5 Construction Materials Subsector

5.1 Current State of the Industries

(1) General profiles of the construction materials subsector

A variety of industrial products are used as construction materials. They vary greatly in material, part used, and performance. This section focuses on cement which is considered to have very important bearings on standardization and quality control in the country's industries. Cement is produced by a relatively large number of manufacturers. In the country, both local and imported products are distributed, while their quality is sometimes questioned to threat safety of buildings and structures constructed.

Among other construction materials, steel bars used as concrete reinforcement are important and are discussed here in conjunction with cement.

As shown in Table 5-1, there are more than 65,000 enterprises classified under the heading of the construction materials industry (1994). Of total, 320 state enterprises are considered to be leading manufacturers of construction materials. The number is further reduced to state enterprises under control the central government and some state enterprises under local governments, which seem to form the cadre of the industry and are responsible for the bulk of production. This is clearly seen in Table 5-2. State enterprises account for 67% of production on a value basis and those under the central government hold a 53% share.

The questionnaire survey was responded by 15 enterprises. 6 enterprises (26%) produced masonry products, 4 (17%) cement, and 3 (13%) concrete and steel products (multiple answers allowed). One enterprise manufactured non-ferrous metal products, and 6 cited other products. In addition, based on observations made during the visiting survey, manufacturers of construction materials seem to supply a variety of metal products, including window frames, iron railings, and steel poles for warehouses and other purposes, bricks, masonry materials, aggregates, and tiles. Production volumes of construction materials reported in official statistics are summarized in Table 5-3.

(2) Industry and market sizes

1) Cement

In 1995, 5,850,000 tons of cement were produced in the country and 1.3 million tons were imported. Compared to domestic production of 2,530,000 tons and imports of 220,000 tons in 1990, the figures grew at an annual average rate of 21%.

Leading cement makers are six enterprises under Vietnam National Cement Corporation (VNCC) which is under control of the Ministry of Construction[1]. More recently, many joint ventures are being planned with these state enterprises.

In addition, there are around 60 small enterprises under control of local people's committees or military forces, which have annual capacity of 60,000 - 80,000 tons. Their annual production in total is estimated at 2 million tons[2].

The demand for construction materials will continue to expand further with anticipated growth of construction activities including public infrastructure, buildings, and housing. The five-year plan sets production target in 2000 at the range between 18 billion and 20 billion tons. On the other hand, many production projects will be initiated and the annual production capacity will reach 21 million tons by 2000. This means, production per capita will jump from 100kg in 1995 to 250kg in 2000.

Recently, the Ministry of Commerce banned imports of cement in May 1997 and onwards so far as locally available..

2) Steel bar

Steel bars used for construction are mostly deformed bars, which are used as reinforcement of concrete. Production of steel materials in the country totaled 300,000 tons in 1995, and imports are estimated at around 700,000 tons[3]. Of local production, steel bars are estimated to account for more than 200,000 tons.

There are two leading steel companies in Viet Nam, Thai Nguyen Iron & Steel Corporation (TISCO) in the north and Southern Steel Corporation (SSC) in the south, both under control of Vietnam Steel Corporation (VSC). In addition, TISCO forms two joint ventures with Hai Phong City and Da Nang City, which has annual 20,000-ton capacity of round bars and deformed bars. Furthermore, VSC, SSC, and TISCO are forming joint ventures with foreign companies.

While the leading manufacturers seem to hold dominant share in steel bar production, there are small shops which produce deformed bars by using steel plates and scraps. These products have a quality problem as they are often welded together to attain required length.

The government predicts that iron and steel demand in the country will reach 3

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[1] Domestic production totaled 7 million tons in 1996, of which 5,420,000 tons were manufactured by VCC (according to The Saigon Times, May 24-30, 1997). Also, the newspaper reported that VCC estimated 1997 production to reach 8.5 - 9 million tons, while demand will grow to 9.2 - 9.5 million tons. Of total demand, 5,730,000 tons will occur in the north, and 2,100,000 tons in the south. The Ministry of Construction estimates domestic demand at 9.5 - 10 million tons, with a production shortage mainly occurring in the south.

