Chapter 3

Manufacturing Capability

Breakthrough in manufacturing

Vietnam's growth was propelled by economic liberalization from the 1980s to the early 1990s, and by external opening and large inflows of capital and investment from the mid 1990s to present. As Vietnam graduates from the status of a low income country and aims at higher income in the future, growth can no longer depend merely on liberalization or accumulation. At the middle income level, productivity breakthrough is needed for creating value and moving up further.

Manufacturing plays a very important role in a developing country like Vietnam where the majority of population still reside in rural areas. While high-tech, software, and professional and financial service industries can provide jobs for well-educated urban people, as witnessed in Singapore and Hong Kong, the creation of jobs and income for a large number of farmers requires a robust growth of manufacturing. Strong manufacturing in turn generates strong demand for foodstuff, trade, domestic service, transportation and construction which further benefits a broad segment of the working population.

Improving agricultural productivity is certainly important for rural development. However, in Vietnam where population pressure is high, land is already divided into small plots, and irrigation, fertilizer and multiple crops have long been introduced, agricultural innovation alone is not enough to raise the income of rural population in line with that of urban brothers and sisters. Non-farm economic activities must lead rural prosperity, and manufacturing should be the central focus in this strategy. Rural industrialization and rural-urban migration in search of jobs are two ways of achieving this. Of these, rural-urban migration is already visible in Vietnam and will be an unstoppable phenomenon in the coming years. Thus, Vietnam's path to broad-based growth will be basically the same as the past experiences of Japan, Taiwan, Korea, Thailand, Indonesia and China in the sense that new manufacturing jobs must absorb a large number of workers migrating from the agricultural sector.

As industrialization proceeds, wages will inevitably rise. Labor shortage and job hopping have already emerged in southern industrial areas such as HCMC and Dong Nai where a large number of labor-intensive FDI firms operate. This situation will certainly spread to other areas in the future. Rising wage is a boon to workers, and policy makers should not fear it but introduce policies to move the economy to a higher level. Competitiveness will be enhanced, rather than harmed, if labor productivity rises faster than the wage. If that is not achieved, wage inflation only shifts the production base from Vietnam to other countries with lower wages, leaving nothing for the industrial capability of Vietnam.

Productivity breakthrough must be attained through a transformation of the manufacturing sector (i) from unskilled labor-intensive to skilled labor-intensive manufacturing; (ii) from copy production and contract manufacturing to *integral* manufacturing (see below); and (iii) from isolated production for local markets to the formation of industrial networks with close links to FDI firms and global markets.

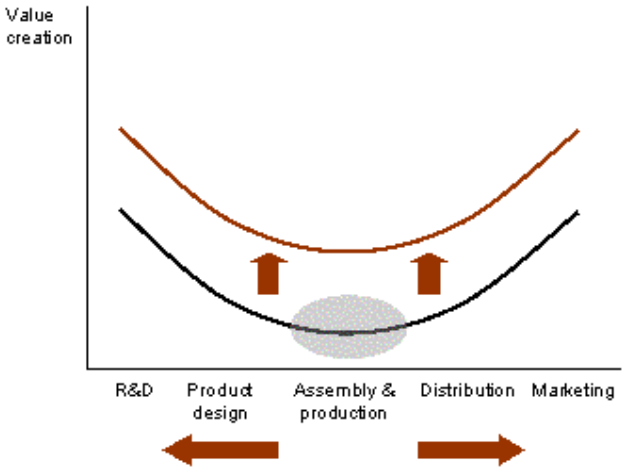
As was shown in Figure 1-3 in Chapter 1, East Asian economies are catching up with different speed. Middle income may be achievable by opening up and absorbing FDI, but high income cannot be reached unless an internal source of competitiveness is created and developed.

Manufacturing++

Malaysia has struggled for long to overcome the middle income trap. *Manufacturing plus plus* and *cluster based industrial development* are two related concepts in Malaysia's Second Industrial Master Plan (IMP2) 1996-2005 which concisely stated its strategy to bolster competitiveness (Ohno, 2006). Of these, *Manufacturing plus plus* expresses a two dimensional desire to (i) expand along the value chain to encompass higher value-added activities in both upstream and downstream; and (ii) uplift the whole value chain by raising productivity (Figure 3-1). Since Malaysia started industrialization as a simple assembler, which was the lowest point in the value chain, it wanted to master R&D, product design, distribution, marketing, and so on horizontally, and improve the skills of all these activities vertically.

