6 Conclusion and Recommendations

6.1 Conclusion

The present study analyzes the current state of the regulatory framework, human resource development, organization and system, facilities and equipment in the areas of standardization, metrology, testing and inspection, and quality control ("standardization and related activities", or SMTQ), and evaluates their ability to address the issues related to industrial development.

The result of the study indicates that the following two goals are important in the area of standardization and related activities so as to address the major issues related to industrial development:

1) Promotion of company standardization and dissemination of the new concept of quality control (or quality management), which help develop industry so that it functions well in the new economic system; and
2) Strengthening and expansion of the standardization system so as to be conducive both to reducing the adverse impacts that market opening will have on the domestic economy, and to the developing technology infrastructure that contributes to industrial development by making the most of the open economy.

The results of evaluation of the current system of SMTQ, and suggested directions for improvement are summarized in Table 6-1. Also, the required actions based on it are shown in Table 6-2 by dimension of activities.

In fact, STAMEQ, the central agency in the country's promotional efforts on behalf of standardization, understands these issues well and has carried out the improvement of many subsystems, including the evolution of the standardization system so as to qualify it for international recognition.

Nevertheless, further efforts are essential in the process of improving, reinforcing, and building the SMTQ system, recognizing the problem areas of the existing system precisely as follows:

1) The system to promote standardization and related activities has thus far developed primarily on the basis of objectives of administrative control and regulation. As a result, there is the apparent lack of understanding of standardization and quality management as being means to strengthen enterprises and their competitiveness.

2) Some of the existing systems are not fully enforced. Some of them may have a symbolic function to show the government's attitude, while others impair reliability of the entire system due to their insufficient enforcement.
3) Testing and calibration equipment, and measuring instruments owned by public testing laboratories, are insufficient in number and variety, and/or are deteriorated in functions due to aging, making them unable to satisfy changing industrial needs.
4) There is a shortage in enterprises of engineers who are experienced in design development and modification of process and product, resulting in a shortage of engineering skills that can be used for development and revision of standards suitable for technology levels in the country.
5) There is a shortage of qualified certification auditors as well as testing and inspection personnel, who are essential in developing the system so as to qualify for international recognition.

6.2 Recommendations

6.2.1 Recommendations

To address the issues, it is recommended to take actions according to the improvement and development suggestions made in Chapter 3 (summarized in Table 6-1). At the same time, immediate implementation is recommended for the following projects among those formulated in Chapter 4 as the measures for realizing these recommendations:

1) Project to develop promotion system of company standardization and quality control under the new concept (or quality management), and nurturing the leaders for it at various levels (Project #1)
2) Project to assist improvement of quality capability of factories positioned as the central core of subsectors (Project #2)
3) Project to upgrade and expand the mandatory certification scheme particularly regarding safety of electrical and electronic appliances (Project #3)

Also, it is recommended to launch the following projects together with, or following the above projects:

4) Project to prepare for development of certification system with conformity with foreign standards under agreement with foreign countries (Project #4)

The immediate implementation of a part of the following project, and further study of a part of it from the long-term stand point of view, are recommended.

5) Project to upgrade/improve metrology and calibration system (Project #5)

These project recommendations and some improvement and development recommendations which require significant capital investment are summarized in Table 6-3.

Some of them have been or are planned to be started as part of other projects. Thus, coordination and promotion will be critical in the project implementation process with a view to bring them as well as those contained in other projects into an entire system which serves the objective in a consistent manner.

By implementing the above recommendations and projects, the organization and resources in the areas of standardization and related activities will be developed step by step accordingly as shown in Figure 6-1.

6.2.2 Recommendation for organizational setup of STAMEQ

All the functions related to the activities of standardization and relevant areas in Viet Nam are concentrated at STAMEQ. However, its traditional role has been limited to the securing of fairness in the production and distribution processes in terms of quality and metrology, and it has only started the function of promoting company standardization and quality management in industry. Therefore, the existing functions of STAMEQ are understood to be not fully satisfying requirements, and this matter is under consideration.

As a basis of planning STAMEQ's organization and resources so as to fulfill its vested function in the areas of standardization and related activities[1], STAMEQ is expected to assume the following roles: 1) to conduct, on behalf of industry, standardization activities which should be undertaken by industry, but cannot be covered by them; 2) to promote standardization activity in industry; and 3) to represent the country's interests in international standardization activities. Based on this framework, the following are the recommendations related to STAMEQ's organization and resources.

1) Functions and organizations to be added in promoting standardization and related activities

   In fact, there is no function which is to be added to those discussed and contained in the individual areas at the present stage. Nevertheless, in the future STAMEQ is required to launch research activities (standardization research) when the need for developing its own standards arises to meet the needs of industries and/or consumers.

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[1] The present study does not cover other functions, such as legal metrology, quality regulation on the basis of quality registration, and import inspection on quantity and specifications.

Further, STAMEQ needs to have an advisory panel or council on standardization, so that the opinions and views of industrial communities can be reflected in STAMEQ activities. The committee members will give advice on the basic direction of standardization activities of STAMEQ, upon request, for the time being. In the future, however, the committee/council should be developed so as to have divisional organizations to investigate and deliberate the direction of standardization policy and activities[2].

2) Functions and organizations to be improved, expanded or modified

a) STAMEQ needs to strengthen its planning department, both in its scope of work and staffing, in order to better grasp the actual needs of industries and translate them into standardization activity.

b) To ensure impartiality of the certification system, either the certification body or the accreditation body must be made independent from STAMEQ.

c) At present, there are three organizations (one of them is in the preparation stage) which assume responsibility for technical guidance related to promotion of standards, and assistance and training in quality management and company standardization; namely, Training Center, SMEDEC, and VPC. However, given the current state of enterprises in the country (dominated by state enterprises, with no significant development of the private sector), it is difficult to justify functional separation of these organizations. It is possible to integrate them into a single organization responsible for promotion and training.

d) It is recommended to assign the functions of technical guidance related to dissemination of standards, and quality management and company standardization to local SMQs which are operated under the technical guidance/advice of STAMEQ, step by step, in accordance with development of domestic industries. More precisely, in contrast to QUATEST which should be strengthened as a part of the central government, SMQ needs to be reinforced in the context of local government. In other words, its organization and resources should be expanded side by side with the enhancement of local government. Basically, it will proceed by gradually transferring QUATEST's functions. At the present stage, it will include the function of legal metrology service as well as testing and technical assistance service for local industries.

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[2] Further development of industry particularly with evolution of industrial technologies in the field of product development and improvement is a prerequisite for the leadership by the industry, and such development is assumed to take time.

3) Geographical location of STAMEQ's office, laboratories, and other facilities

Organizations under STAMEQ can be roughly classified into the following categories:

a) Those closely related with other government organizations, including policy formulation in coordination with other agencies, departments and industries

b) Those providing service for enterprises and government organizations, including information service, training, and technical guidance service, etc.

c) Those required to be located in industrial areas, such as testing and inspection function

d) Those requiring interaction with other research organizations, such as an organization to maintain national measuring standards or to develop standards

Among them, those under Category (a) will function most effectively if they are located in Hanoi where government organizations are concentrated. Those under (c), on the other hand, should preferably be located in the center of an industrial area, and according to the current factory distribution pattern, Nghia Do seems to be the most suitable site. However, as factory distribution will change in future (for instance, due to industrial development in the north of Hanoi near the airport, and the major development in Ha Tay under planning), relocation of laboratories should become the subject of discussion.

Those under (b) are strongly related to both government agencies and manufacturers. While they will be convenient if they are located in the same site as (a) for the time being, they may have to be added to industrial areas, too, in future.

The location and environment conditions of VMI, which maintains national measurement standards, should be studied with the objective of placing it suitably with regard to achieving its purpose of maintaining national measurement standards in a long-term view. A building for exclusive use of VMI would be suitable.

Further, financial and other constraints necessitate laboratories to be operated by centralizing staff and equipment as far as possible at the present stage. In future, however, they should develop branch laboratories convenient for the manufacturers and following the expansion of industrial zones.

Table 6-1: Summary of Issues and Recommendations

Areas and Issues	Recommendations		
	Immediate actions (1-3 years)	Short/mid term (3-5 years)	Mid/long term (5-8 years)
Public administration system related to standardization and quality control, and their organizational setup			
1) **Direction of national standardization activities:** strong drive from administration view points, while insufficient reflection of needs of industry on standard development and system development	Include the following as one of the major targets of activity: 1) Encouragement of participation of industry and enterprises in national standardization and quality management activities, 2) Promotion of standard activities at industry and enterprises. (The details of recommended activities for functional development are given in the individual items.)	Establishment of an advisory panel on basic plan of STAMEQ.	Establishment of Standardization Council as a national representative body for standardization, while STAMEQ acts as the secretariat of the Council.
2) **Functional development:** under study or in transition stage in many areas of system and organizational setup and improvement		Promotion of (international) regional cooperation in joint development/undertaking of standardization and quality management promotion (the details of recommended activities are given in the individual items.)	(The details of recommended activities for functional development are given in the individual items.)
Development and dissemination of standards			
1) **Establishment and updating of standards:** need to develop standards in the following areas of strong needs of industry. ・Review of national standards established on the basis of GOST/COMECON standards, to ensure consistency with international standards ・Adopt international standards to national standards, while harmonizing them with the local technology level ・Standard development/adoption of international standards in the following: 1) to prevent confusion in trade and product design, 2) to expand and reinforcement of mandatory product certification, 3) to be used in quality management.	Development and update of standards in the following fields of strong needs: 1) Metallurgy 2) Machine elements 3) Electrical standards 4) Quality management	Increased involvement and reflection of needs of industries, consumers, and academe in standard development and update.	Research work for establishing standards of industrial technologies, and development of testing methods, and standards.

Areas and Issues	Recommendations		
	Immediate actions (1-3 years)	Short/mid term (3-5 years)	Mid/long term (5-8 years)
2) **Voluntary or mandatory:** Co-existence, while inconsistent implementation.	Establishment of all the standards as voluntary, to change the system for standards to be developed as technological basis.		
3) **Dissemination of standards:** ・Need for dissemination activities to deepen the understanding of contents of standards.	Strengthen the dissemination activities for publicity of : 1) Transition of standards based on GOST/COMECON system to ISO/IEC system 2) Expansion of coverage of products under mandatory certification scheme, and 3) Encouragement of company standards		
・Difficulty in obtaining technological information on foreign standards, international standards and quality management.	Strengthening of information gathering activities with integrated activities in Hanoi and HCMC	Upgrading of information center	

Areas and Issues	Recommendations		
	Immediate actions (1-3 years)	Short/mid term (3-5 years)	Mid/long term (5-8 years)
Certification and accreditation			
1) **Voluntary product certification scheme:** limited number of companies certified, and industries involved. Limitation of quality registration scheme and import/export inspection system in their role in promotion of standardization and quality management.			
・Need for certification of enterprises active only in the local market.	1) Ensure reliability of certification scheme 2) Transfer enterprises under quality registration scheme to product certification scheme with transition of the system 3) Provision of incentives by the Government to the enterprises under product certification scheme		
・Need for certification of enterprises engaged in export and in trade with J/V in Viet Nam.	Upgrading of product certification scheme to be accepted in the international trade: 1) Review of current procedure of certification 2) Nurturing of assessors for certification 3) Ensuring the testing capability **(Project Recommendation # 4)**	Development of the system of certification with conformity with foreign standards **(Project Recommendation # 4)**	

Areas and Issues	Recommendations		
	Immediate actions (1-3 years)	Short/mid term (3-5 years)	Mid/long term (5-8 years)
2) **Mandatory certification scheme:** a) Limited number of products covered, b) not operated effectively due to incomplete execution. The same situation for import/export inspection system.	Ensuring reliability of the scheme with complete execution, through: 1) review of necessity of certification for the currently covered products, and 2) integration of similar schemes. Expansion of coverage and preparation for execution in accordance with the expansion: 1) Establishment of safety standards to be used for certification 2) Provision of technological assistance to the manufacturers 3) Upgrading/preparation of testing equipment needed 4) Strengthening of public relation function **(Project Recommendation # 3)**	International joint undertaking for establishment of safety standards and testing method standards.	Transition to the system based on self declaration.
3) **Quality system certification & accreditation system:** Incomplete legal entity of national accreditation body in view of ISO/IEC Guides. Insufficient number of qualified assessors to operate the system.	1) Nurturing of staff required for certification and accreditation bodies 2) Securing legal entity of national accreditation body according to ISO/IEC Guides	Expand the system to environmental management	