[2] Based on interview from related industries.

[3] The figure does not include steel bars which are imported as part of plant construction materials.

million tons annually in 2000, of which construction materials will account for around 70%. To meet demand, a number of projects to build new plants are under way in the form of joint venture with foreign capital.

The Ministry of Commerce banned imports of steel materials for construction in May 1997 and onwards when so far as locally available.

(3) Major markets for cement

Cement is roughly classified into: (1) Portland cement which is most widely used; (2) blended cement based on Portland cement; and (3) special cement. In Viet Nam, Portland cement is primarily produced, as well as blended and special cement, such as white cement, alumina cement, and special cement for oil fields. Recently, production of blended and special cement has been on the rise.

The domestic market is divided into two segments, large construction projects and smaller ones. Cement is also consumed in large quantities to produce concrete products.

Large construction projects are usually awarded to foreign contractors, under which foreign and local enterprises perform work.

(4) Production technology and equipment, and their origins

The cement production process consists of: (1) preparation including the drying, crushing, and blending of raw materials; (2) baking; and (3) finishing. Some cement manufacturers have the finishing process only by purchasing clinker produced in the baking process from outside sources. In Viet Nam, an increasing number of cement manufacturers operating in urban areas use clinker to produce cement as the preparation and baking operations are banned for environmental consideration. Also clinker is increasingly imported, representing around 20% of domestic production in 1995.

In the country, there are very old production facilities and equipment built and brought by French companies before 1960. Later, the country introduced equipment from Romania and other East European countries. Recently, it has started to use equipment from France and other West European countries, India, China, and Korea. While production technology used in Vietnamese industries has been changing with equipment, it still finds some roots in French technology.

5.2 Current State of Standardization and Quality Management

(1) Standards and their development status in Viet Nam: Current use

TCVN maintains standards for Portland cement, covering three strength levels of 30,

40, and 50, as well as 30 and 40 for blended cement.

Old standards are based on GOST, and new standards based on ISO are increasingly adopted. GOST-based standards are still used, and there is increasing demand for ISO-compatible standards among the industries.

There is no TCVN for ready-mixed concrete and quality registration is carried out on the basis of specifications contained in the customer's order. In purchasing clinker, ASTM is applied.

Some of large enterprises develop internal standards (TC) on the basis of BS or French standards.

(2) Certification

The cement industry boasts the largest number of enterprises which have obtained voluntary product certification, totaling 23. All cement bags distributed in the country bear applicable TCVN indication. In construction projects carried out by local enterprises, the certification label is used as an accepted means of quality assurance.

Notably, quality of cement supplied by each manufacturer is stable, whether high or low grade. Cement supplied by state enterprises under control of the central government does not show any quality problem. Users rely on brand name for preliminary quality check. However, imitation of some brands occurs, so that inspection is made to compare the package and content.

No quality problem has occurred for cement which has passed certification. On the other hand, the use of substandard cement has led to corruption of a theater and a hospital. No serious problem has occurred in connection with brick.

Large construction projects are often executed by foreign contractors, and construction materials complying with standards of the contractor's country are usually used. If a compliance test cannot be conducted in the country, samples are often sent to the contractor's country. Products of small manufacturers are sent by the contractor to a suitable local or foreign laboratory. In this case, the manufacturer is notified only when its product has been rejected.

In contrast, no steel bar maker uses the certification system. They are required to make quality registration; each manufacturer registers as to which standard it uses to produce its products, i.e., TCVN, TCN or foreign standard. Based on registration, the regulatory body performs a periodical audit to check if production is carried out in accordance with registered standards. Although manufacturers can sell their products

only after they have passed the audit, some products without it are on market.

In addition, follow-up examination is conducted by using samples collected from the market. Nevertheless, products that do not meet standards are sometimes distributed without control. More importantly, each product bears no indication of whether it has been inspected, so that the consumer has no way of knowing it.

