and related components, steel cast products as well as off-highway dump tracks for construction and mining activities under the global trademark of Komatsu.

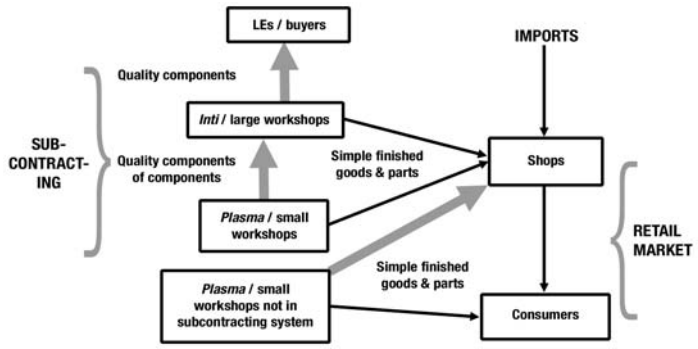
Plasma workshops usually hire cheap, unskilled labor or use family members, mainly men, as unpaid workers, "helpers," and the owner passes basic metalworking skills on to his employees, leaving the technical capacity of the workshop highly dependent on the technical capacity of the owner. *Inti* workshops often sub-contract part of their production to *plasma* workshops.

Inti and *plasma* workshops, which have no subcontracting businesses with *inti* workshops, manufacture entirely for the wholesalers and retailers or sell their products directly to local consumers rather than through marketing channels. Many wholesalers and retailers purchase goods from Tegal metal workshops for resale in stores in cities throughout the country.

Research Methodology

This case study is based on findings from two-weeks of fieldwork in Tegal district with thirty-four respondents. During the fieldwork in-depth interviews were carried out with thirty-four respondents including owners of *inti*, *plasma*, retail manufacturing metalworking firms, wholesalers, retailers, and some NGOs. These respondents were selected from four sub districts: Adiwerna, Talang, Desa Kebasen and Desa Dampyak. Semi-structured interviews were also held with relevant local government officials to discuss government-led knowledge diffusion initiatives and the history of subcontracting linkages in the district. The research sampling focused on clustered metal workshops in the automotive and shipbuilding industries.[9] During the fieldwork, two focus group discussions (FGDs) were held in Desa Kebasen includ-

Figure 3: **Structure of the Tegal Metalwork Value Chain**



ing with workshop owners to discuss the needs of their businesses and to rank and discuss government and private sector trainings that they received in the last five years. Extensive, semi-structured interviews were also conducted with representatives of PT Komatsu and its local subcontractors including three of the four inti workshops filling subcontracting orders directly to PT and with *plasma* workshops that subcontract from Komatsu's *inti* workshops.

Research Findings

The Major Knowledge Providers

Tegal District's main external knowledge providers are LEs like PT Komatsu and to a lesser extent local government. Some domestic retail market suppliers also act as knowledge providers by informing metal workshops about consumer preferences, demand, and new innovations.

To access knowledge from LEs, however, a workshop must have attained a certain level of technical and managerial capacity. Larger metal workshops are more likely to adopt new technologies in their bid to become subcontracting *inti* to LEs. By building upon existing technical and managerial capacity, larger workshops are able to enter a virtuous circle where quality output leads to subcontracts, which lead to private training provided by LEs.

Trainings provided by LEs have proven to be the most successful method of efficiently transferring knowledge to selected inti workshops. While government led initiatives attempt to cover a broader range of workshops, and with more topics, this did not result in the efficient transfer of high-quality, usable knowledge to *inti* workshops.

Though a combination of reputation and personal connections are important, LEs want proof that a workshop has the capacity to produce high quality components. An audit determines if the workshop has the required machinery, manpower, facilities, legal standing and use of ISO standards. The potential subcontractor is then requested to produce a sample component from provided technical drawings. Before an agreement is signed, LEs will often ask for a trial run of the mass production process, subjecting the output to quality control tests.

After winning a contract, an *inti* subcontractor has access to a significant level of technical training. According to a sub-contractor of PT Komatsu, trainings directly addressed the technical needs of the workshop in meeting the production requirements of Komatsu. Indonesian experts from the Jakarta Komatsu office lead the training and used a teaching style that clearly delivered the necessary knowledge, emphasizing practical application with 90% of training time spent in hands-on experience. Trainers also help the workshop identify problems and troubleshoot.