Areas and Issues	Recommendations		
	Immediate actions (1-3 years)	Short/mid term (3-5 years)	Mid/long term (5-8 years)
Quality Management			
1) **Awareness of needs for and practice of quality management:** quality inspection is regarded as quality management. High rejection rate in the production process remains unchanged without improvement, deteriorating the international competitiveness. Insufficient quality of raw materials and components results in decrease in industrial linkage in the country.	Quick and mass dissemination of quality management under new concept. 1) Nurture of promotion leaders and organizers **(Project Recommendation # 1)** 2) Dissemination to the enterprises positioned at the central core of industries **(Project Recommendation # 2)**	Strengthen the dissemination system to SMEs: Development of promotion guideline of quality system designed particularly for SMEs.	
2) **Testing equipment and measuring instruments required for undertaking quality management:** Even the factories positioned at the central core of the industry, do not have sufficient equipment and instrument.	Preparation/upgrading of testing equipment and measuring instruments required for undertaking quality management: 1) Deployment to public laboratories **(Project Recommendation # 1)** 2) Assist installation by the core enterprises **(Project Recommendation # 2)**	Expansion to other industrial accumulation areas.	Further development to district industrial technology supporting centers

Areas and Issues	Recommendations		
	Immediate actions (1-3 years)	Short/mid term (3-5 years)	Mid/long term (5-8 years)
Testing and Inspection			
1) **Inspection system to support operation of certification schemes, etc.:** a) Insufficient testing/inspection equipment at public laboratories, b) no accredited laboratory under the new accreditation scheme of laboratory.	Improvement of testing system for certification: 1) Revision of requirement of testing for certification scheme 2) Upgrading/preparation of testing equipment at public laboratories 3) Development of laboratory accreditation scheme from the view point of international mutual recognition	1) Joint activities for mutual recognition of laboratory accreditation. 2) Promotion of owning and maintaining of different advanced standards among ASEAN countries each other under international cooperation	
2) **Testing equipment and measuring instruments required for undertaking quality management:** Even the factories positioned at the central core of the industry, do not have sufficient equipment and instrument.	Preparation/upgrading of testing equipment and measuring instruments required for undertaking quality management: 1) Deployment to public laboratories **(Project Recommendation # 1)** 2) Assist installation by the core enterprises **(Project Recommendation # 2)**	Expansion to other industrial accumulation areas.	Further development to district industrial technology supporting centers

Areas and Issues	Recommendations		
	Immediate actions (1-3 years)	Short/mid term (3-5 years)	Mid/long term (5-8 years)
Industrial Metrology and Calibration			
1) **Equip and maintain national measurement standards:** Insufficient accuracy of equipment and unsatisfactory condition of facilities result in difficulty in ensuring required accuracy.	To meet the urgent and immediate needs: 1) Provision of scales for mass calibration with higher accuracy level 2) Provision of a set of general electric standards with higher accuracy level 3) Provision of high precision and capacity standards in the area of flow and related secondary standards **(Project Recommendation #5)**	Development of calibration network through establishment of national metrology system, while making most of the equipment available in industry, institutes, etc. **(Project Recommendation #5)**	Upgrading of VMI in view of long-term development: 1) through international cooperation 2) upgrading starting from the secondary standards making use of the advanced standards available overseas 3) relocation to the more suitable site **(Project Recommendation #5)**
2) **Calibration system:** Inconsistency of national calibration system among North and South. Difficulty to fulfill the calibration needs of petroleum industry, and electrical & electronics industry in terms of accuracy and volumetric capacity.			
3) **Metrology and calibration technology:** Difficulty in nurturing and ensuring the number of qualified engineers.		Promotion of (international) regional cooperation in joint establishment of training center for nurturing metrology engineers.	

Table 6-2: Summary of Requirements for Development of SMTQ

Fields and Recommended Actions	Requirements by Dimension			
	Regulatory systems	Systems/Procedures & Organizational Set-up	Human Resources	Facilities/Equipment
Public administration system related to standardization and quality control, and their organizational setup				
• **Direction of national standardization activities:** Reflect needs of industry on standard development and system development	• Include as one of the major targets of activity.	• Establishment of an advisory panel/ standard council.		
Development and dissemination of standards				
1) **Establishment and updating of standards:** Need to develop standards in the areas of strong needs			• Promotion of involvement of engineers from industry in standard development	
2) **Voluntary or mandatory:** Establishment of all the standards as voluntary	• Establishment of all the standards as voluntary, while make it mandatory by law.	• Execution of the law by the competent gov't agency as mandatory.		
3) **Dissemination of standards:** -Strengthen dissemination activities to deepen the understanding of contents of standards.		• Define the function of Training Center	• Nurture of testing engineers (QUATEST)	
-Gathering & provision of technological information on foreign standards and quality management.		• Reinforcement of Information Center		

Fields and Recommended Actions	Requirements by Dimension			
	Regulatory systems	Systems/Procedures & Organizational Set-up	Human Resources	Facilities/Equipment
Certification and accreditation				
1) **Voluntary product certification scheme:** • Meet the needs for certification of enterprises active only in the local market.			• Nurture of certification auditors	• Installation of testing equipment for products covered
•Meet the needs for certification of enterprises engaged in export and in trade with J/V in Viet Nam.		• STAMEQ as qualified certification/inspection body by foreign certification system	• Nurture of certification auditors, and testing engineers	• Installation of testing equipment for products covered
2) **Mandatory certification scheme:** Ensuring reliability of the scheme with complete execution, expansion of coverage and preparation for execution	1) Establishment of all the standards as voluntary, while make it mandatory by law. 2) Unification with import inspection system 3) Adopt production process assessment method 4) Expansion of coverage		• Nurture of certification auditors, and testing engineers	• Installation of testing equipment for products covered
3) **Improvement/development of system for certification & accreditation:** 1) Nurturing of staff required for certification and accreditation bodies 2) Securing legal entity of national accreditation body according to ISO/IEC Guides		• Ensuring impartiality of certification and accreditation bodies	• Nurture of certification auditors	
Quality Management				
1) Quick and mass dissemination of quality management under new concept.			• Nurture of quality management leaders, organizers at dissemination organizations, and lecturers	

Fields and Recommended Actions	Requirements by Dimension			
	Regulatory systems	Systems/Procedures & Organizational Set-up	Human Resources	Facilities/Equipment
2) Preparation/upgrading of testing equipment and measuring instruments required for undertaking quality management.				1) Installation of testing equipment for QM at QUATEST 2) Establishment of branch laboratories of QUATEST in industrial areas
Testing and Inspection				
1) Improvement of testing system for certification.			· Acquisition of testing skill to be conducted based on standards	· Installation of testing equipment for products covered
2) Preparation/upgrading of testing equipment and measuring instruments required for undertaking quality management.			· Nurture of industrial technology extension officers	1) Installation of testing equipment for QM at QUATEST 2) Establishment of branch laboratories of QUATEST in industrial areas
Industrial Metrology and Calibration				
1) Meet the urgent and immediate needs.				· Meet the urgent and immediate calibration needs.
2) Upgrading of VMI in view of long-term development.	· Development of metrology/calibration system	· Development of metrology/calibration system	· Joint establishment of training center of metrology/calibration engineer	1) Making most of the facilities/equipment available in other organizations through development of metrology/calibration system 2) Joint development of the system with regional cooperation 3) Making most of the advanced measurement standards available internationally 4) Study on optimal location of VMI, with possible transfer plan

Table 6-3: Summary of Project Recommendations

Recommended Projects	Objectives	Outputs	Evaluation Results	Expected Economic Effects, and Difficulty in Implementation	Estimated Costs for Facility/ Equipment
Thrust 1: Qualitative improvement of industries/ enterprises through promotion of company standardization and QM					
(1) Development of promotion system of company standardization & QM, and nurturing of leaders of various levels	Develop an organization and resource of promotion know-how to support quick and large-scale promotion of company standardization and quality management among enterprises.	Establishment of promotion system of QM 1) Nurturing of pioneer leaders and lecturers 2) Development of programs, curriculums, and textbooks for dissemination 3) Nurturing of extension staff 4) Installation of testing equipment for QM at laboratories in industrial areas, with nurturing testing engineers	Immediate implementation is recommended	**Economic effect** (Direct effect) ・ Decrease in rejection rate through standardization (Ripple effect) ・ Economic effect due to improved competitiveness ・ **Financial position of investment** Improvement of balance deficit with increased testing demand in the future	1) For machinery/metal working fields: US$ 2.58 mil. 2) NDT equipment: US$ 0.11 mil. 3) Measuring instrument in electrical field: US$ 0.03 mil.
(2) Assist improvement of quality capability of core factories	Develop improvement plans for the selected factories to upgrade their quality capabilities and provide support for their implementation. Technology transfer on QM.	Phase I 1) Subsector development plan (including reorganization) 2) Factory improvement plans for key factories in the selected subsectors 3) Introductory training at key factories about actual practice of company standardization and QM Phase II ・ Assistance for the key factories in their plan implementation.	Immediate implementation is recommended	(Economic effects) ・ Reduction of rejection rate , improvement of sales price, market development, through quality improvement (U$$ 3.7 mil./year of direct economic effect assuming that the foundry subsector is selected)	Phase I: ・ Testing equipment for QM evaluation: US$ 0.18 mil. Phase II: ・ Depending on the study result of Phase I

Recommended Projects	Objectives	Outputs	Evaluation Results	Expected Economic Effects, and Difficulty in Implementation	Estimated Costs for Facility/ Equipment
Thrust 2: Development of Standardization Promotion System meeting the Needs of Open Economy					
(3) Expansion of mandatory certification scheme particularly focused on safety of electrical and electronics appliances	Expansion and complete execution of the mandatory certification to secure operational safety of electrical and electronics appliances (EEA) produced or distributed in the country.	1) Reduction of electrical leakage, exposure, fire and other accidents caused by use of EEA. 2) Development of relevant standards 3) Upgrading of equipment and devices to test and inspect EEA 4) Acquisition of relevant testing and inspection techniques and skills 5) Exclusion of imported substandard products from the market	Immediate implementation is recommended	(Economic effects) - Reduction of loss and damages caused by use of EEA. (Ripple effects) - Improvement of technologies of manufacturers particularly of product improvement and development - Development of R&D function of QUATEST	Testing equipment of electrical/electronics appliances (Unit: US$ mil.) · Phase 1: 5.10 · Phase 2: 5.10 · Phase 3: 4.17 · Phase 4: 5.00 · Phase 5: 4.17
(4) Development of certification system with conformity with foreign standards under mutual agreement	Create an authorized system to certify conformity of a locally manufactured product with foreign standards in Viet Nam under an arrangement with foreign certificate system	· Qualification of STAMEQ as the assessing/ inspection body for the foreign standard-based certification under the formal arrangement.	Recommend implementation together with, or following the Projects #1, and #3.	(Direct effects) - Inspection fees to STAMEQ (Indirect/ ripple effect) 1) Expansion of export with improved reputation in export. 2) Dissemination of QM concept. 3) Improvement of assessment and inspection technology.	Not applicable (Assuming implementation of the Projects #1, and #3 in advance, and target being the certification in the fields of machinery/metal working and EEA)

Recommended Projects	Objectives	Outputs	Evaluation Results	Expected Economic Effects, and Difficulty in Implementation	Estimated Costs for Facility/ Equipment
(5) Upgrading/ improvement of metrology and calibration system	1) Meet the immediate calibration needs	1) Upgrading/improvement of mass standards and relevant equipment 2) Installation of electrical standards and calibration equipment 3) Installation of flow standards for oil	Recommend implementation	1) Improvement of accuracy of legal metrology in the field of mass 2) Calibration locally of measuring instrument which is calibrated abroad. 3) Reduction of financial loss caused by measurement error of oil	(Unit: US$ mil.) VMI: 1) Mass standards: 0.14 2) Electrical standards: 0.13 3) Calibration of electromagnetism: 0.08 QUATEST 3: ・Flow standards: 0.30
	2) Improvement of metrology system	1) Unification of domestic metrology system 2) Improvement of calibration system	Recommend implementation	・Making the possible use of local calibration equipment	
	3) Development of total system of metrology and calibration. Establishment (or transfer) of building for maintaining national measurement standards.		Recommend further study from the long-term stand point of view		Necessary to define the project taking into account the probability of joint undertaking among ASEAN, and possibility to utilize higher measurement standards available internationally.