On the other hand, *Cluster-based industrial development* broadens the concept of industry. An industrial cluster is defined as "an agglomeration of inter-linked or related activities comprising industries, suppliers, critical supporting business services, requisite infrastructure and institutions" (IMP2, p.23). It is a collection of various supporting industries and services as well as hard and soft infrastructure that surround any industrial activity. Malaysia's IMP2 selected eight industrial clusters to be strengthened: electronics and electricals, textiles and apparel, chemicals, resource-based industries, food processing, transportation equipment, materials, and machinery.

Figure 3-1 Manufacturing ++ of Malaysia



Source: Economic Planning Unit of the Prime Minister's Department, Malaysia (edited).

Policy orientation of IMP2 was thus clear. However, whether Malaysia was able to make significant progress along these lines during 1996-2005 is an open question. Among the monitoring criteria, investment targets were surpassed but other targets, more directly related to the broadening and raising of value chains, did not produce remarkable results. Part of the

reason for less-than-expected performance was the outbreak of the Asian financial crisis in 1997-98 whose negative impacts were however dissipated by 2005. Another reason seems to be the lack of selectivity; it was very difficult to simultaneously improve the scope and productivity of eight industrial clusters which cover virtually all manufacturing activities of this country. Finally, despite fairly active policy support, responses of the local private sector appeared to have been too weak.

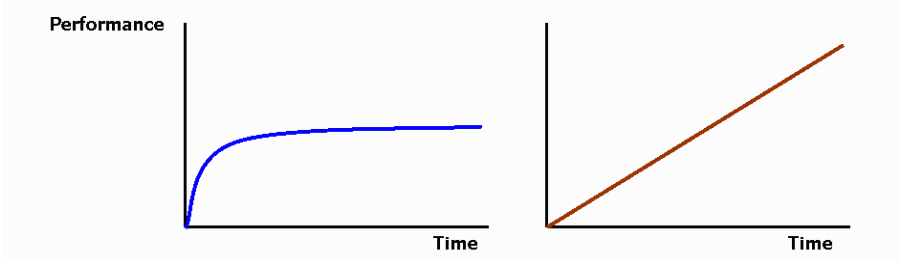
The general direction for leveling up Vietnam's manufacturing can be basically the same as Malaysia's Manufacturing ++ and cluster based industrial development. Vietnam should study why Malaysia could not fully realize these goals and formulate its own industrial policies to avoid delays and pitfalls.

Integral manufacturing

Prof. Takahiro Fujimoto and his research team at the University of Tokyo have advanced a business architecture theory to explain the fundamental differences among manufacturing industries of major economies such as the United States, Japan and China (Fujimoto, 2004; Fujimoto and Shintaku, 2005; Ohno and Fujimoto, 2006). According to this theory, there are two basic architectural types in manufacturing: *modular* and *integral*. In modular architecture, the modality of interaction among components is standardized for easy assembly. For example, desktop computers are a typical modular product in which globally common components from various companies can be freely combined, be it Korean, Taiwanese, or Thai. By contrast, in integral architecture, the complexity of interaction among components is happily accepted, and improvements are achieved through numerous trials and errors involving an assembler and a large number of component producers. For example, automobiles must be manufactured with integral architecture if multiple objectives such as power, comfort, style, safety, cost reduction, and fuel efficiency are to be attained simultaneously. Generally speaking, modular architecture is suitable for obtaining quick results at low cost while integral architecture is appropriate for the pursuit of ever-higher product quality in the long run (Figure 3-2).