This style of knowledge diffusion has two important limitations. First, it focuses training only on larger *inti* workshops, with smaller sub-contracting firms (*plasma*) benefiting only indirectly, or in the case of small retail market firms deriving no benefit at all. Second, LE training does not seek to develop the *inti* workshop's capability beyond its capacity as a low-cost production center for selected components. Moreover, LEs do help *inti* workshops gain the capacity to manufacture component parts, but there has been little interest in upgrading from specialized parts manufacture to manufacture and assemblage of finished products.

Most *plasma* workshops lack the technical ability to produce complicated components with the precision required by LEs, thus making it unlikely they will receive sub-contracting orders. *Plasma* workshops often use second-hand or home-made equipment. They hire low-skilled, low-wage workers with little or no experience and rely on shop owner's technical knowledge. Since many *plasma* workshop owners built their expertise through working in small shops and rarely have formal academic training, they have difficulties reading technical drawings and instead rely on copying samples, leading to less accurate output. Most *plasma* workshops sell to the retail market or to a domestic market with a limited range of simple final products like pulleys or ship windows. While these retailers may demand a sample product, there is much less emphasis on precision. Generally, retailers emphasize low cost over quality. Moreover, strong competition among retail suppliers inhibits knowledge transfer and encourages production of low-quality, inexpensive products. For knowledge improvement, these *plasma* workshops depend largely on un-targeted, irregularly publicized government programs, which may not be suit their needs

Cheap labor and relatively small, shifting job orders reduce incentives for workshops to specialize or acquire expensive machineries to increase productivity. As one seasoned metal worker explained, the strength of the *plasma* workshop is the flexibility to do smaller orders. However this flexibility becomes a liability to capacity development when workshops must fill many small orders and never develop specialization that leads to expanded command of technology.

Though less direct, the subcontracting system does provide some market opportunities for smaller workshops to benefit from the virtuous circle affecting *inti* capacity building. Subcontracting *plasma* gain from the incentive to produce higher quality for a higher price with technical coaching from *inti* clients in their own virtuous circle. *Inti* respondents for auto components, for instance, turn to *plasma* workshops to produce 10–15% of their orders from LEs, usually components of components or basic parts made more cheaply in small workshops while still passing the quality control requirements of LEs. Often soft loans are provided to *plasma* to help them acquire new machines capable of higher quality output. *Inti* and *plasma* involved in subcontracting are more likely to use the UPTD Lab, especially to test the quality of materials. They are more able to offset lab usage costs through the higher price paid by LEs for quality parts.

Learning takes place through quality control as *inti* often build a procedure for troubleshooting mistakes into their subcontracting relationships. *Inti* workshops engage in coaching *plasma* on quality control standards, and, in some cases support former employees already familiar with these standards in starting up *plasma*.[10]

Knowledge Diffusions Among Small Workshops

It was stated before that a cluster of producers can be a powerful means for knowledge diffusion; but, in this Tegal case, knowledge transfer between small workshops is often contingent on personal networks and conditioned by competition. Especially among workshops producing for the retail market, competition sometimes becomes "unhealthy," which has opposite effects like inhibiting knowledge diffusion; for example, when a competing firm bought off a shop owner's driver after a marketing trip and followed up with lower bids to the same potential clients. Many workshop owners were worried about other firms' tactics to reduce production costs, often at the expense of quality. Some workshops find the right combination of cheap scrap metals to get their products to pass their buyer's inspection standards, but these lower quality items wear out more quickly and do little to strengthen the reputation of the Tegal metal working industry as a whole. This cost cutting in turn creates price pressure forcing competing workshops into a race for the bottom in terms of quality.

Small workshop respondents mentioned that there was hesitancy among metalworkers to share new and possibly advantageous technical knowledge. Technical knowledge was shared, if at all, amongst personal friends whose shops were not in direct competition. The same hesitancy was seen in giving too much training to employees. Ex-employees were likely to start up competing businesses, as was the case with one workshop owner interviewed who lost 40% of his retail market share to ex-employees who began producing ship windows out of lower grade materials.

Marketing information is kept even more closely guarded. In addition to the tactics mentioned above, domestic market suppliers sometimes will come to the cluster and play the workshops off of each other, using their proximity and lack of specialization to engage them in competitive price-cutting. The owner of KPY, one of the district's most successful metal workshops in both subcontracting and retail production, explained that lack of trust and mutual suspicion between metalworkers was the main constraint to metal works development and was the reason for the lack of growth in metal workers associations.