Figure 6-1 Development of MSTQ System through Implementation of the Proposed Projects (1/2)

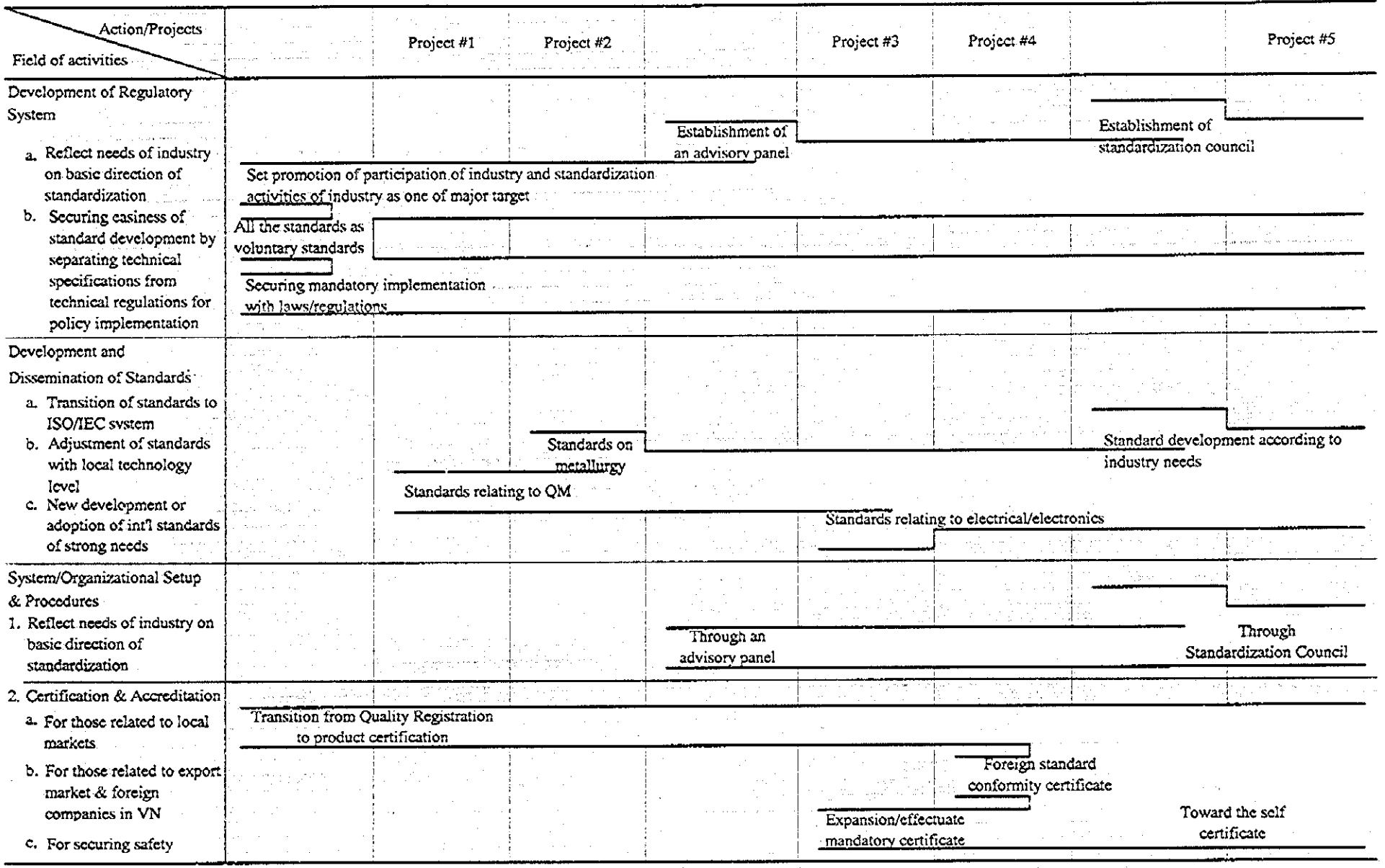
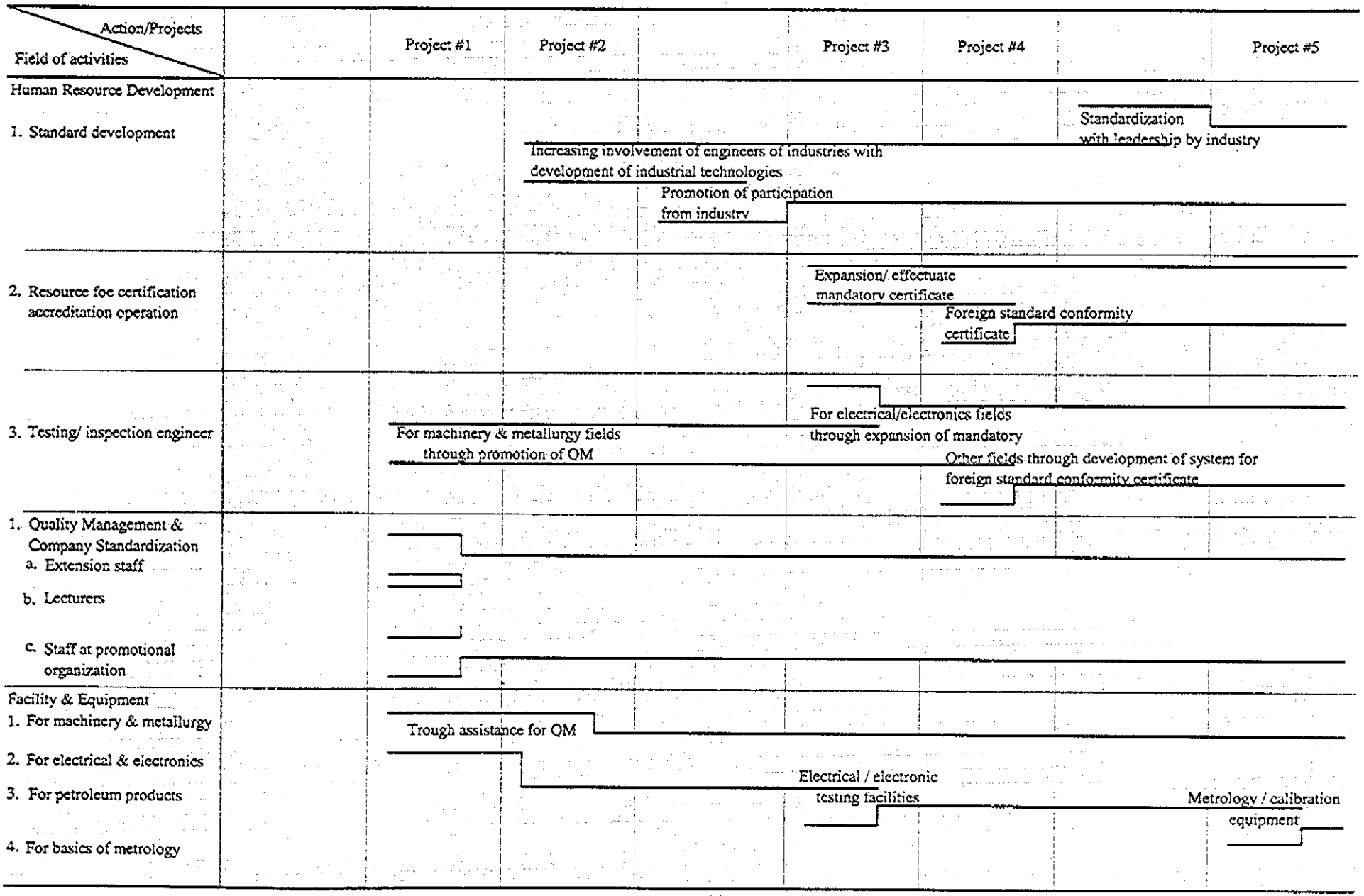


Figure 6-1 Development of MSTQ System through Implementation of the Proposed Projects (2/2)



Part IV: Subsector-wise Analysis

1 Machinery Industry

1.1 Current State of Industry and Issue for Sectoreal Development

1.1.1 Breakdown of the machinery sector

The machinery sector consists of the following subsectors under ISIC tabulation categories and divisions:

D-29 Manufacture of Machinery and Equipment N.E.C.
D-30 Manufacture of Office, Accounting and Computing Machinery
D-33 Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks
D-34 Manufacture of Motor Vehicles, Trailers and Semi-Trailers
D-35 Manufacture of other Transport Equipment

The study covered the subsectors which are actually engaged in production within the country.

1.1.2 Investment trends by neighboring countries in relation to the Vietnamese machinery industry

In Viet Nam, foreign investment in the machinery sector has only begun recently. In particular, it is led by the automobile assembly sector which seems to represent up-front investment by foreign automakers looking for the new market, the assembly of motorcycles which domestic demand is on the rapid rise, and manufacturers operating in the export processing zones.

Those in the export processing zones are wholly owned by foreign companies and attempt to use high quality, low cost labor force in the country for processing of imported materials and re-export of products in the bonded area.

Tan Thuan Export Processing Zone in Tan Thuang Dong District, Ho Chi Minh City, has been established by Taiwanese investors pursuant to Decree No.322/HDBT, setting forth the Export Processing Zone Law dated October 18, 1991. The export processing zone is strategically located in a central part of Asia and is supported by well-developed infrastructure, including ship and air freight services for export. In the export processing zone, 40 Japanese-affiliated companies are operating, including sewing machine assemblers, manufacturers of parts and components for sewing machines, automotive parts, molds and dies, and machinery. A die manufacturer based in Japan, produces standard

parts such as punches, dies, and die holders, which can be made by workers with relatively low skills in the standardized process.

The company supplies 75% of its products to the parent company and 25% to a Japanese-affiliated trading company specialized in molds and dies, based in Singapore. Apparently, the company has selected Viet Nam as its production base of standard molds and dies which are too expensive to make in Japan with high labor cost, for presence of the export processing zone with various advantages and benefits, in addition to availability of high quality, low cost labor force.

On the other hand, assembly manufacturers of automobiles and motorcycles, and parts manufacturers are operating in the form of joint venture with state enterprises. For instance, joint ventures with Vietnam Engine & Agricultural Machinery Corp. (VEAM) include Mekong Corp., Toyota Vietnam, Ford Vietnam, and Vietnam Suzuki Corp. (producing small trucks and motorcycles), Honda Vietnam, and Kumba J.V. Enterprise (a Korean maker of injection pump plungers for diesel engines).

The joint venture automaker starting operation in 1991, is 70% owned by a Japanese mid-sized trading company and a Korean trading company. It manufacturers special-purpose 4WD cars (based on technologies furnished by Mitsubishi and Mercedes), Fiat's passenger cars, "Tempera," together with CKD production of commercial vehicles under licensing from Fiat's affiliated company, IVECO.

The local English newspaper "Viet Nam News" reports, in its articles dated June 10 and 11, 1997, that license has been awarded to 14 automobile assembly joint ventures. While Chrysler has decided not to proceed with actual production, 8 companies have already started commercial production. Meanwhile, Viet Nam is still far from experiencing the wave of motorization, and the number of vehicles assembled in the country totals 7,500 in 1996, according to the newspaper.

At present, the Vietnamese government welcomes foreign automakers without any conditions. In addition to the fourteen companies, Hyundai, GM, Volvo, and Peugeot reportedly plan production in the country.

While motor vehicle demand in the country is limited to government and corporate uses, these companies clearly have an eye to the future of the country which has 80 million population and the growing economy.

At present, the most popular means of transportation in the country are bicycles and motorcycles.

Estimated 17 million bicycles are in use throughout the country. While the large installed base represents massive replacement demand, local production does not grow much as the local market share is deprived by imports including informal ones. There is no plan for joint venture with foreign manufacturers.

On the other hand, motorcycle production has been growing rapidly. According to an June 21, 1997 edition of Viet Nam News, three Japanese companies (Honda, Yamaha, and Suzuki) and a Taiwanese company (VMEP) are manufacturing motorcycles locally. In addition to production by joint ventures, these companies have a large number of licensees for CKD production. Reportedly, more than 80 factories churn out 500,000 units annually. Meanwhile, demand has been growing at an annual rate of 20%, and VMEP and Honda are considering major capacity expansion.

Nevertheless, there is concern about the lack of parts industries serving the motor vehicle assembly plants, which may hinder localization and technology transfer planned by the Vietnamese government.