Figure 3-2 Two Types of Manufacturing

	Modular manufacturing	Integral manufacturing
Parts interface	Parts are common and can be used for any model	Each product has unique parts, specifically designed
Merits	Quick results and flexibility	Endless pursuit of quality
Demerits	No differentiation, excess entry, low profit, lack of R&D	It takes much energy and time to achieve results
Institutional requirement	Openness, quick decision making, flexible outsourcing	Long-term relations, building internal skills & knowledge



Correspondence between products and business architecture is not fixed. It evolves dynamically with the business strategy of each firm or country, technical progress, and consumer tastes. For instance, a motorcycle can be produced as an integral product or a modular product with different product quality and different targeted customers. In addition, business architecture often has structural layers in which, for example, modularization may proceed in final assembly while integration may deepen in components.

Japan is a country of integral architecture, intensely interested in efficient factory operation and product integrity. By contrast, the United States excels in modularization and is good at slicing the supply chain of a product into appropriate elements, standardizing them, and making profits by the novelty of combination. China is also a country of modular architecture, but its comparative advantage lies in labor-intensive modular products rather than knowledge-intensive modular products as in the case of the United States. Fujimoto considers China to be a country of *quasi-modularity* since its manufacturing features mass production of products with copied design and technology rather than original innovation.

In general, there is no absolute superiority of ether business architecture. At advanced stages of economic development, which architecture is more suitable depends on each product as well as the strategy of each manufacturer. However, most producers in developing countries start with quasi-modular manufacturing, which means (often illegal) copy production of existing products with low to medium quality and low prices. This is expectable because they are initially in possession of little capital and technology. Such copycats are often collectively trapped in the vicious circle of too many entries, too low prices, and too little profit for investing in higher technology--a situation which Fujimoto dubs as *technological lock-in*. This is a very common problem among indigenous industries in developing countries (Sonobe and Otsuka, 2006).

To break free from this trap and raise overall productivity, innovative entrepreneurs who adopt new management, technology and marketing must lead the way, with less efficient producers exiting the scene. In Japan, Taiwan and South Korea, there were business innovators in sufficient number, at least in the past, which enabled these countries to proceed to the next level of industrialization. However, innovators are far scarcer in developing countries where the situation of low quality and low price persists.

From the perspective of business architecture theory, developing countries may start from, but should not stay forever at, the stage of copy production with simple modularity and little value-added. As a country with potentially good workers, Vietnam should strive to learn integral manufacturing to become a strong manufacturing country. Fujimoto (2006) regards Vietnam and Thailand as the best candidates for becoming producers of labor-intensive integral architecture goods. Skilled labor, supporting industries and logistics are the three requirements for mastering integral manufacturing. These requirements are discussed in more details below.

Supplying skilled labor

The importance of human resource development is well recognized. However, to gain industrial competitiveness general promotion is not enough. High literacy and universal primary education are certainly necessary but not sufficient for competing fiercely in the global market. Technical and vocational education and training (TVET) must be concrete and integrated with the nation’s industrial positioning strategy.

Vietnam's human resource development has many problems. On the policy side, the lack of clear industrial positioning vision prevents effective formation of strategies for industrial skill build-up or labor demand and supply matching. On the side of students, the popularity of computer science, finance, and business administration as subjects and the corresponding lack of interest in engineering and industrial technical training is a problem. On the side of workers, short-terminism and materialism create preference of higher salaries and greater benefits today instead of striving for higher technical competency in the long run, which leads to high incidents of job hopping. On the side of managers, enthusiasm to learn technology and conduct aggressive marketing to become business partners of foreign companies is frequently missing.

In order to overcome these problems, the following policy goals are proposed for 2020. First, the annual flow of university graduates from technical and engineering departments should be raised to at least the level equivalent to Malaysia and Thailand (relative to population). Second, the vast majority (80-90%) of top executives of manufacturing FDI firms should be Vietnamese locals in all areas including administration, production management, sales and procurement (however, localization of skilled labor should be realized on a voluntary, not compulsory, basis just as in the case of localization of parts and components). Third, the National Manufacturing Meister System should be established, with appropriate training institutions, foreign dispatches, testing criteria, and a certificate system, to produce at least 100 extremely skillful engineers (Meisters) per year in electronics and mechanical production. These Meisters should contribute directly to the actual production processes of manufacturing enterprises and be responsible for teaching others. Detailed sectoral targets may be set for these three goals if that is necessary.