The Role of Government

While the district government has demonstrated a high level of awareness of the importance of enhanced knowledge and skills to improve the competitiveness of local metalworking shops, it has not yet been very successful at systemically improving the skills of local firms. It has attempted to both facilitate direct trainings as well as build up supporting institutions that can assist firms and lower information costs. These efforts, while significant and well intentioned, have been handicapped by poor targeting, lack of sufficient funds, a small number of skilled staff dedicated to the effort, and weak feedback mechanisms between government and the metalworking shops.

The government is the only source of managerial training for *plasma* and retail market workshops as well as many *inti* that receive only limited management training from LEs clients. Since 2001, the majority of government training has focused on technical subjects or technical quality management processes. For some smaller workshops without direct links to LEs, local government-facilitated technical trainings remain the only source of technical information outside the past experience of the workshop owner. However, according to respondents who participated in government trainings, these activities were poorly targeted, often exceeding their skills or the machinery available; or, conversely, focused on skills they had already mastered.

The district government has currently partnered with outside institutions including strong partnerships with the Central Government's Indonesian Agency for the Assessment and Application of Technology (BPPT) and with an NGO, **Yayasan Dana Bakti Astra** (YDBA). Although this strategy succeeds in bringing new knowledge to the cluster, the offerings are often not suited to the needs of workshops attending trainings. In 1997, the district government opened the UPT to enhance subcontracting workshops' ability to produce with precision. The first government funded UPT opened in 1982. There the metal working cluster was able to access the machines necessary to fill their orders. The UPT was not able to keep up with technical advances and soon several of the workshops internalized more advanced machinery.

Policy Implications

This review of literature and empirical studies in Indonesia, including the Tegal case study suggests the following recommendations for policy makers and the private sector's efforts to support capacity building, especially with respect to technology, in non-farm SMEs in Indonesia.

[1] Promote commercial interaction with actors outside the local economy. One of the key lessons from the above analysis is that an outward orientation is critical to success. This is true at a national level where the government should promote an export-led technological learning strategy. According to this strategy, Indonesia's exports should gradually move up the technological ladder from labor-intensive light to more heavier manufacturing products, or from standardized manufacturing processes to more advanced stages of process engineering, product-process interfacing and product design. The success stories also occur at the local level, for instance, the garment industry's success in Bali can be attributed in part to its unique access to foreign tourists.

[2] Promote private sector driven technological learning. Perhaps, the one overriding message from the above analysis is that knowledge diffusion is not something that government does to SMEs. It is something that happens when SMEs work together with LEs on mutually profitable activities. The job of the government in such learning is primarily to facilitate such private interactions by reducing the "search costs" for suitable partners for both SMEs and LEs.

[3] Creating a culture of innovation in the educational system. It has been shown elsewhere that innovative economic systems cannot function well without a highly educated work force. Improving the quality of secondary-and tertiary-level

science and technology skills to encourage creativity and enlarge the number of innovators is a critical strand of policy in supporting technology/innovation capacity building in enterprises. To this end, the central government should improve the educational curriculum to place greater stress on science and technology and on innovation and creativity. The district governments, on the other hand, have the responsibility of effectively monitoring or in creating incentives for improvements in the delivery of educational services.

[4] Improve the capabilities of R&D institutions and universities and make them more demand driven. This should be achieved through the implementation of a national strategy for technological development and would involve increasing the government budget for science and technology, particularly (i) to improve salaries to attract a high-caliber staff, (ii) to upgrade facilities including equipment to meet practice requirements and (iii) to increase capacity in those agencies working in remote rural areas to engage in meaningful outreach activities for the targeted client groups. Indonesia's research institutes and universities will also need to be made more demand driven. This can be done by creating incentives for R&D institution and universities to increase their linkages with the private sector. The R&D institutes should implement three important steps: (i) change their mission statements and philosophies from a supply base to a demand base, (ii) adopt a more progressive approach to selling their developed technologies or innovations and to disseminate information to the private sector, and (iii) provide incentives through various measures including opening access to funding for R&D activities or providing direct subsidies for R&D institutes and universities, granting them greater managerial autonomy, and enforcing greater observance of intellectual property rights.