1.1.3 Industry and market size

(See Table 1-1 to Table 1-4)

Many of machinery factories have been established to support the Viet Nam war, rather than to meet market demand. Thus, their locations have been selected for strategic reasons, without much economic consideration. As a result, some of the factories are unable to win contracts as they are remote from customers.

After the Viet Nam war, the factories were allowed to manufacture products as ordered by the government, general practice under the centrally planned economy. Then, the transition to market economy started. While it requires product development and marketing to meet market needs, the machinery industry is not capable of doing so in terms of resources and mindset.

At present, the machinery subsectors in the country is not particularly large in terms of the sizes of industry and market

1.1.4 Major markets and domestic supply capabilities

Generally, major markets for the machinery industry in Viet Nam are agriculture, forestry, cement, fertilizer, paper, sugar, mining, port cargo handling, marine shipping, construction, and textile and garment, all of which are indigenous industries in the country. Notably, all these industries, except for agriculture, are dominated by state enterprises and are characterized by small-lot production in large varieties. Furthermore, REMs as well as OEMs account for large portions.

On the other hand, industries requiring a wide range of supporting industries, such as electric/electronics and automotive industries, which are fast growing in neighboring ASEAN countries, are still at the nascent stage. The following section reviews individual

products according to the ISIC classification, whether they are produced in the country and their reasons.

ISIC-D-2911 Engines and turbines, excepting aircraft, vehicle and cycle engines

At present, 5-12HP diesel engines for agricultural machinery, 50HP diesel engines for tractors, and 80HP diesel engines for marine use are being manufactured at facilities with technologies imported from Japan, Russia, and other countries under technical assistance.

Trial production of small air-cooled gasoline engines is carried out under technical assistance from France.

Large diesel engines used for ships and power generation are not manufactured due to the small domestic market which cannot justify large capital investment and advanced production technology required.

Hydraulic turbines are locally produced, while steam and gas turbines are not manufactured due to the same reason seen for large diesel engines.

ISIC-D-2912 Pumps, compressors, taps and valves

Small centrifugal pumps for irrigation use have been manufactured at several factories visited during the field survey. As for large pumps, the industry has experience in manufacturing axial flow pumps with discharge rate of 8,000m^3/hour.

Small compressors used for refrigerant compression, a critical component of refrigerators and air-conditioners, have still to be localized.

Large compressors to produce compressed air, one of major utilities in production facilities, are not produced locally, probably because the small home market does not justify large capital spending and advanced production technology required for local production.

Valves for water piping are presumably produced as casting materials have been seen at machinery factories.

ISIC-D-2913 Bearings, gears, gearing and driving elements

A factory affiliated to VEAM machines and assembles small, low-grade ball and roller bearings, which are primarily used for agricultural machinery operated at low speeds and loads. In fact, a VEAM diesel engine factory incorporate bearings made in Japan and Sweden to engines.

A ball bearing manufacturer under LIXEHA, a union of bicycle manufacturers, makes 3 - 16ϕ balls for ball bearings of bicycles. On the other hand, a wide range of gears are produced, ranging from large ones (module 45) used in the cement industry to small gears being incorporated into engines of agricultural machinery. Also, transmissions for

tractors and fishing boats are assembled from the gears. Very small precision gears for electronic equipment and office machinery are not localized due to an infant market.

Finally, cam shafts, crankshafts, connecting rods, and other parts for locally produced engines are available from local sources.

ISIC-D-2914 Ovens, furnaces and furnace burners

Non-electric furnaces and ovens, which do not require highly accurate temperature control, are manufactured locally, both furnace bodies and burners. On the other hand, those with strict time/temperature control requirements, such as quenching furnace for bearing balls, are mostly imported, including burners, controllers, and bodies. As for electric furnaces for metal melting, arc furnaces and medium- and high-frequency furnaces are entirely imported, while low-frequency furnaces are localized and used in part.

These classes of electric furnaces are not locally produced mainly because of small local demand. Induction heat treatment equipment used at various factories seems to be produced internally.

ISIC-D-2915 Lifting and handling equipment

Forklift trucks, produced in volume, are not localized and rely solely on imports. While general-purpose cranes and winches are locally manufactured, large cranes for port cargo handling depend on imports, probably because local production is not feasible in terms of technology and production equipment. Finally, special cranes to handle objects by using hydraulics have still to be localized as the manufacture of hydraulic equipment requires large capital investment and advanced production technology. On the other hand, consumable parts and components, including buckets, shovels, and grabs, are mainly supplied by local sources.

ISIC-D-2919 Other general purpose machinery

Weighing machinery used at home and for commercial transactions are locally produced (sensitive balances for laboratory use are not included).

Refrigerators for industrial use do not seem to be locally produced, probably due to the same reason seen for large compressors.

On the other hand, filter presses appear to be localized as their parts are made at machinery factories.

ISIC-D-2921 Agricultural and forestry machinery

Farming tractors seem to be localized, although production is fairly small. They are actually used for freight transportation by attaching trailers, rather than farming.

However, production has been dropping sharply as driving trailer tractors in urban areas has been banned by the Ministry of Transport since July 1995.

Power tillers are also used for transportation of goods, and production is on the decline. Agricultural implements, both those used as tractor attachments and those hauled by domestic animals, such as harrows, hoes, and ploughs, are produced locally.

Finally, combines and engine driven threshers are not produced on a full scale.

Transition of a collective farm to privately (family) owned farm make mechanizing agriculture step backward, and agriculture has been a combination of human labor and domestic animals dominates. The market for agriculture machinery has not been form.

ISIC-D-2922 Machine tools

Among machine tools used for cutting operations, the country manufactures general-purpose machines including small lathes, upright drilling machines and shapers, all of which are non-NC machines. IMI, research institute, develops CNC lathes and wire cut electric discharge machines.

As for stamping machines used for press working of steel sheet, only small models of simpler design are locally produced, while high speed transfer presses and progressive type stamping machines are not available.

Similarly, hydraulic presses and drop hammers are not locally produced. Nor laser beam steel sheet cutters or electric welding machines have still to be localized.

The lagged development of machine tools and metalworking equipment production in the country seems to come from the fact that Viet Nam assumed a minor role in the area within the COMECON economic zone.

ISIC-D-2923 Machinery for metallurgy

Converters, ingot molds, ladles, and other equipment to handle hot metal seem to be localized as they are made mostly through steel plate working and casting.

As for die casting machines, gravity die casting equipments other than pressure die casting seem to be locally produced.

Small metal-rolling mills for wire and rod production are manufactured within the country.

ISIC-D-2924 Machinery for mining, quarrying and construction

In this category, ore crushers, ball mills, rod mills, stirrers, flotation equipment, rotary screens, and conveyors are locally produced, while large mining equipment including excavators, bulldozers, bucket elevators, and coal reclaimers rely on foreign supply. These equipment is supplied by a handful of multinational specialized manufacturers who

control the world market. The similar situation is found in construction equipment.

ISIC-D-2925 Machinery for food, beverage and tobacco processing

In this category, rice hullers and polishers are most demanded and produced in volume. Also, grain dryers and flour mills are locally manufactured.

On the other hand, most of sugar production machinery, dairy machinery, beverage and tobacco processing machinery depend on imports.

ISIC-D-2926 Machinery for textile, apparel and leather production

Most equipment used in the textile and garment production processes, including spinning, weaving, and knitting, is purchased from internationally operating manufacturers. Industrial sewing machines are also imported.

The country produces peripheral devices for these equipment, accessories for sewing machines, and shoe making machines.

ISIC-D-3410 Motor vehicles

The country's automotive production was started fairly recently. In 1992, joint ventures between state enterprises and foreign manufacturers commenced KD production of motor vehicles ranging from passenger cars, mini-buses, large buses, small trucks, large trucks, and specialty cars.

Fourteen joint ventures obtained production license and eight companies are currently operating. Yet, total production in 1996 was only 7,500 vehicles.

At present, CKD production is carried out, but the poor infrastructure, i.e., the shortage of parts and components suppliers which support assemblers, makes it difficult to raise the local content within a short period of time.

ISIC-D-3420 Bodies (coach work) for motor vehicles

This category includes production of bodies for lorries, buses, trucks, and specialty cars as well as trailers. Local production has not emerged, and current activities are limited to maintenance service for motor vehicles imported on a CBU basis.

ISIC-D-3430 Parts and accessories for motor vehicles and engines

In the country, there is no manufacturer of automotive parts and components on an OEM basis.

Repair parts for large vehicles such as trucks and buses imported from the former USSR and Eastern Europe, including cylinder liners, pistons, and piston rings, are locally produced.

ISIC-D-3511 Building and repairing of ships

There are 4 shipyards under Ministry of Transport (Hai Phong) and 1 shipyard under People's Committee of Quang Ninh Province which build and maintain ship. The present capacity of building new ship is less than 5,000 DWT and that of maintenance is 20,000 DWT. All engines for ship are imported.

ISIC-D-3512 Building and repairing of pleasure and sporting boats

This subsector has not emerged yet in the country due to no demand.

ISIC-D-3520 Railway and tramway locomotives and rolling stock

In Viet Nam, railways mainly use diesel locomotives. It appears that major activity is limited to maintenance service for locomotives as well as other rolling stock (passenger and freight cars).

ISIC-D-3591 Motorcycles

In the country, motorcycles are one of the most popular means of transport, rivaling bicycles. Although no accurate data are available, according to a local newspaper report, 500,000 motorcycles are locally produced each year.

As the parts supplier base has not developed well, however, most of production is carried out on a CKD basis by using imported parts and components.

ISIC-D-3592 Bicycles and invalid carriages

This subsector is relatively well developed, including parts suppliers. However, production does not grow much as products imported from China, Taiwan, Japan, and other countries are dominating the market. Local products reportedly lose competitiveness in terms of production cost, as well as riding comfort and design.

1.1.5 Procurement of parts, materials and equipment

(1) Procurement of production equipment

Emerging joint ventures with foreign partners and state enterprises which adopted foreign technologies in former South Viet Nam are mainly using production equipment imported from partners' countries or industrialized countries in the West.

In contrast, other enterprises use equipment imported from former Eastern Europe (including Russia) and China, as well as local products albeit small in number.

The apparent lack of locally made production equipment seems to stem from the fact that Viet Nam did not have opportunity to foster its own machinery industry under the COMECON system.

Machinery and equipment used by state enterprises other than joint ventures are mostly of old type and lack of efficiency and accuracy. To manufacture products having international competitiveness, these obsolete equipment needs to be upgraded. Nevertheless, most of enterprises do not seem to have definite financial plans for equipment purchase.

(2) Procurement of parts and materials

Major materials for machinery, including steel plates, carbon steel and alloy steel for structural use, tool steel for die making, cutting tool steel, and cemented carbide alloy, are not locally produced and imported from various countries including Russia, Korea, Taiwan, and Japan.

Pig iron is produced in small quantities and has quality problems due to fluctuated chemical composition. Products imported from China, Russia, and Korea are used.

Welding rods are locally produced in part and are largely imported from Korea, China, and Japan.

On the other hand, CKD parts for motorcycles and bicycles seem to account for large portions of imported machine parts. Other parts not locally produced due to economic or technical reasons include high-grade bearings for high speed and heavy duty use (including ball bearings and roller bearings), injection pump nozzles for small diesel engines, small diameter piston rings, hydraulic pumps, hydraulic cylinders, pistons, solenoid valves, drive chains. They are imported from Japan, Sweden, India, Russia and other countries.

1.1.6 Industrial structure and production technology

Enterprises mainly constituting the machinery industry in Viet Nam are state enterprises directly controlled by ministries (e.g., the Ministry of Industry) or People's Committees in major industrial cities of Hanoi, Hai Phong, and Ho Chi Minh City.

They mostly make products by using technologies introduced from the former COMECON countries under the old centrally planned economy.

One of the major findings is that products made by state enterprises are facing deteriorated international competitiveness under rapid transition to market economy. In fact, these enterprises are losing jobs. Also, they are expected to shift their marketing focus from production goods for state enterprises to consumer demand for durable goods.

For instance, bicycle manufacturers try to move into motor cycle production with a license with foreign companies in the future. For the time being, they produce a steel furniture such as a steal bed and a chair in order to survive.

Diesel engine factory under VEAM produce demanding rice hulling machine and rice polisher to make up large drop of production of engine by decreasing of demands from farmer and competition with Chinese and Japanese products.