As a precondition to realize these goals, a national campaign should be launched to elevate the social status of manufacturing and engineering to at least the same level as computer science, finance or business administration. Moreover, TVET policies and programs should be designed carefully with sufficient inputs from domestic and foreign experiences and in close trilateral cooperation among training institutions, enterprises and international donors.

Vietnam already has excellent industrial training programs although the number is still small. These institutions should be identified, publicized and supported. The government should provide necessary support to sustain their programs and encourage spillover effects to other institutions. Table 3-1 shows some industrial training programs that are considered successful.

Table 3-1 Some Successful Industrial Training Programs in Vietnam

	Period	Location	Foreign partner	Budget size	No. of students	Courses
Cao Thang Technical College	1905-	HCMC	No	Self finance	7,500 in 2006 (plus 7,000 in short courses)	30 industrial majors with clear career orientation and practical workshops
Vietnam-Germany Center at HCMC University of Technical Education	1993-2000	HCMC	Germany	7 mil USD	400 per year	Standardized programs to train teachers in electrical-electronics and mechanics, with modern equipment
Vietnam-Singapore Technical Training Center	1997-2005	Binh Duong	Singapore	5 mil USD	500 (in 2002)	Electrical-electronics, mechanics, mechatronics, customized courses; in

						cooperation with VSIP
Vietnam-Japan Technical Center at Hanoi Industry University	2000-2005	Hanoi	Japan	6 mil USD	720 per year (plus 1,300 in short courses in 5 years)	Machining, metal processing, electrical control; using modern equipment and teaching good attitude
Vietnam Japan Cooperation Center	2000-2010	Hanoi, HCMC	Japan	n.a.	2,000 in 6 years	Business administration and strategy, production management, etc. for top and middle managers

Source: Pham Truong Hoang and Ngo Duc Anh (2008).
Note: Budget size includes counterpart funds on the Vietnamese side. Original currency units are converted to USD at prevailing exchange rates.

These programs achieve good performance in different ways. Some provide broad technical training while others focus on high skills in limited fields using most modern equipment. Some train new workers, others target teachers, and still others educate top and middle managers. However, all of them share common features such as (i) integrating theory with practice; (ii) labor demand-orientation in close consultation with manufacturing firms; and (iii) constant updating of teaching to catch up with technical progress.

Close trilateral cooperation among training institutions, enterprises and donors is crucial for the overall effectiveness of training. Working with enterprises is particularly important for adjusting curriculums to their labor requirements, receiving their support in the forms of instructors and equipment, obtaining information on new technology, and securing the employment of graduating students. Without this linkage, TVET programs will be hardly effective.

Trilateral cooperation is also needed for financial viability. A large expenditure is required to update training programs to catch up with rapid technical progress. Purchasing modern equipment especially costs a large sum which is beyond the financial ability of most training programs in Vietnam. Even foreign supported programs with good records, as in Table 3-1, may face financial difficulty when international cooperation ends. Several methods should be introduced to solve this problem, including (i) providing services, such as consulting and product development, to make commercial profit[1]; (ii) cooperating with enterprises which value the training program highly and are willing to donate equipment[2]; (iii) continuing to receive foreign support from the same or another source.

Supporting industries

Supporting industries are multiple layers of domestic manufacturing establishments that produce parts and components for machinery assemblers such as electronics, automobiles, and motorcycles (Ichikawa, 2005; Nguyen Thi Xuan Thuy, 2007). Since a large part of value

[1] After Japan ended its support, the Vietnam Japan Technical Center began to conduct commercial projects such as R&D in the water pressure testing system, the material measuring and mixing system, the control system for Nghi Son Cement, and jigs and drags for Canon Vietnam.
[2] The Vietnam-Germany Center received a lab for operating PLC S7-300 from Siemens Automation and a room with CAD-CAM/CNC software and equipment from Berlin Software and Technical Company. The Vietnam-Singapore Technical School also received a prematics lab from Festo (Singapore) Pte Ltd. and a metrology lab from Mitutoyo Asia Pacific Pte Ltd.