[5] Make government, and other business development services a facilitator of demand driven training, rather than a provider. Government facilitated technical training can be useful; however, the Tegal case and evidence from other empirical studies show that this training was generally of poor quality and of limited relevance to recipients. The government needs to shift from being the principle provider of such training to avoid crowding in demand-driven private sector training and other business development services. For example, government could help to bear the costs of identifying the types of training needed by SMEs in a local area and help to disseminate this information widely.

[6] Evaluate the effectiveness of specific programs and scrap those that do not work. Given that many of the existing government support programs are not effective in boosting the technological capacity of the vast majority of non-farm SMEs, the government urgently needs to undertake a comprehensive evaluation of the outcomes (rather than merely the inputs) of these programs and scrap those that create no net benefits. More importantly, it should learn the lessons from those programs that are more successful and apply these to the redesign and implementation of the remaining programs.

References

Agrawal Ajay (2001), "University-to-industry knowledge transfer: literature review and unanswered questions", *International Journal of Management Review*, 3(4): 370-85.

Anselin, L, Varga, A. and Acs, Z. (1997). Local spillovers between university research and high technology innovations. *Journal of Urban Economics* 42(3): 210-26.

Berry, Albert and Brian Levy (1994), "Indonesia's Small and Medium-Size Exporters and Their Support Systems", Policy Research Working Paper 1402, December, Policy Research Department, Finance and Private Sector Development Division, World Bank, Washington, D.C.

Berry, Albert, Edgard Rodriguez and Henry Sandee (2001), "Small and Medium Enterprise Dynamics in Indonesia", *Bulletin of Indonesian Economic Studies*, 37(3): 363-84

Cole, William (1998), "Bali's Garment Export Industry", in Hal Hill and Thee Kian Wie (eds.), *Indonesia's Technological Challenge*, Research School of Pacific and Asian Studies, Australian National University, Canberra, and Institute of Southeast Asian Studies, Singapore: 255-78

Doeringer, Peter B. and David G. Terkla (1995), "Business Strategy and Cross-Industry Clusters", *Economic Development Quarterly*, 9(3): 225-37.

Harianto, Farid (1993), "Study on Subcontracting in Indonesian domestic firms", paper, PEP-LIPI, Jakarta.

Hill, Hal (1988), *Foreign Investment and Industrialization in Indonesia*, Oxford University Press, Singapore.

Hill, Hal (2001), "Small and Medium Enterprises in Indonesia: Old Policy Challenges for a New Administration", *Asian Survey* 41(2): 248-70.

Hobday, Michael (1994), "Export-led Technology Development in the Four Dragons; The Case of Electronics", *Development and Change*, 25(2): 393-61.

Humprey, John and Hubert Schmitz (1995), "Principle for promoting Clusters and Network of SMEs", paper commissioned by Small and Medium Enterprise Branch, Institute of Development Studies, University of Sussex, Brighton.

Ito, Keiko (2004), "Foreign Ownership and Productivity in the Indonesian Automobile Industry: Evidence from Establishment Data for 1990-1999", in Takatoshi Ito and Andrew Rose (eds.), *Growth and Productivity in East Asia*, National Bureau of Economic Research, East Asia Seminar on Economics, Vol.13, University of Chicago Press: 44-65.

Jacob, Jojo and Christoph Meister (2005), "Productivity Gains, Technology Spillovers and Trade: Indonesian Manufacturing, 1980-96", *Bulletin of Indonesian Economic Studies*, 41(1): 37-56.

JICA (2000), "Study on Inter-firm Linkages and Financial Needs for the Development of Small and Medium Scale Manufacturing Industry in Indonesia", Jakarta: Japan International Cooperation Agency in cooperation with PT Kami Karya Nusantara.

Kitabata, T. (1988), *Report on the Subcontracting System in the Indonesian Machinery Industries*, Japan International Cooperation Agency (JICA), Tokyo.

Klapwijk, Martin (1997), "Rural Industry Clusters in Central Java, Indonesia. An Empirical Assessment of their Role in Rural Industrialization", unpublished PhD dissertation, Tinbergen Institute Research Series No.153, Vrije Universiteit Amsterdam.

Kokko, A., Tansini, R., and Zejan, M.C. (1998), "Local Technological Capability and Productivity Spillovers from FDI in the Uruguayan Manufacturing Sector", *Journal of Development Studies* 32 (4): 602-11.

Lall, Sanjaya & Kishore Rao (1995), "Indonesia: Sustaining Manufactured Export Growth", Vol. 1, Main Report, Revised draft report submitted to the national Planning Board (Bappenas), Jakarta, August.