VEAM actively make joint venture companies with automobile and motorcycle assemblers in industrial nations. However, most of them are carrying out CKD production with import parts at present.

Bicycle manufacturers, local industries in Viet Nam which produce most of parts for bicycle now try to produce parts for motorcycle. Introducing foreign capital and technology are most likely to happen to localize motorcycle parts to meet increasing demand.

1.1.7 Major issues related to sectoreal development

Examining the machinery industry in Viet Nam from the viewpoint of the need for maintaining international competitiveness under the increasingly globalized world economic system, it is facing a number of issues. Possible solutions for some of them are proposed as summarized below.

(1) Slow progress of specialization within the machinery industry

Under the centrally planned economy where there are no strict requirements for quality (Q), production cost (C) and delivery (D) which are key elements to be satisfied under market economy, machinery manufacturers often chose to manufacture all the materials and parts internally, ranging from castings and forgings to stamping parts and other metalworking products, in order to ensure a certain level of output mandated by government.

For the machinery industry in Viet Nam to supply these basic materials, serving as key machine elements, which satisfy three elements of Q, C and D and thus maintain competitiveness in the international market, organizations to manufacture them should be operated separately from machinery manufacturing organizations to promote specialization which is another important element of manufacturing operation under market economy. There are some enterprises which closed or suspended casting operations with poor performance, while there is a case of a joint venture with a Japanese company, which is specialized in casting successfully.

It is important to recognize that the fostering of manufacturers specialized in production of basic metalworking products holds the key to the successful development of the machinery industry in any country.

(2) Equipment obsoleteness

With the exception to joint ventures having foreign partners and wholly owned subsidiaries of foreign companies operating in export processing zones, most of local enterprises use production equipment of old type and with poor efficiency, many of which are deteriorated to result in lower dimensional accuracy. Installation of advanced equipment, such as forging presses, drop hammers, transfer presses for high speed stamping, high speed presses using progressive dies, and CNC machine tools, seems very rare case.

Also, most factories do not have a necessary set of equipment used for quality control and assurance, or have deteriorated equipment.

Clearly, equipment modernization is called for, including production equipment as well as QC/QA equipment.

(3) Absence of proper production management techniques

The rejection rates of metalworking products (e.g., castings and forgings) reach 20% at maximum, if defects after machining are included. In addition, some of accepted products did not appear to clear international standards.

Except for some of foreign-affiliated joint ventures and local companies who receive technical assistance from foreign companies, working environment at most of enterprises is untidy and poorly maintained, failing to meet basic requirements 3Ss for efficient work (good arrangement, orderliness, and cleaning).

Clearly, it is the time for the country to introduce modern production management techniques which are increasingly adopted in neighboring countries.

1.2 Current State and Issue for Standardization and Quality Management

1.2.1 Standards applicable to the machinery sector and the current status in Viet Nam

Generally, in manufacturing a product or procuring parts or raw materials, companies in less developed countries under market economy often use standards adopted in countries to which they ship their products or from which they purchase parts and materials, or international standards or internationally accepted standards used in industrialized

countries, such as the U.S., Europe, and Japan.

The machinery sector in Viet Nam before Doi Moi, i.e., under the former COMECON economic zone, primarily adopted GOST (the former USSR's standards) and TCVN which was based on GOST.

Under market economy, the country has been adopting international standards and U.S. and European standards to replace or supplement TCVN. With market changes and diversification of sources for parts and raw materials, the country is also using increasingly diverse standards as seen in other developing economies.

TCVN standards related to the machinery sector are considered to cover a fairly broad range in consideration to current technology levels required for making products in Viet Nam.

Examples:

Quality management and assurance, metrology and measurement physical phenomena incorporating ISO
Testing to integrate ASTM
Mechanical systems and components for general use
Internal combustion engines
Fluid systems and components for general use
(pipe, flange, fittings, valves, pumps etc.)
Manufacturing engineering
(machine tools, cutting tools, forging equipment, moulding equipment, welding equipment, surface treatment and coating, industrial furnace etc.)
Road vehicle engineering
(passenger cars, commercial vehicles, motorcycles and their component parts etc.)
Shipbuilding and marine structures
(Including marine engines)
Material handling equipment
(cranes, conveyors, earthmoving machinery etc.)
Agricultural machines, implements and equipment
(agricultural tractor, soil-working equipment, irrigation equipment, harvesting equipment)

Some of enterprises having design departments have been adopting ISO for dimensional tolerance and limits and fits for engineering since 1988, due to the lack of TCVN. Also, complaints are heard about the lack of material standards.

1.2.2 Use of standards in individual industries and enterprises

(1) Current state of adoption by product type

- GOST and JIS are used for diesel engines, not TCVN.
- The bicycle industry adopts TCVN alone.
- Ball bearings and bearing balls also use TCVN.
- Automotive repair parts (for vehicles imported from the former USSR and Eastern Europe) have been conforming to TCVN since 1970, in place of TC and TCN.
- Manufacture of boilers and pressure vessels relies on TCVN, while testing is conducted in accordance with ASME Code or QPVN (Viet Nam's own boiler code).
- Manufacture of large pumps, generator turbines, gates, and penstocks is governed by GOST-based TC, while TCVN is used for dimensional tolerances for welding assembly.
- Sewing and weaving-related equipment is manufactured in accordance with TCN, TCVN, and GOST. Dimensional tolerances in the design stage are based on ISO.
- IMI, a machinery-related research institute, uses ISO more than TCVN. ISO and foreign standards are primarily used for procurement of raw materials.

(2) Current state of adoption by customer

Generally, GOST, TCVN, TCN, and TC are primarily applied to products for domestic users, while ISO and foreign standards are frequently used by foreign-affiliated companies and for export products.

For instance, many of large plant and equipment manufacturers supply newly built equipment to foreign-affiliated manufacturers operating in the country or provide maintenance service. While domestic standards (TCVN, TCN, and TC) are used for local customers, foreign standards (e.g., JIS, BS, AS, ASTM) are adopted for equipment delivered to foreign-affiliated companies, according to their country of origin.

(3) Current state of adoption by source of production technology

In the country, technology sources vary according to which region a particular product is made, north or south. For instance, small diesel engines for agricultural machines manufactured in the northern region comply with GOST as production technology has been supplied by Russia. On the other hand, two manufacturers in the south have introduced technology from Japan and thus use internal standards of foreign partners

(based on JIS) as TC.

The similar situation is observed among joint ventures with foreign companies which have recently started operation.

(4) Use of international and foreign standards

Generally speaking, insufficient coverage of TCVN forces companies to rely on international standards or foreign standards, such as ISO, GOST, JIS, ASTM, and BS. In particular, for the purchase of steel plates and bars, GOST is used if they are supplied by Russian companies, and JIS for Korean and Japanese manufacturers.

ASME Code is frequently used for inspection of pressure vessels, and ASTM for material testing.

(5) Use of TCN and TC

Notably, many companies use TC in Viet Nam, which are slightly different from internal standards in Japan. Individual companies establish their own TC when products not complying with TCVN or TCN or new products are development, which are registered with each city's SMQ. Thus, TC is considered as one type of national standard, ranked below TCVN and TCN, although it is not a general purpose standard.

Many TCs are based on GOST, while some originate in JIS, such as diesel engines for agricultural machines.

TCN is also used by some companies, not as extensive as TC. TCN is developed at a rate of 4-5 per year, and as it becomes widely used, it maybe upgraded to TCVN.

In Viet Nam, a variety of standards are used, including TCVN (mandatory and voluntary), TCN, TC, and ISO and foreign standards, and not much confusion or conflict is seen, except for cases where some companies using material standards feel difficulty in conversion between GOST and JIS.

(6) Major issues related to development and use of TCVN

Complaints about the development and use of TCVN, frequently heard from enterprises, are summarized as follows:

1) TCVN is not incomplete and fails to provide full coverage as seen in JIS and GOST. For instance, there are no detailed standards for materials.
2) Many TCVNs are based on GOST, which increasingly lags behind world standards. As a result, currently available TCVNs do not meet customers' needs, and foreign customers do not accept them. Thus, TCVNs in their present form are not suitable for highly competitive market economy.
3) Current TCVNs are not compiled in a systematic manner, as seen in JIS, and

searching a required standard is difficult.

1.2.3 Need for promotion of standardization and recommendations on development of the promotion system

(1) Need for promotion of standardization

Enterprises, which make non-volume production goods for the domestic market, mainly rely on TC as product standards. TCVN and TCN are used as far as available.

Some of these enterprises want to promote TC to TCVN, but they admit that there is no means to develop such industry-wide proposal as the industry lacks close relations among the enterprises.

Foreign-affiliated companies and enterprises exporting their products are urged to comply with standards in customers' countries, and many of them do not intend to rely on TCVN. Rather they want to obtain latest foreign standards in English versions.

Boiler manufacturers use QPVN or ASME (U.S.) as available TCVN standards are mostly old. They want QPVN to be promoted to TCVN as soon as possible.

Production of small diesel engines for agricultural machinery, which entirely depends on foreign technology, is naturally based on foreign standards, mainly GOST and JIS. None of manufacturers the study team interviewed expressed the request to develop TCVN. Instead, they want to obtain English versions of latest GOST and JIS.

(2) Recommendations on systematic promotion of standardization

For instance, TCVN standards related to bicycles have been revised four times, and safety standards are based on ISO 4210.

A foreign manufacturer making gas cylinders for household use is currently relying on U.S. standards and has been assisting the efforts to develop TCVN standards related to pressure vessels in order to supplement currently available five standards established in 1996, which are general in scope and coverage. Accordingly, new standards for household gas cylinders will be published soon.

While there are some cases, such as the above, that existing standards have been modified or new standards have been established under cooperation of affected industries, some criticize that testing laboratories under STAMEQ do not have a necessary set of equipment and are not capable of evaluating draft standards which have been considered by TC.

Under these circumstances, the following recommendations are made as the effective means to further promote industrial standardization in the country:

1) To establish an industry organization which is capable of proposing TC standards - which are adopted by individual companies for non-standard products or new products - as industrial standards by collecting and coordinating industry-wide opinions and proposing draft standards to TC.
2) To provide a library of foreign standards in English version at STAMEQ's VSI Information Center to provide opportunity for related industrial people to understand them.
3) To establish a cooperative network of foreign enterprises in various industrial fields to obtain their assistance in developing standards for new machines, parts and raw materials, which emerge with increasing operation of foreign companies in the country.

As the industry does not expect TCVN development to progress over night, it is recommended that it is time to develop infrastructure required to effectively spur and support the initiatives.

1.3 Need for Reinforcement of the Certification System and Recommendations on Development of the Promotion System

1.3.1 Certification systems related to the machinery subsector

Both scheme and body for certification are called QUACERT except Quality Registration. Certification systems applicable to the machinery subsector are summarized as follows.

(1) System certification

Three systems are in operation since 1996 under TCVN5956-1995 (ISO/IEC Guide-62), ISO 9000 (Quality System), Q-base Quality System (a system developed in New Zealand particularly for SMEs), and ISO 4000 (Environmental Management System).

(2) Product certification

The new product certification system was started in 1996, under ISO/IEC 65 of 1996. Product certification is roughly divided into two types, one based on Vietnamese standards and one based on foreign standards. The former is further divided into voluntary certification which is issued to products that comply with quality standards specified in TCVN, and mandatory certification which requires compliance with safety standards.

It should be noted that mandatory certification covers two types and three items, which do not include those in the machinery subsector (bicycles were excluded in the 1996 list as their exports and domestic sales declined).

Product certification based on foreign standards is voluntary and covers two types. One is issues to products which comply with foreign standards, and the other covers products which comply with foreign standards and are allowed to bear foreign certification marking.

(3) Quality registration system

Apart from the product certification system, the quality registration system is designed to assure quality of products in terms of safety, covering exported and imported products as well as locally produced ones. It is also classified into voluntary and mandatory. Mandatory items are designated and announced every year. The list of mandatory items, other than those under jurisdiction of the Ministry of Health (i.e., food and cosmetics) is prepared by STAMEQ and published by MOSTE. Registration is made at 61 SMQ, located in 57 provinces and 4 special cities.

Mandatory registration items in the machinery subsector include small trucks, passenger cars, and motorcycles.

In the long run, however, the quality registration system will be discontinued, both mandatory and voluntary, and will eventually be replaced with the product certification system.