(typically 80-90%) of mechanical products comes from parts and components while labor-intensive assembly adds relatively little value (typically 5-10%), competitiveness requires easy access to suppliers of parts and components that can offer QCD[3]. The quality of final products critically depends on the quality of parts and components that go into assembly.

Among East Asian economies, Japan and Taiwan are well equipped with strong supporting industries. In most developing countries, however, supporting industries are either nonexistent or very weak, which negatively affects FDI attraction, industrial agglomeration and technology transfer. In fact, the term *supporting industries* was created by Japanese firms to point out the absence of such industrial activities in Southeast Asia when Japanese FDI inflows to that region increased in the 1980s (MITI, 1985). In comparison with the ASEAN4 countries with at least a few decades of supporting industry promotion, Vietnam's supporting industries are in the very early stage of development.

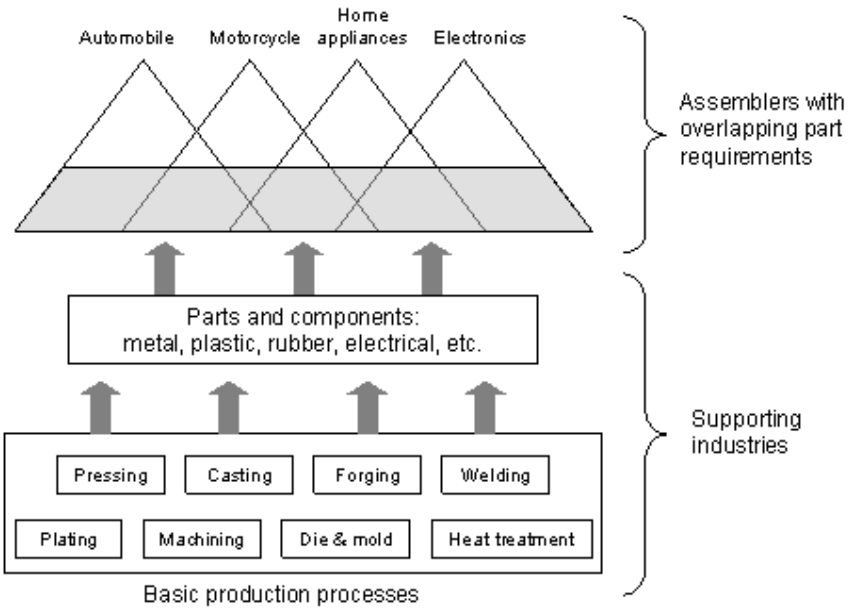
Many developing countries target highest-value components such as engines for automobiles and motorcycles, optical devices for DVDs and hard disks, compressors for air-conditioners and refrigerators, and so on. However, these key components are usually too difficult to produce without significant foreign help. Even in advanced countries, only a few firms have the capability to produce them competitively and their technology is a top industrial secret. Low or middle income countries with only a short history in industrialization should first strengthen basic skills applicable to a large number of products instead of trying to leapfrog to the most advanced production technology.

What assembly-type FDI manufacturers desperately need is a critical mass of reliable domestic producers (this includes both local and FDI firms) that can perform basic production processes such as *pressing, casting, forging, welding, plating, machining, molding* and *heat treatment* on metals, plastic, rubber, and other industrial materials. These processes are generic and can support different manufacturing sectors including automobiles, motorcycles, industrial and construction machinery, precision machinery, electronics, or home appliances (Ichikawa 2005; VDF 2006). Among such processes, by far the most crucial task is the *production and maintenance of dies and molds* for metal and plastic processing. To perform these processes at variable quality is relatively easy; the only requirement for that is the purchase of relevant equipment. But to do them at the level required by demanding FDI assemblers is extremely hard. This difference determines whether or not the supplier can become part of the global value chain, and that is what local firms in ASEAN4 by and large fail to attain after many decades of trying[4].

Figure 3-3 The Concept of Supporting Industries

[3] Quality, Cost and Delivery (i.e., zero defects, low cost, and on-time delivery). QCD is recognized by virtually all Japanese manufacturing firms as the source of competitiveness as well as the criteria for selecting business partners and subcontractors.