Mans, Darius (1996), "Indonesia: Industrial Technology Development for a Competitive Edge", Indonesia Discussion Paper Series 4, World Bank, Jakarta.

Nadvi, K. and H. Schmitz (1994), "Industrial Clusters in Less Developed Countries: Review of 15 Experiences and Research Agenda", IDS Discussion Paper, No. 339, Institute of Development Studies, Sussex University.

Perry, C. and Pyatt, R. (1995), *The space of network relationships in a Southeast Asian setting*, Academy of Marketing Science, Melbourne.

Rice, R. and I. Abdullah (2000), "A Comparison of Small and Medium/Large Indonesian Manufacturing Enterprises from 1986 and 1996 by Sector", mimeo, Partnership for Economic Growth Project, USAID, Jakarta

Sandee, Henry (1994), "The Impact of Technological Change on Interfirm Linkages. A Case Study of Clustered Rural Small-Scale Roof Tile Enterprises in Central Java", in P.O. Pedersen, A. Sverrisson, and M.P. van Dijk (eds.), *Flexible Specialization: The Dynamics of Small-Scale Industries in the South*, Intermediate Technology Publications, London: 72-95.

Sandee, Henry (1995), "Innovation Adoption in Rural Industry: Technological Change in Roof Tile Clusters in Central Java, Indonesia", unpublished PhD dissertation, Vrije Universiteit, Amsterdam.

Sandee, Henry (1996), "Small-Scale and Cottage Industry Clusters in Central Java: Characteristics, Research Issues, and Policy Options", paper presented at the International Seminar on Small Scale and Micro Enterprises in Economic Development Anticipating Globalization and Free Trade, Satya Wacana Christian University, November 4-5, Salatiga.

Sandee, Henry and J. ter Wingel (2002), "SME Cluster Development Strategies in Indonesia: What Can We Learn from Successful Clusters?", paper presented for JICA Workshop on Strengthening Capacity of SME Clusters in Indonesia, March 5-6, Jakarta.

Sandee, Henry, P. Rietveld, Hendrawan Supratikno, and P. Yuwono (1994), "Promoting Small Scale and Cottage Industries. An Impact Analysis for Central Java", *Bulletin of Indonesian Economic Studies*,30 (3): 115-142.

Sandee, Henry, Roos Kities Andadari and Sri Sulandjari (2000), "Small Firm Development during Good Times and Bad: The Jepara Furniture Industry", in C. Manning and P. van Dierman (eds.), *Indonesia in Transition: Social Aspects of Reformasi and Crisis*, Indonesia Assessment Series, Research School of Pacific and Asian Studies, Australian National University, Canberra, and Institute of Southeast Asian Studies, Singapore: 184-98.

Sandee, Henry, B. Isdijoso, and Sri Sulandjari (2002), *SME clusters in Indonesia: An analysis of growth dynamics and employment conditions*, Jakarta: International Labor Office (ILO).

Sato, Yuri (1998), "The transfer of Japanese management technology to Indonesia', in Hill, Hal and Thee Kian Wie (eds.), *Indonesia's Technological Challenge*, Research School of Pacific and Asian Studies, Australian National University and Institute of Southeast Asian Studies: 326-41.

Sato, Yuri (2000), "Linkage Formation by Small Firms: The Case of a Rural Cluster in Indonesia", *Bulletin of Indonesian Economic Studies*, 36(1):137-66.

Schiller, J. and B. Martin-Schiller (1997), "Market, Culture and State in the Emergence of an Indonesian Export Furniture Industry", *Journal of Asian Business*, 13(1): 1-23.

Shepherd, W.F., A. Szirmai and D.S. Prasada Rao (1998), "Indonesia Manufacturing Sector Output and Productivity: An Australian Comparative Perspective, 1975-90", *Bulletin of Indonesian Economic Studies*, 34(2): 121-42.

Sjðholm, Fredrik (1999a), Exports, Imports and Productivity: Results from Indonesian Establishment Data", *World Development* 27(4): 705-15.

Sjðholm, Fredrik (1999b), "Productivity Growth in Indonesia: The Role of Regional Characteristics and Direct Foreign Investment", *Economic Development and Cultural Change*, 47(3):559-84.