1.3.2 Current use of the certification systems

(1) Quality system

In the machinery subsector, there is the lack of interest in ISO 9000 probably because it does not export much, except for enterprises operating in export processing zones. Some of enterprises surveyed by the study team have their staff attended at ISO 9000 related seminars held by STAMEQ, but mostly consider actual application as the future issue.

At the time of the survey, there was no enterprise in the machinery subsector, which obtained ISO 9000 certification or prepared for application. In fact, there were only a few enterprises which obtained the certification throughout the country. As for ISO 14000 (Environmental Management System), there is little concern or interest.

Foundries which produce dust and noise, and plating shops discharging harmful effluent have some environmental consideration partly due to DOSTE's environmental audit. Most of other manufacturers, however, do not have concern or interest in environmental management.

Nevertheless, there was no enterprise which obtained certification.

(2) Product certification

In the machinery subsector, bicycles continue to be subject to product certification, although they were reclassified from mandatory to voluntary in 1996, and they are required to bear the VN mark. According to the survey, no other manufacturers have obtained product certification.

Certification of foreign standards, is still at preparation stage.

(3) Quality registration

Quality registration involves product quality review for mandatory items, but it does not require the reviewing of QC and QA systems. Voluntary quality registration is further simplified. The manufacturer selects any standard it complies with and registers it with any of the SMQ.

Mandatory items in the machinery subsector were limited to automobiles and motorcycles.

As for voluntary registration, many of manufacturers which produce machines related to durable consumer goods have obtained certification partly for quality assurance and marketing purposes. For instance, enterprises which make small diesel engines for agricultural machinery, rice hullers, rice polisher, hand tools, and files made voluntary registration.

1.3.3 Need for reinforcement of the certification systems and recommendations on development of the promotion system

State enterprises are required to establish financial independence and self-accountability in the midst transition from centrally planned economy to market economy. Under these circumstances, they seem to realize that they have to make committed efforts to help upgrade both the quality system and the product certification system in response to the relentless wave of international competition. In particular, those manufacturing machinery related to consumer durables are enthusiastically working with the issue. The academic circle also realizes the importance of the upgraded certification systems which is conducive to the improvement of equipment performance as well as higher levels of design and manufacturing techniques.

Both the industry and the academic circle agree that STAMEQ, the prime mover, is still not up to provide satisfactory service in terms of staff and testing facilities and equipment.

1.4 Need for Promotion of the Quality Control and Recommendations on Development of the Promotion System

1.4.1 Current level of quality control

(1) Quality control system and implementation status

Most of enterprises have product's quality inspection sections (KCS) or full-time inspectors.

In practice, however, there is a significant difference in level of quality control between state enterprises and foreign-affiliated companies including joint ventures. Quality control practiced by state enterprises mainly focuses on examination of shapes and dimensions according to specific inspection standards, which is performed between individual processes and at the completion stage.

In contrast, foreign-affiliated companies and joint venture, particularly those having Japanese partners, ensure that every worker perform his or her job according to working standards. A variety of measurement is made during the work to prevent defective products from being transferred to the subsequent process. In other words, the focal point of quality control is placed on in-process control, rather than inspection on final products or between processes. On the other hand, products which are required to meet safety standards, such as boilers and other pressure vessels, are subjected to non-destructive testing (e.g., ultrasonic and x-ray tests) as well as mechanical strength tests on welds by using test pieces, pressure tests, and leak tests.

Although many enterprises record defects found though inspection and their causes, none of them analyze the causes statistically nor feed back the results of analysis to design and production divisions.

(2) Employee education and training

Again, there are differences in employee education and training related to quality control between state enterprises and foreign-affiliated companies/joint ventures.

In fact, there is no fundamental difference between state enterprises. They do not provide any education or training for general workers. Many of them believe that national skill grade certification tests provide an opportunity for education and training.

Many of the enterprises surveyed send heads of engineering divisions or KCS managers to STAMEQ's seminars related to quality control. However, most send them only once a year.

On the other hand, activities of foreign-affiliated companies/joint ventures are summarized as follows. A joint venture having a Singapore partner sent quality control

personnel to the parent company for education and training. A wholly owned subsidiary of a Japanese company holds meetings by local workers during work hours as the preparation stage for QC circle activity. Other Japanese-affiliated joint venture ensure that workers comply with working standards in an attempt to raise awareness of importance of quality control.

(3) Quality control and assurance related equipment and instruments

Again, there is a significant difference in type of QC and QA related equipment between state enterprises and foreign-affiliated companies/joint ventures.

1) Equipment related to testing of metallic materials

Equipment owned by state enterprises is generally described as follows. Regarding analytical equipment on chemical composition, only one company has a spectrometer capable of performing quick analysis, while several enterprises have simple wet-type analyzing apparatus. Nevertheless, these apparatus do not seem to be used frequently.

Many have hardness testers, while metallographical microscopes, universal testing machines, and impact testers are owned by only a few.

On the other hand, foreign-affiliated companies and joint ventures who need to test metallic materials own many of necessary equipment. For instance, a foundry operated by a Japanese-affiliated company has CE meters and spectrometers which are used for quick analysis of chemical composition of molten metal before pouring. In addition, it has hardness testers and metallographical microscopes. Tensile tests are conducted by its local partner.

2) Equipment related to measurement of dimensions and shape

Most of state enterprises have vernier calipers, micrometers, dial gauge, and other measuring instruments used during the work, although the number is fairly small.

Some of them, although small in number, have metrology labs equipped with advanced instruments, including height gauge, profile projectors, length measuring machines, tool maker's microscopes, and gauge blocks.

A wholly owned subsidiary of a Japanese manufacturer of standard parts for stamping dies has a sufficient number of vernier calipers (digital display type), micrometers, and dial gauge, which are provided for workers.

It has a metrology laboratory which is equipped with a necessary set of measuring instruments including profile projectors, surface roughness testers, roundness testers, and Rockwell hardness testers.

3) Equipment related to non-destructive testing

Many of state enterprises manufacturing pressure vessels, steel structures, and similar products have a variety of non-destructive testing machines such as ultrasonic testers and X ray testers, which are used to check the soundness of weld parts.

Although no comparison is made as there is no foreign company or joint venture in this category, it is desirable to have a gamma-ray tester to check weld part of thicker plate.

1.4.2 Current operation of the existing promotion system

The formal institution responsible for promotion of quality control in the country is QUALIMENT (Quality Management Training Network), which members include STAMEQ (Hanoi), SMEDEC (Ho Chi Minh City), QUASEI (Hanoi), and VINATEST (Ho Chi Minh City).

Training courses include the following:

ISO 9000	Quality Assurance System
ISO 14000	Environment Management System
ISO Guide 25	Laboratory Accreditation System
TQM	Total Quality Management
Q-base	Quality System for S.M.E.
Quality Improvement Practice	
HACCP	Hazard Analysis Critical Control Points
GMP	Good Manufacturing Practice

Generally, there is not much interest in these courses within the machinery subsector. Some enterprises, which export their products to industrialized countries, send executive officers to seminars on ISO 9000, ISO 14000 and similar subjects. Even these enterprises, however, have decided not to participate in a four-day TQM seminar held by QUALIMENT for an expensive fee (800,000 Dong).

1.4.3 Need for promotion of quality control and recommendations on development of the promotion system

In the machinery subsector, the need for promotion of quality control concept and practice is not widely realized, except for foreign companies and foreign-affiliated joint ventures. However, manufacturers of diesel engines and bicycles well realize a quality gap as they are exposed to competition with imported products.

Also, manufacturers of repair parts for motor vehicles made in the former Eastern Europe are aware of a significant quality gap from genuine parts used for those in Japan, Western Europe, and the U.S..

Manufacturers exporting to industrialized countries are striving to meet strict quality requirements demanded by customers. Nevertheless, many of state enterprises seem to have hard time to find the ways to improve their quality to international levels.

Recommendations to enterprises

The machinery industry in the country is still strongly characterized by the top-down approach as it is dominated by state enterprises. To disseminate quality control practice in this environment, the process should be proceeded step by step, rather than the import of the TQM system with hope to proliferate it within a short period of time.

(1) As the first step, the current quality assurance system based on KCS-led after-process inspection and final inspection should be modified to the new system under which each worker is responsible for maintaining quality in his own process, while KCS staff is responsible for final inspection to prevent defectives from being shipped.

(2) To support the new system, each worker must be equipped with a necessary set of measuring instruments and tools, including a vernier caliper, a micrometer, a limit gauge, a go-no-gauge, and other special jigs and tools.

(3) Then, KCS staff will perform statistical analysis of defects identified in the entire process and feed back the results to design and manufacturing departments. The process should be formalized as SQC (statistical quality control) system.

(4) As one step before the introduction of the TQM system, the "5S" rules which are increasingly adopted in ASEAN countries need to be promoted.

(5) It is desirable to introduce the TQM system only after any doubt or resistance has disappeared among employees and management has understood the true meaning of TQM.

Recommendations on STAMEQ

The TQM system has become an essential tool for manufacturers to survive through international competition. It depends on each company to decide whether it will introduce and implement the system.

STAMEQ's role is therefore limited to support for proliferation of TQM among local enterprises. In particular, it should focus on efforts to maximize the effect of the newly established QUALIMENT activity through various measures including:

(1) To reduce a seminar fee to increase participation, including discriminatory rates according to enterprise size, and subsidy to cover a portion;

(2) To recruit speakers who can provide interesting and useful lectures, including foreign businessmen who have successfully improved quality levels; and

(3) To increase opportunity for enterprises to participate in TQM seminars by increasing locations and the number of seminars. At present, seminars are held in Hanoi and Ho Chi Minh City only.

1.5 Need for Inspection, Verification, Metrology, and Calibration, and Recommendations on Development of the Official Systems

1.5.1 Testing and Inspection

(1) Current state in the machinery subsector

Testing and inspection required in the machinery subsector is roughly classified into three categories, namely metallic material testing, dimensional/geometrical inspection, and non-destructive testing. Each category is described in more detail, as follows.

1) Metallic material testing

This category can be further divided into chemical composition analysis, metallographic examination, and mechanical strength testing.

Chemical composition analysis can be classified, by methodology, to wet analysis conducted manually and instrumental analysis using instruments capable of rapid analysis, such as spectrometers and carbon-sulfur analyzers.

Metallographic examination is mainly done by using an optical microscope. Mechanical strength testing checks a wide range of items including tensile strength, bending strength, elongation, hardness, impact value, fatigue strength, and creep strength.

2) Dimensional/geometrical measurement

Measurement of work in progress and finished products is carried out by using a variety of instruments, including a vernier caliper, a micrometer, a dial gauge, a height gauge, and a 3D coordinate measuring machine.

Geometrical measurement of two-dimensional objects is performed by using a profile projector. A roundness tester is used to check roundness of a cylinder, and a roughness tester for surface roughness.

3) Non-destructive testing (NDT)

Most frequently used non-destructive testing methods are ultrasonic, magnetic

particle, x-ray, and gamma ray.

Enterprises visited by the study team perform the above tests and inspections by using their own equipment, and where no appropriate equipment is available, entrusts tests to nearby laboratories.

(2) Use of outside laboratory by individual enterprises

1) Use of outside testing and inspection organizations

Among metallic material tests, chemical analysis and tensile testing are most frequently commissioned to outside organizations. Chemical analyzers of metallic materials, particularly those for "instrumental analysis" to perform quick analysis by using an emission spectrometer, an atomic absorption and flame spectrophotometer, and C.S. analyzer, seem to be a very few installed in the country, partly due to large funds for capital investment.

Evidently, most of enterprises commission chemical analysis of metallic materials to outside testing services, including Hanoi Institute of Technology, a research institute under the Ministry of Defense, and National Metallic Material Research Institute in the north, and a laboratory owned by Bien Hoa Steel Works (VICASA) under SSC located in Bien Hoa Industrial Zone in the south. In any case, frequency is very low, once per month at most. The fee is reportedly 20,000 Dong per one element.

QUATEST 1 and QUATEST 3 receive a relatively large number of requests for tensile test, reportedly for the purpose of mandatory or voluntary product certification as well as application for mandatory quality registration. QUATEST 1 sometimes receives requests from 4 - 5 enterprises per day.

Among the enterprises surveyed, there is no case of commissioning dimensional and shape measurement to outside service. Many of enterprises making welded structures, such as boilers, pressure vessels, and steel structures, have ultrasonic testers and X-ray testers. There are some which do not own non-destructive testing (NDT) equipment, which use service of QUATEST 1 or 3 under STAMEQ.