It should be noted, however, that standards applicable in actual conditions of use are not always available. In fact, there are no applicable standards for various construction materials, e.g., steel poles and window frames, in which case the manufacturer makes quality registration system based on its internal standards by declaring the compliance. Another complication occurs when product specifications change frequently. In this case, each change must be registered, but most of manufacturers keep original registration. Thus, the quality registration system is partially effective and fails to convey accurate product information to the public.

Both cement and steel bars are subject to quality registration. Generally, manufacturers register applicable standards, based on which products are manufactured.

Other products for which workable standards do not exist, e.g., steel poles and window frames for warehouses, are also the subject of quality registration, and internal standards (specifications) are registered. And quality registration is made for a representative product only, and no change is reported for other products or revision of original specifications.

In addition, the Ministry of Construction regulates construction materials, which are divided into: 1) cement and other products; and 2) aggregate. No compulsory regulation is carried out for building standards.

(3) Quality control

Large enterprises manufacturing cement and steel bars practice quality control, which is virtually limited to quality inspection.

Cement mills operating at a local level conduct visual inspection only, and do not have testing equipment. From operational needs, they use outside testing service, but not suitable for timely management of defects when occurred.

Both the construction industry and the construction materials industry have strong interest in quality control (particularly ISO9000 and TQM). A major reason for this is STAMEQ's promotional efforts targeting these industries, which indicates that promotional activity can spur strong interest if properly managed.

(4) Testing and inspection

The cement industry mostly uses outside testing service for the following purposes: 1) to obtain TCVN-based certification (or renewal); 2) to make quality registration; 3) for internal quality control; and 4) to meet the customer's request.

Tests required to obtain certification under TCVN are performed by QUATEST. The audit related to quality registration, previously QUATEST's responsibility, has been transferred to SMQ under control of local governments. Note that every SMQ facility does not have sufficient testing equipment. In fact, its audit is often based on tests conducted by QUATEST, large enterprises or other testing laboratories[4] (those accredited under the old system). QUATEST is capable of conducting tests on cement and other construction materials, including concrete, masonry products, and aggregates. At present, there is high demand for concrete testing.

QUATEST is also used when a manufacturer submits quality certification by a third party organization upon its customer's request. The exception is cement supplied to the construction projects executed by foreign contractors, who not satisfied with QUATEST certification in many cases and send samples to their countries for testing.

As for tests conducted for internal quality control, small- and medium-sized enterprises under control of local government or military force use outside service due to the lack of their own equipment. Usually, nearby laboratories, large cement manufacturers or other testing organizations are used. QUATEST primarily handles tests to check compliance with standards and is not used for tests for quality control purposes because of many test items and considerable time required.

Steel bars are mostly manufactured by large enterprises which conduct detailed quality tests at their own laboratories. Outside service is used to obtain a third party's certificate upon the customer's request, and QUATEST is most frequently used. In addition, university laboratories are used.

QUATEST, while capable of performing tests on reinforcing bars, do not have testing equipment on steel frames. Clearly, QUATEST and its present equipment will not be able to perform adequate tests on construction materials used for higher buildings and larger structures which will be increasingly constructed in future.

[4] For instance, Institute of Building Materials

Table 5-1 Number of Establishments (Construction Materials Subsector)

(Unit: Number)

	1990	1991	1992	1993	1994
State Industrial Enterprises	492	439	375	325	320
Central state	78	71	66	66	64
Local state	414	368	309	259	256
Collective economic establishments	2,802	1,970	1,161	978	487
Individual & mixture	106	216	262	462	517
Private industrial households	29,187	37,278	41,056	54,027	64,213
Total	32,587	39,903	42,854	55,792	65,537

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

Table 5-2 Gross Output
(Construction Materials Subsector)

(Unit: VND billion)