[4] Indonesia, a country that received large waves of manufacturing FDI in the 1970s and again in the 1990s, still needs help in strengthening its die and mold technology. In 2006, the Indonesian Mold & Dies Industry Association was launched for this purpose under bilateral cooperation between Japan and Indonesia.



One way to build up supporting industries, especially in early stages, is to absorb a large mass of FDI suppliers of parts and components. The majority of FDI suppliers are SMEs that use expensive equipment, and for this reason they need large orders and stable policy environment to invest in Vietnam (VDF 2007). The only two products that have sufficient large operation scale in Vietnam are motorcycles (for the domestic market) and electronics such as printers and mother boards (for export). The operation scale of automobiles, TV and audio-visuals are too small to invite foreign suppliers at present. Another way to promote supporting industries is to strengthen the capability of local suppliers. For this to succeed, the capability of local suppliers needs to be greatly improved with proper policy support. Realistic plans for local capability building should be established since some parts and components, such as precision parts for electronics, may be initially too difficult for Vietnamese suppliers to produce with QCD.

To increase the capability of Vietnam's supporting industries at the maximum speed, the following targets are proposed for 2020. First, Vietnam should aim to become a global supplier of dies and molds and their maintenance service with QCD. For this to be realized, a very intensive promotion plan must be implemented with appropriate foreign assistance. Second, Vietnam should be able to fill the domestic needs for all basic production processes mentioned above with QCD. Third, strategic FDI marketing should be conducted to create an industrial agglomeration of several large-scale foreign electronics assemblers and a large number of FDI suppliers to serve them in an appropriate location in Northern Vietnam. Any province in the Red River Delta can be a host to such agglomeration (including Hoa Lac High Tech Park in Ha Tay).

The Motorbike Joint Working Group (2007), which drafted the motorcycle master plan in close cooperation among officials, producers and experts, argued that initial agglomeration of local supporting industries should be built around the motorcycle industry, and proposed the following six measures to enhance motorcycle supporting industries: (i) financial incentives; (ii) effective use of foreign experts; (iii) strategic FDI marketing; (iv) supporting industry database linked with business matching service; (v) pilot institutions for TVET; and (vi) quality testing centers. These measures can be extended to the supporting industries of other

industries. In fact, the promotion of motorcycle supporting industries will have spillover effects on other industries because supporting industries are overlapping across many assemblers as illustrated in Figure 3-3.

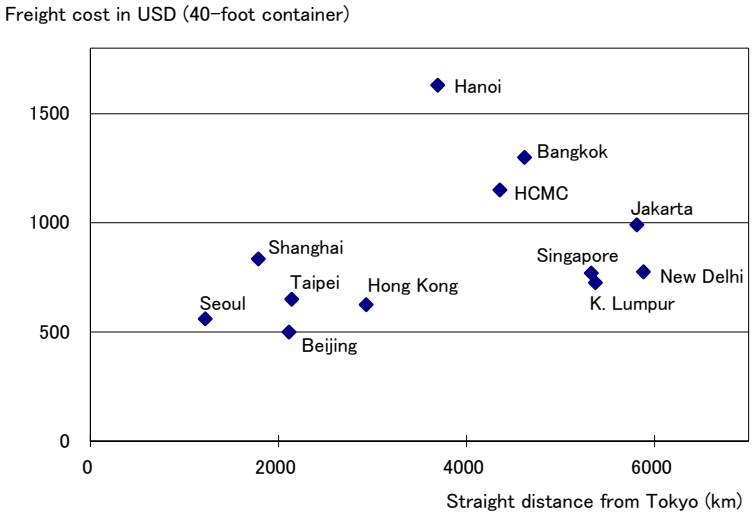
Logistics

Good logistic services can reduce the cost of doing business. They enable manufacturers to achieve quick deliveries of inputs and finished products, lower transport cost, and the shortening of production lead-time. These are essential conditions for attracting investors, especially those firms that produce high-value products in response to rapidly changing customer demands.