In case that NDT is conducted for large structures, both QUATEST 1 and 3 frequently conduct it on site.

2) Current state of internal test and inspection

The internal testing and inspection system varies greatly with quality levels of products manufactured at the factory which operates the system. Generally, foreign-affiliated enterprises and joint ventures having foreign partners, which manufacture high-grade products, have a full range of testing and inspection equipment.

Many of state enterprises making boilers, high pressure vessels, and steel structures, which require sound weld quality, have NDT equipment.

Internal testing and inspection equipment which is not widely available at state enterprises includes instrumental analyzers for metallic materials, and universal testing machines, which need is strongly felt but cannot be purchased due to high price.

Finally, equipment which demand is not high but will grow rapidly with industrialization includes optical profile projectors for precise measurement of dimensions and shape, and 3D coordinate measuring machines. At the time of the field survey, there are few enterprises which have and operate these precision measuring instruments.

(3) Need for upgrading the testing and inspection system, and recommendations

The machinery industry in Viet Nam is still in the transition from centrally planned economy to market economy and faces sluggish demand.

While state-run testing laboratories and enterprises equally understand the need for improving the testing and inspection system, they have difficulty in securing the funds required to purchase necessary equipment. To overcome the situation, the following recommendations are made:

1) Procurement of internal equipment and tools

It is desirable to procure a necessary set of testing equipment and tools so far as affordable. To minimize financial burdens to reflect the reality of local enterprises, however, the scope of procurement should be limited to those required for in-process quality control, particularly dimensional measurement tools such as vernier calipers, micrometers, dial gauges, and limit gauges, in sufficient quantities to be available to all operators.

2) Strengthening of QUATEST's testing and inspection system

Chemical composition analysis of metallic materials and mechanical strength testing are most frequently entrusted to outside laboratories by enterprises in the machinery subsector.

Manufacturers choose a laboratory on the basis of proximity to their location and availability of required equipment. In addition to QUATEST, universities, state research institutes, and state and private laboratories are used.

QUATEST 1 and 3 do not have instruments to analyze chemical composition of metallic materials.

At present, QUATEST is located in Hanoi, Ho Chi Minh City, and Da Nang. They are not easily accessible from all parts of the country

It is desirable to provide QUATEST facilities in major industrial areas where possible, each of which has equipment which is selected according to local needs.

1.5.2 Calibration

The calibration system in the country does not function properly on both sides of calibration bodies and enterprises.

For instance, most enterprises calibrated their working measuring instruments such as vernier calipers and micrometers by using gauge blocks they owned, which were calibrated by VMI or QUATEST3 once per year. However, VMI performed calibration service only five cases in FY1996.

Enterprises supposed to calibrate their universal testing machines (used to test strength of metallic materials) were calibrated by VMI staff once per year. However, VMI only had a 300kgf national standard on force at the time of the survey, and a new national standard, 300KN, was just introduced and installed by CSIRO in Australia.

As for hardness testers, all the enterprises responded that calibration was carried out by using a standard specimen brought by VMI staff once every year. According to VMI, it has a standard hardness machine used as a national standard and has provided visiting calibration service 100 cases per year, but it receives much less requests from enterprises recently. After calibration, VMI affixes the label indicating validity to the hardness tester or issues a certificate. However, few label or certification has been observed during the field survey, including gauge blocks and universal testing machines.

A major reason for improper functioning of the calibration system in Viet Nam seems to lie in the lack of the established traceability system, i.e., there is no facility having a secondary standard and capable of calibrating working standards used by manufacturers and issuing a certificate.

Table 1-1: Production and Import of Machinery

	Unit	Production				Import			
		1994	1995	1996	1997 (Estimated)	1994	1995	1996	1997 (Estimated)
Machinery									
Diesel engine	Units	3,371	4,217	8,304	8,013				
Vertical cylinder	Units								
Horizontal cylinder	Units								
Gasoline engine	Units								
Machine tools	Units	1,538	1,358	1,425	1,390				
Lathe	Units								
Upright drilling machine	Units								
Shaper	Units								
Planer	Units								
Milling machine	Units								
Water pump (NN)	Units	632	547	592	628				
Water pump (CN)	Units	800	691	720	700				
Tractor	Units	2,808	2,709	2,650	2,715	90	358	186	200
Power tiller	Units								
Thresher	Units	43,942	36,398	38,125	40,011				
Rice hurler	Units	2,067	2,043	2,055	2,116				
Rice polisher	Units								
Automobile	Units								
Passenger car	Units	25,126	25,589	26,033	26,315				
Truck	Units	33,840	39,086	42,580	43,154	8,413	6,500	7,260	7,800
Motor cycle	1000u	2,667.8	2,955.6	3,112.5	3,304.7	283.6	458.5	470.5	357.8
Bicycle	1000u	285.0	236.1	250.7	277.3				

Source: General Statistical Office

Table1-2 Gross Output
(Equipment and machinery)

(Unit : Bill dongs at 1989 constant prices)

	1990	1991	1992	1993	1994	1995
Total gross output	597.7	588.0	668.1	765.9	876.0	973.0
State industry	321.8	311.0	352.3	424.9	516.1	578.0
Central industry	189.5	195.4	222.0	273.6	333.9	376.0
Local state industry	132.3	115.6	130.3	151.3	182.2	202.0
Non-state industry	275.9	277.0	315.8	341.0	359.9	395.0
Collective economy	114.7	44.3	37.8	25.7	13.9	
Individual & mixture economy	4.9	11.1	9.3	17.7	37.9	
Private household	156.3	221.6	268.7	297.6	308.1	

Source : General Statistical Office, "Statistical Yearbook, 1995"

Table1-3 Number of Establishments
(Equipment and machinery)

(Unit : Number)

	1990	1991	1992	1993	1994
Total	18,836	18,076	10,988	9,254	7,707
State industry	377	358	287	257	254
Central industry	109	109	104	107	107
Local state industry	268	249	183	150	147
Non-state industry	18,459	17,718	10,701	8,997	7,453
Collective economy	530	429	305	265	73
Individual & mixture economy	26	35	21	117	98
Private household	17,903	17,254	10,375	8,615	7,282

Source : General Statistical Office, "Statistical Yearbook, 1995"

Table1-4 Gross Output per Establishment (Equipment and machinery)

(Unit : Mill dongs at 1989 constant prices)

	1990	1991	1992	1993	1994
Total	32	33	61	83	114
State industry	854	869	1,228	1,653	2,032
Central industry	1,739	1,793	2,135	2,557	3,121
Local state industry	494	464	712	1,009	1,239
Non-state industry	15	16	30	38	48
Collective economy	216	103	124	97	190
Individual & mixture economy	188	317	443	151	387
Private household	9	13	26	35	42

Source : General Statistical Office, "Statistical Yearbook, 1995"

2 Metalworking Industry

2.1 Current State of Industry and Issue for Sectoral Development

The metalworking industry in Viet Nam mainly consists of the following four subsectors:

(1) Casting, forging, metal pressing responsible for supplying fundamental and key parts and components to the machinery industry, as well as pattern and die making that is the essential process for the three subsectors

(2) Manufacture of products which are used as metalworking products (end products) such as cast iron pipes, ship anchors, hand tools, boilers, and gas cylinders

(3) Manufacture of steel structures used for bridges, buildings, and other structures

(4) Manufacture of billet, steel bars for construction and wire

2.1.1 Size of the Industry

In Viet Nam, many metalworking shops are operated by enterprises in the machinery or electrical machinery industry to produce parts and components for internal assembly. Thus, it is difficult to obtain statistical data on the metalworking industry sector, including production volumes of castings, forgings, and metal pressing products, and the number of manufacturers (See Table 2-1).

Previously, there was a large number of foundries including small private enterprises. Today, the number has dwindled with the declines of the machinery and electrical machinery industries which supply capital goods. Some of enterprises which the study team visited and have their own foundries have suspended their own foundries (2 out of 16) and purchase castings from outside sources as required. At present, there seem to be 15 - 20 foundries which can produce castings used in machinery and electrical machinery.

Forging shops are operated solely by large enterprises, and their number seems to be small compared to foundries. There seem to be around 15 forging shops which can produce materials and parts for the machinery industry.

There are around 10 not roll steel shops of large state companies manufacture steel bars for construction and wire.

In the vicinity of Hanoi (Da Hoi Village in Ha Bac Province, northeast of the city), there is a concentration of home industries, where around 60 small factories produce reinforcement bars and nails for construction from steel wastes by using old rolling machines and nail making machines. In the past, there seemed to be a large number of foundries in the area, most of which have converted to production of reinforcement bars

which are highly demanded. At present, there is only one foundry operating in the area.

Metal pressing shops produce bicycle parts, hand tools, folks and knives, in addition to parts for machinery and electrical machinery.

Many enterprises have their own presses, and there seems to be a sizable number of metal pressing shops if small- and medium-sized private enterprises are added.

Enterprises with forging, pressing and/or casting capabilities have also die and pattern shops which manufacture and repair dies and patterns for their own use. On the other hand, there is only a few specialized mold and die manufacturer operating in Hanoi and Bien Hoa industrial zone, joint venture between local and Japanese companies. In fact, there is another specialized die making factory operated by a Japanese company, which produces standard parts for pressing dies in the Tan Thuan export processing zone in Ho Chi Minh City, but its products are entirely exported.

Plating shops are owned by enterprises which manufacture hand tools, locks, and bicycle parts, while heat treatment shops are operated by those making bearing balls, hand tools and standard parts for pressing dies. In fact, enterprises which need these metalworking processes have internal facilities, and there is no local manufacturer specialized in plating and heat treatment but foreign J/V.

Finally, welding is carried out by a variety of enterprises for a wide range of work, including steel structures such as boilers, pressure vessels, tanks, gas cylinders, and bridge members, and the manufacture of bicycle frames and metal plates. If small- and medium-sized private enterprises operated in the form of ironworks, there must be a large number of welding shops throughout the country.

2.1.2 Major markets and domestic supply capabilities

Metalworking products are used in a variety of industries ranging from the machinery industry including machine tools, agricultural machines, mining machinery, and forestry machinery, to the electrical machinery industry including motors, transformers, fans, rice cooker and washing machines.

There are a handful of manufacturers specialized in foundry process plating, while there is no specialty manufacturers in the areas of metal pressing, forging, and heat treatment.

Many metal parts and materials are manufactured at internal facilities of state enterprises operated by the national or local government. There are some manufacturers which supply metal parts to other enterprises on a contract basis. In particular, pistons, cylinder liners, and other parts for engine are directly shipped to the merchandise market as spare parts.

Cast iron water pipes are reportedly manufactured by 5-6 factories, one of which supplies 70-80% of total (state-owned, specialized manufacturer located in Hai Phong).

Metalworking products such as hand tools and gas cylinders are directly supplied to the market where they must compete with foreign products.

Dies and patterns are made and repaired by manufacturers at their own shops. Joint venture partnering with a Japanese company and wholly owned Japanese companies are specialized in contract molds and die making. In addition, a Japanese die maker producing standard parts for pressing dies (punch die holders) is operating in the Tan Thuan export processing zone in Ho Chi Minh City. It exports all the products to Japan and Singapore and does not ship them to the domestic market.

Structural steel products such as boilers, pressure vessels, structural members of bridges and buildings are manufactured by specialized companies for use by chemical and food processing companies, and construction companies. Steel bars and wires are produced by mainly hot roll steel factories of state companies and small private factory as well.

Major metal parts and components of automobiles and motorcycles are mostly imported, while local production covers carrier frames of trucks, bus bodies, mufflers of motorcycles, and similar products. Thus localization in the area is still at an early stage. Repair parts for motor vehicles made in the former USSR, such as cylinder liners and pistons, are manufactured by copying the originals.

In the area of electrical machinery, mainly metal pressing products, such as transformer cores and outer frames, cores and stands for fan motors, switch boxes, frame for rice cooker and washing machines are made by manufacturers at internal facilities. On the other hand, some foundries make and supply stands for electric fans and fittings of ceiling fans to manufacturers.

2.1.3 Procurement of materials and equipment

(1) Materials

Many factories use key casting materials which are imported, including pig iron (imported from Russia, China, and Japan), coke (China and Japan), ferro alloy (Russia and China), bentonite (China), electrodes for arc furnaces (China and India), resin-coated sand (Taiwan). In addition, resin used for binder of self-hardening core is imported. Although pig iron and coke are produced locally, their supply is small in volume and quality is considered to vary between lots.