	1990	1991	1992	1993	1994	1995
Gross output						
of Construction materials (A)	1,000.2	1,165.1	1,383.5	1,601.0	1,957.3	2,143.0
of which:						
by State industry	608.9	740.5	902.4	1,094.4	1,330.4	1,441.0
(%) of (A)	61	64	65	68	68	67

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

Table 5-3 Production and Import of Major Products (Construction Materials Subsector)

	unit	1990	1991	1992	1993	1994	1995
Production							
Steel	'000tons	101	149	196	243	279	380
Metallic construction materials	000tons	6.2	5.8	6.1	7.8	6.9	n.a.
Construction materials							
Cement	'000tons	2,534	3,127	3,926	4,849	5,371	5,854
Bricks	mill. Pieces	3,476	3,769	4,274	5,001	5,797	6,576
Tiles	mill. Pieces	405	455	431	466	565	577
Lime	'000tons	663	665	693	787	825	n.a.
Stones	'000m^3	5,362	4,464	5,420	5,479	n.a.	n.a.
Sand/ pebbles	'000m^2	10,438	12,447	10,572	11,061	13,843	n.a.
Fibro-cement tiles	'000m^2	6,705	4,283	4,672	5,694	9,641	n.a.
Import							
Cement	'000tons	221.0	7.0	43.4	134.4	571.9	1,300.0
Clinker	'000tons		12.3	5.1	176.3	749.5	1,100.0

Note: n.a. - Not available

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

6 Petroleum Products and Related Industries

6.1 Current State of the Industries

6.1.1 Size and structure of the Industry

(1) Product types

Petroleum products are classified according to their state and form, as follows:

1) Gaseous form - Petroleum gas (e.g., LNG and LPG)
2) Light distillate - Gasolines, naphthas, jet fuel, kerosene
3) Medium- and heavy distillate - Gas oils, fuel oils, lubricating oils, insulating oils, cutting oils, and liquid paraffin
4) Semi-solid and solid - Grease, asphalt, wax, and coke

Each product is further classified according to use, such as aviation gasolines, automotive gasolines, and industrial gasolines.

Viet Nam has no full-scale refinery and imports all the petroleum products but lubricating oil. As shown in Figure 6-1, 90% of consumption are accounted for by diesel fuels, gasolines, and other fuel oils. The following sections describe the general structure of the petroleum industry and general distribution channels in the country.

(2) Industrial structure

PetroVietnam, a state enterprise serving as a principal organization to develop and produce crude oil, is responsible for negotiation and conclusion of production sharing (PS) contracts with oil companies, and providing necessary assistance for crude oil development projects. It is also involved in the planning of refinery projects and the establishment of lubricating oil blending facilities. Furthermore, PetroVietnam is mandated to manage and control the oil industry in the country, however, consolidation does not progress as planned. Under PetroVietnam, Petchim is responsible for exports of crude oil and imports of petroleum-related equipment, petrochemical products, and fertilizers. Petrolimex under supervision of the Ministry of Commerce imports, distribute and sell petroleum products in the domestic market. VINAPCO imports and supplies jet fuel for Vietnam Air. Saigonpetro is a public enterprise under control of Ho Chi Minh City People's Committee to produce and sell petroleum products (see Figure 6-2).

Eleven enterprises have lubricating oil blending facilities, three joint ventures, three state enterprises, and five private enterprises. In addition, there are foreign-affiliated importers, such as Esso, Mobile, Caltex, Idemitsu, engaged in direct imports. Annual demand for lubricating oil is estimated to be around 100,000 tons, while the aggregate production capacity in the country is around 270,000 tons.

Lubricating oil manufacturers import base oil and additives from Singapore and other countries, and blend them according to specifications established by manufacturers. Blended lubricating oil is packed in varying sizes of containers (oil drums, plastic tanks, and cans) according to demand. These containers are manufactured locally.