SMERU (2004), "Mapping Assistance Programs to Strengthen Microbusinesses", *Smeru News*, no.10, April-June.

SRI International (1992), "Technology Development Plan for Indonesia's Engineering Industries", draft final report for the Ministry of Industry, Republic of Indonesia, Jakarta.

Supratikno, Hendrawan (2001), "Subcontracting Relationship in Indonesian Manufacturing Firms", *Gadjah Mada International Journal of Business*, 3(2): 115-127

Supratikno, Hendrawan (2002), "The Strategies of Cluster Upgrading in Central Java", A Preliminary Report to Depperindag, Salatiga.

TAF (2000), "Strategic Alliances and Development of Small and Medium-Scale Enterprises in Indonesia", Final Report, May, The Asia Foundation, Jakarta.

Takii, Sadayuki (2004), "Productivity Differentials between Local and Foreign Plants in Indonesian Manufacturing, 1995", *World Development* 32(11): 1957-69.

Takii, Sadayuki (2005), "Productivity Spillovers and Characteristics of Foreign Multinational Plants in Indonesian Manufacturing 1990-1995", *Journal of Development Economics* 76(2):521-42.

Takii, Sadayuki and Eric D. Ramstetter (2004), "Employment, Production, Labour Productivity, and Foreign Multinationals in Indonesian Manufacturing, 1975-2000", Working Paper No.25, International Centre for the Study of East Asian Development, Kitakyushu.

Takii, Sadayuki and Eric D. Ramstetter (2005), "Multinational Presence and Labour Productivity Differentials in Indonesian Manufacturing, 1975-2001", *Bulletin of Indonesian Economic Studies*, 41(2):221-42.

Tambunan, Tulus T.H. (1998), "Cluster Diagnosis in Padang Rattan Industries and Proposed Action Plan", Study report, October, UNIDO, Jakarta.

Tambunan, Tulus T.H. (2000), Development of Small-Scale Industries During the New Order Government in Indonesia, Aldershot, et.al.: Ashgate.

Tambunan, T.H. (2006), *Development of Small and Medium Enterprises in Indonesia from the Asia-Pacific Perspective*, Jakarta: LPFE-Usakti.

Thee Kian Wie (1990a), "Indonesia: technology transfer in the manufacturing industry", in Hadi Soesastro and Mari Pangestu (eds.), *Technological Challenge in the Asia Pacific Economy*, Sydney, Allen & Unwin: 23-43.

Thee Kian Wie (1990b), "Prospects for Cooperation in Technology", in Kim Seung Jin and Suh Jang Won (eds.), *Cooperation in Small and Medium-Scale Industries in ASEAN*, Kuala Lumpur: Asian and Pacific Development Centre: 40-55.

Thee Kian Wie (1991), "The Surge of Asian NIC Investment to Indonesia", *Bulletin of Indonesian Economic Studies*, 27(3): 55-88.

Thee, Kian Wie (1994), "Technology Transfer from Japan to Indonesia, inYamada Keiji (ed.), *The Transfer of Science and Technology between Europe and Asia, 1780-1880*, International Research Center for Japanese Studies, Kyoto: 30-59.

Thee Kian Wie (1997), "The Development of the Motor Cycle Industry in Indonesia", in Mari E. Pangestu and Yuri Sato (eds.), *Waves of Change in Indonesia's Manufacturing Industry*, Institute of Developing Economies (IDE), Tokyo: 93-111.

Thee, Kian Wie (1998), "Determinants of Indonesia's Industrial Technology Development", in Hill & Thee (eds.): 117-35.

Thee Kian Wie (2003), "The Major Channels of International Technology Transfer to Indonesia: An Assessment", paper presented at the Conference on "Catch-Up Growth and Technology Transfer", Groningen Center for Growth and Development, University of Groningen, 17-18 October.

Thee Kian Wie (2005), "The Major Channels of International Technology Transfer to Indonesia: An Assessment", *Journal of the Asia-Pacific Economy*, 10(2): 214-36.

Thee Kian Wie and Pangestu, Mari (1994), "Technological Capabilities and Indonesia's Manufactured Exports", revised report for UNCTAD/SAREC Project on Technological Dynamism and the Export of Manufactures from Developing Countries, January.