Steel materials used in forging and metal pressing operations are imported from Russia, Korea, Japan, China, Germany, and other countries. Local steel mills produce

carbon steel, which is supplied in small quantities and is considered to be inferior in quality by many users while price is similar to that of imported products.

Special steel used for dies and molds is entirely imported, mainly from Japan.

Steel materials for boilers, pressure vessels, gas cylinders, and bridges are imported mainly from Japan, Korea, Russia, and Australia, while welding rods are purchased from Japan, Korea, Australia, and Russia. Again, local products are considered to vary greatly in quality and are not used by domestic users due to the lack of reliability.

Billet for steel bars and wire are made of locally purchased scrap iron.

(2) Equipment

Local enterprises mostly use production equipment made in the former USSR or Czechoslovakia when they started operation, which are thus deteriorated due to aging. By contrast, joint ventures with foreign partners use relatively new equipment. Japanese companies and joint ventures partnering with Japanese companies use machinery and equipment imported from Japan. Some of them use both new and used equipment, the latter of which is used as it is field proven in Japan and intended to help assure smooth production, in addition to cost saving purposes.

The following section describes existing facilities and equipment by key process technology.

1) Foundry facilities and equipment are vary greatly different between local enterprises and foreign-affiliated joint ventures.

a) Local enterprises

Melting facilities

Arc furnaces, cupolas, small cupolas are used for iron casting, while arc furnaces and electric induction furnaces for steel casting. Crucible furnaces are used for aluminum alloy by using cast iron pots.

All of these furnaces are small in capacity and deteriorated due to aging. Several companies are now upgrading their melting furnaces, including electric induction furnaces made in China and the U.S., which have already been installed or are scheduled to be installed.

Molding facilities and equipment

Most of foundries make molds manually. Dry molds are used for steel castings and large iron castings. On the other hand, small iron castings, and aluminum alloy and copper alloy castings are made by using green sand, floor molds. Few foundries

have molding machines, and accordingly, few sand preparation equipment are owned.

A foundry has very long car type conveyors and molding lines with inefficient layout, which operation is currently suspended, consisting of machines made in the former USSR.

Foundries which produce cylinder liners generally use lathe-type centrifugal casting machines that are made internally.

A state enterprise, the largest manufacturer of cast iron pipes which manufacturers 5m long straight pipes by using vertical continuous casting lines, makes bend and T pipes by using floor molds.

Several companies are mechanizing molding operations by importing equipment from foreign sources. A state-owned manufacturer specialized in cast iron pipe production plans to purchase centrifugal casting machines made in Germany and manufacture ductile cast iron pipes by using casting technology introduced from the Netherlands, which will start commercial operation by the end of 1998. Furthermore, a foundry manufacturers and exports pump casings to South Korea by introducing a small jolt squeeze molding machine made in Taiwan; a foundry is installing a second-hand molding machine (made in France); and a foundry has recently installed a molding machine for shell mold.

Cleaning and fettling equipment

A few foundries have shot blasting machines and grinders, which are highly advanced from the country's standard, whereas many foundries remove sand manually.

b) Foreign-affiliated joint ventures

There are few foundries which are joint ventures with foreign manufacturers. In fact, a joint venture with a Japanese company operating in an industrial estate in Hai Phong constitutes an exceptional case.

The joint venture uses 2-ton medium-frequency electric induction furnaces, made in Australia, for melting, with furan no-bake mold for large castings and green sand mold for small ones. The two molding lines are equipped with Japanese molding machines and sand preparation equipment. Cleaning and fettling equipment include shot hanger blasting equipment, swing grinders, and hand grinders.

A standard set of inspection and quality control equipment is provided and used, including emission-spectrophotometer (Quantovac), Brinell hardness tester, metallurgical microscopes, and sand testing equipment.

2) Forging and press shops mostly manufacture small products by using air drop

hammers, friction presses, and mechanical presses. A state-owned factory has a 1,600-ton mechanical press and a 10-ton drop hammer, but their equipment is generally aged.

As for specialty products, there is a joint venture which manufacturers gas cylinders by using a 200-ton deep-drawing equipment (made in Germany), and another joint venture manufacturers knives and folks for export to Japan by using presses furnished by a Japanese customer and materials imported from Japan.

3) As for pattern, mold and die making, local enterprises have their own shops, but none of them has precision processing equipment such as electric discharge machines. Generally, they use lathes, milling machines, boring machines, and other standard machine tools made in the former USSR and Czechoslovakia.

On the other hand, although exceptional cases in the country, two Japanese-affiliated companies have a broad set of equipment which is equivalent to that owned by Japanese pattern, mold and die makers, including machining centers, NC lathes and grinding machines, NC milling machines, electric discharge machines, wire cut electric spark machines, three-dimensional measuring instruments, and other precision processing equipment and measuring instruments. They are a wholly owned subsidiary of a Japanese company which manufactures standard parts and components for molds and dies as a factory producing entirely for export, and a joint venture with a Japanese company, also specialized in making molds.

4) Plating equipment used by local enterprises is internally made or furnished by foreign partners. Although no information on foreign-affiliated joint ventures is available, they are presumably using equipment imported from countries of their partners.

5) Heat treatment equipment used by local enterprises is mostly made in the former USSR and Poland. In contrast, the Japanese company that manufactures standard parts and components for exported molds and dies uses most advanced vacuum furnaces.

6) As for welding equipment, manufacturers of boilers, pressure vessels, and tanks for chemical process plants have TIG and MIG welding machines made in the U.S. and other countries. Gas cylinder manufacturer incorporates MIG welding machines into the line.

On the other hand, a bridge manufacturer has welding machines which were procured from the former USSR in 1974, when it was founded, and are now deteriorated. It is now planning to upgrade the existing equipment by replacing an entire line.

Welding methods adopted by these companies vary greatly according to product and material.

7) Hot rolling equipment used has been made in Taiwan (designed in Japan) or the former USSR, while hot rolls are produced by local enterprises. Billets are made by continuous casting or gravity casting that uses ingot molds.

2.1.4 Industrial structure and production technology

(1) Industrial structure

In Viet Nam, there are a small number of large manufacturers specialized in foundry. On the other hand, there are no specialized manufacturers of significant size in the areas of forging, pressing, plating, and heat treatment. Most of metal parts and materials are therefore manufactured internally at factories of state enterprises which make end products. Only a few products are supplied to other enterprises or exported.

Vietnam Engine & Agricultural Machinery Corporation (VEAM) and Machine and Industrial Equipment Corporation (MIE) which are under supervision of the Ministry of Industry are leading entities in the machinery industry. These corporations control a number of enterprises, some of which own and operate metalworking shops to meet internal demand, as summarized in the Table below.

	No. of enterprises under VEAM & MIE	Those having foundries	Forging shops	Press work shops
VEAM	12*	8	9	7
MIE	9*	3	6	4

* Not including joint ventures partnering with foreign companies, laboratories and trading companies

On the other hand, there are a number of small- and medium-sized enterprises as well as microenterprises which serve as small iron works specialized in casting, rolling, welding, and sheet metalworking. They have still to grow to "critical mass" to become the supporting industry which can serve as industrial infrastructure.

Foreign-affiliated joint ventures and foreign companies in the industry are classified into two categories. First of all, there are manufacturers specialized in particular

products which are supplied to the domestic market, such as molds, dies and gas cylinders. The second category focuses on export products, including standard parts for stamping dies, and castings used as parts and components of machine tools.

(2) Production technology

1) Source of technology

Production technology used by local enterprises has been primarily introduced from the former USSR and Czechoslovakia

In case of enterprises located in the suburb of Ho Chi Minh City, used to produce under Japanese and other foreign technologies, they have used only their own production technologies now.

After the introduction of the Doi Moi policy, an increasing number of enterprises has been importing new technologies from a variety of countries including Taiwan, Japan, Singapore, Italy, Switzerland, and the Netherlands.

Also, some joint ventures with foreign companies are on the rise and introduce foreign technologies from their partners.

2) Skill levels of workers

Generally, workers have high levels of skills. In fact, local enterprises having old production equipment rely on experience and skills of workers as they have poor production management techniques and quality control equipment is rarely used.

3) Environmental consideration including working environment

The country has environmental regulations to control industrial effluents, air pollution, noise, and other environmental factors. DOSTE under the local government conducts annual inspection at each factory by sending its staff.

While some foundries admitted difficulty in complying with all the regulations and intended to introduce control measures gradually, most enterprises stated that they cleared current levels of environmental standards. Some billet factories also have difficulties in the disposal of slag coming out from the furnace.

A plating shop carried out neutralization of Cr and Ni in effluents and monitored the results in each shift by recording data on sheets posted in the testing room. However, such practice was not observed in other factories.

There is no or little interest in or recognition of ISO 14000.

Thus, there are clear differences in working environment between foreign-affiliated companies (including joint ventures) and local enterprises.

Factories of local enterprises are poorly maintained and lighted, and shop floor is untidy. Foundries using arc electric furnaces show poor working environment as melting shops are filled with smoke and dust. At steel structure shops, materials and products are stacked all over the place.

Few enterprises know about the 5S housekeeping rules, while enterprises having Japanese partners intend to comply with the 2S (classification and storing, tidy-up).

2.1.5 Major issues related to sectorial development

Transition to the open market economy has severely impacted less international competitive Vietnamese industries such as the machinery and electric machinery industries, thus the metalworking subsector supplying parts to these industries has decreased output dramatically.

At captive foundries of state enterprises which make castings for the machinery industry, actual production is 20 - 40% of capacity. On the other hand, factories making metalworking products (end products) experience a less drop in production. Manufacturers of cast iron pipes for water supply and hand pumps maintain the operating rate of around 65%. A lock manufacturer boosts production by moving from one shift to two shift operation. Also some steel bars and wire manufacturers produce twice more than official capacity by two shift operation to meet aggressive demand.

Non-durables such as hand tools, metal kitchen utensils, and gas cylinders are exposed to intensive competition with foreign products in the domestic market. A joint venture with a foreign company and specialized in production of gas cylinders has latest production equipment, but production volume remains at one third of capacity.

At factories of local enterprises, production and testing equipment is generally obsolete due to aging and falls far below international standards.

To revitalize the metalworking industry to quality and technology levels competitive in international markets, the following measures are called for:

(1) While many enterprises have highly skilled workers, production relies solely on their skills and experience, and modern production management and quality control techniques and know-how have rarely been introduced. It is recommended to promote early introduction of quality systems such as TQM and ISO 9000, QC circle activity, the 5S rules, and statistical quality control methods along with upgrading facilities and essential technologies.

(2) Production equipment at most factories of local enterprises is deteriorated due to aging, and production capacities fall below nominal ones to result in poor production efficiency and create quality problems such as the lack of dimensional accuracy. Equipment upgrading and modernization seems to be imperative by overcoming financial difficulty in some cases. Three strategies seem to offer feasible solutions as follows:

1) Corporations controlled by the central government and local governments have a larger number of enterprises, each of which has internal facilities specialized in similar metalworking processes, including casting, forging, and metal processing. As a result, each facility is utilized far below its capacity. If these facilities are consolidated according to each process to create job shops specialized in casting, forging, metal processing, die and pattern making, plating, and heat treatment. This way, duplication in capital investment can be minimized. More importantly, consolidation will help raise technology levels as compared to decentralized resources and skills seen today.

2) The current industrial structure in Viet Nam requires metalworking shops to be highly flexible in supplying a variety of products in small lots, rather than volume production capabilities. For instance, a foundry should use an induction furnace which can easily control the chemical composition of molten metal and produce high temperature molten metal, while self-hardening molds, such as furan-no bake mold process, which is suitable for flexible production, should be used.

3) The high pressure molding line should be introduced as the automotive industry develop to require volume production of castings with high dimensional accuracy. Meanwhile, motorcycles are increasing at an accelerated rate and localization of their parts and components will soon be considered, requiring aluminum die cast casting facilities.

(3) Enterprises should make efforts to improve working environment to ensure safety and health of workers.

(4) Products made by local enterprises are exposed to intensive competition with imported products. There are some areas where the government is expected to change its policy to support such efforts, including imbalance of tariff rates.

Take gas cylinders, for instance. Raw materials, such as steel materials, and welding wire and flux, are imported with tariff rates of 10% - 25%. On the other hand, imported gas cylinders are subject to the 5% tariff rate if less than 26.2 liters, and no tariff if 26.2 liters or more, As a result, those made in Taiwan and China are imported in large quantities.