To deliver products cheaply, quickly and on-time requires not only short distance, but a large number of factors related to both hard and soft infrastructure. They include efficient transport systems such as ports, roads, air links and cargo handling facilities; improvements in the systems of collection, delivery, sorting, loading and unloading; transparent and speedy tax and customs procedures; and supporting functions such as finance, insurance, storage and trucking.

Figure 3-4 illustrates shipping costs of 40-foot container from various Asian cities to Tokyo. It is clear that distance cannot explain everything. Despite relatively large distance, freight costs from Singapore, Kuala Lumpur, Jakarta and New Delhi are similar to those from much closer cities such as Shanghai and Taipei. Hanoi has the highest freight cost among all these cities, and at above USD 1,000 Bangkok and HCMC are not very competitive either.

Figure 3-4 Sea Transportation Cost to Tokyo



Source: JETRO, "The 15th Survey of Investment-related Cost Comparison in Major Cities and Regions in Asia," March 2005.
Note: Sea transport cost from the city via the nearest port to Yokohama Port (adjacent to Tokyo) as of November 2004.

Hanoi's low performance is mainly due to the absence of direct shipping service between Hanoi and Tokyo. Shipment must go through one of the hub ports such as Hong Kong, Singapore or Kaosiung for reloading to larger vessels because Hai Phong is a feeder port with low capacity (10,000t maximum) and Cai Lan Port, although deep, lacks a truck terminal and

frequent service (JBIC 2006). Additional problems for Hanoi include small and lopsided cargo (inbound freight is larger than outbound) and road transportation cost from either port to Hanoi. These disadvantages impede Northern Vietnam's ability to integrate effectively into the regional production network. Serious policy consideration is needed to ameliorate these problems and make Hanoi more competitive.

A comprehensive study on the logistic aspects of Vietnam's competitiveness should be conducted, with concrete recommendations for reducing the time and financial cost of moving products, people and information. Based on the study, the Government should launch aggressive measures that make the logistic services of Vietnam at least as efficient as—and hopefully better than—ASEAN4 by 2020.

Three conditions for success

Three additional conditions are needed if the policy initiatives discussed above are to be implemented effectively.

First, Vietnam must have an overall industrial master plan which is sufficiently strategic and concrete before specific strategies such as skilled labor, supporting industries and logistics can be effectively formulated. An overall industrial master plan, containing clear targets and action plans in these areas, should be drafted as a matter of highest national priority.

Second, a significant reform in policy making methodology is necessary. Vietnam's current methodology retains the features of old economic planning and seriously lags behind those of neighboring countries. Weaknesses include the lack of stakeholder involvement (especially the business community) and the lack of inter-ministerial coordination. Too many laws, master plans and policies are produced that are often delayed or remain unimplemented due to the lack of necessary details, budget, personnel and organization. This is a very odd situation that must be corrected as soon as possible.

Third, Vietnam should positively mobilize international support in all areas suggested above. International assistance, both private and official, should be aligned to realize specific targets in the overall industrial master plan. It is particularly important to mobilize Japan's ODA and business support on a large scale[5]. Assistance from other advanced industrial economies such as Singapore, Korea and Taiwan should also be sought. The strengthening of Vietnam's industrial capability will also benefit these economies as the scope of their global production networks broadens.

These policy efforts should be exerted intensively and in a relatively short time, rather than broadly for an extended period. Policy makers should sharply focus on a few strategic areas where the maximum impacts are expected and the largest attention can be drawn from investors. A national strategy for intensive leveling up of manufacturing should be launched and all policy efforts and international assistance should be mobilized to generate tangible results within four to five years—for instance, from 2009 to 2012. Speed is essential in staging a manufacturing breakthrough because Vietnam is currently receiving the second

[5] From 2003 to 2007, the Vietnam-Japan Joint Initiative was conducted in two phases to improve the business environment for competitiveness. A large number of issues were taken up and most of them were corrected successfully. However, removing business obstacles is not enough for Vietnam's manufacturing breakthrough. From now on, Japanese assistance should be mobilized mainly for setting concrete industrial targets and achieving them.

wave of FDI with increasing demand for skilled labor, supporting industries and logistics. If this chance is missed, the momentum for stepping up may not return in the near future.