Timmer, Marcel P. (1999), "Indonesia's Ascent on the Technology Ladder: Capital Stock and Total Factor Productivity in Indonesia Manufacturing, 1975-95", *Bulletin of Indonesian Economic Studies*, 35(1): 75-97.

van Dierman , Peter (1997), *Small Business in Indonesia*, Ashgate Publishing, Aldershot, et al.

van Dierman , Peter (2004), " The Economic Policy Environment for Small Rural Enterprises in Indonesia", Thomas R. Leinbach (ed.), *The Indonesian Rural Economy Mobility, Work and Enterprise*, Singapore: ISEAS: 95-117.

Weaver, K. Mark and Pat H. Dickson (1995), "Towards a unified model of SME-based strategic alliances: transaction costs, resource dependencies and social controls, paper submitted to the Academy of Management Entrepreneurship Division, Department of Management and Marketing, The University of Alabama, January, Tuscaloosa, Alabama.

WEF (2005), *The Global Competitiveness Report 2005-2006*, Palgrave Macmillan.

Weijland, H. (1992), "The Role of Middlemen in Rural Industry. An Empirical Study of Rural Industry in 25 Indonesian Provinces", mimeo, Faculty of Economics, Free University Amsterdam.

World Bank (1996), "Indonesia - Industrial Technology Development for a Competitive Edge", Report no. 15451-IND, May 29, Washington, D.C.

World Bank (2006), "Revitalizing the Rural Economy: An Assessment of the Investment Climate faced by non-farm enterprises at the District level", Consultative Draft, July, Jakarta.

Endnotes

1. This is part of the World Bank Study Project on Rural Investment Climate (RIC) Assessment in Indonesia, 2005-2006, financially supported by the World Bank-Netherlands Trust Fund for Institutional Development and Capacity Building and the DFID Poverty Reduction Partnership Trust Fund. I want to express sincere thanks to Dr Thee Kian Wie from P2E-LIPI and Dr Neil McCulloch from the World Bank Jakarta Office for their comments on this paper. Also I want to thank to the RIC Survey team for the Tegal case study led by Stefan Nachuk, and in particularly to Agni Paramita and Nunik Yunarti.
2. More empirical studies shown in, among others, Sandee *et al*. (1994), Van Dierman (1997), and Tambunan (1994, 2000, 2006).
3. See for example Harianto (1993), Kitabata (1988), Sato (2000), Supratikno (2001), and JICA (2000).
4. See Agrawal (2001) for a review of this literature.
5. See e.g. Anselin, *et al*., 1997).
6. The scale of each assistance program varied greatly based on the amount of funds, time frame and geographical scope.
7. For discussion explicitly or implicitly on the government programs to support SMEs in Indonesia, see for instance Klapwijk (1997), Sandee (1994, 1995), Sandee et al (1994, 2000, 2002), van Dierman (1997, 2004), and Sato (2000).
8. In this scheme, introduced on a nation-wide basis in February 1992, all state-owned enterprises and big private companies (LEs) were required to assist SMEs with capital, training and technical assistance, marketing, procurement of raw material, and many others. For example, with respect to marketing, the parent companies provided promotion facilities such as trade exhibitions and study tours for the supported enterprises or acted as a trading house. With respect to technology, the parent companies provided the supported enterprises with financial assistance for the purchase of new machines or provided them technical trainings or technicians during the innovation process.
9. These two industries were selected by the local government for intensive assistance based on existing competencies. According to Mr. Dasuki, Head of Industrial Affairs Sub-Agency, the industries showing the greatest competency are those seen as having access to key markets, having many including small workshops involved in the production, and having developed quality management systems.
10. A *plasma* subcontractor for KPY, one of PT Komatsu's *inti*, explained that his company received useful technical coaching as part of a quality control process conducted upon delivery of his product to KPY. In a case of knowledge spillover, his firm applied some of these technical lessons not only to his subcontracting operations, but also to the production of retail market goods.

Dr. Tulus Tambunan is lecturer and researcher in the Faculty of Economics, Trisakti University, Jakarta, Indonesia. He is also the director of the Center for Industry and SME Studies in the same university. His research areas of interest are development of small and medium enterprises (SMEs), industrial development, rural development and poverty. With respect to the issue of SME, recently he has published two books: Development of SMEs in Indonesia from the Asia-Pacific Perspective (Jakarta: LPFE-Usakti, 2006), and Entrepreneurship Development in Developing Countries (New Delhi: Academic Excellence, 2007). Dr. Tambunan received his PhD in Economics from Erasmus University (Rotterdam, the Netherlands).