In the country, there is only one mini-refinery which is operated by Saigonpetro (production capacity of 8,000 b/d). As a result, most of crude oil produced in the country is exported to Japan and Singapore, while petroleum products including gasolines consumed within the country are mostly imported (see Table 6-1). A major import source is Singapore. Consumption of gasoline and diesel fuel is expected to grow at an annual 10% with an anticipated increase in the number of passengers cars and trucks. Based on the forecast, consumption will nearly double between 1995 and 2000.

The Vietnamese government plans to construct a refinery in the central part of the country (Dung Quat), but negotiation with foreign partners is in stalemate and the government is considering to implement it by itself. Nevertheless, completion in 2000 in the original plan seems to be difficult due to financing and other problems.

Viet Nam has 2.5 billion barrels of crude oil reserves according to IMF's estimate, which has largely been untapped. At present, the Bach Ho (White Tiger) field located 200km off the southeast coast is the only oil field in commercial production. It is produced by Vietsovpetro, a joint venture between Russia and PetroVietnam. Crude oil produced is exported without processing, with more than one half being bound to Japan. In 1997, 9 million tons are planned to be produced. As shown in Table 6-2, crude oil production has been growing steadily, and the Vietnamese government intends to boost it to 400,000 barrels/day by 2000.

(3) Distribution

In the country, petroleum products are distributed by four enterprises, Petrolimex, Petech, Saigonpetro, and PTSC under PetroVietnam. Petrolimex controls 60 - 65% of the market. The country stills bans foreign companies to enter the business of distributing and marketing. The above four enterprises own and operate oil import

terminals. A potential problem is seen in the northern region, however, where there is only one port to accommodate large tankers, Hon Gai (Quang Ninh), which may not be able to supply sufficient fuels to the northern industrial area expected to grow in future. In the south, Petrolimex operates import terminals owned by Shell, Esso and Caltex before 1975, which are aging.

From the import terminals to consumers, petroleum products are transported through pipelines (Quang Ninh and Hanoi), by railroads or ships. As water channels are well developed in the south, water transport accounts for 60% of total traffic.

In the country, there are approximately 2,000 filling stations, one half of which is state owned and the remaining half is privately owned. Many of them are old and have safety problems such as the lack of safety management and a small site.

Quality of gasoline and diesel fuel sold to general consumers is not properly controlled. In rural regions, low-grade gasoline is sold to motorcyclists in plastic bottles.

6.2 Current State of Standardization and Quality Management

6.2.1 Development of standards

TCVN for petroleum products are classified into nine categories: 1) drilling and refining of crude oil and natural gas; 2) crude oil; 3) natural gas; 4) general petroleum products; 5) lubricating oil; 6) waxes, bituminous materials, and other petroleum products; 7) fuel; 8) facilities and equipment of oil and natural gas industries; and 9) oil and natural gas handling equipment. Many standards were established and revised between 1978 and 1984, based on GOST and Romanian standards.

Product standards are limited to diesel fuel and automotive gasoline, and there is no product standard for kerosene, fuel oil, and natural gas.

6.2.2 Use of standards by individual enterprises

Most enterprises adopt ASTM (American Society for Testing and Materials), API(American Petroleum Institute) and IP (Institute of Petroleum) standards, while TCVN is not widely used, partly because they have testing equipment based on ASTM and other standards, and partly because TCVN lacks some of essential standards. Also, international standards are convenient to use as most petroleum products are imported. As a result, their internal standards are developed based on ASTM and meet TCVN

requirement as well, as seen in automotive gasoline.

Automotive gasoline is subject to mandatory inspection, under which QUATEST tests imported automotive gasoline in accordance with TCVN (see Table 6-3) and issues a certificate required for imports to the product which satisfies applicable TCVN requirements.

Lubricating oil blenders are required to receive testing and inspection on production capacity, technology levels, and imported materials which are conducted by MOSTE (QUATEST). The blenders and importers are required to indicate product quality in Vietnamese according to standards established for lubricants. This requirement has been recently introduced to control low-grade lubricating oil which has been imported and marketed, and is set forth in a ministerial order, rather than TCVN. Quality standards set forth in the requirement are based on API and SAE (Society of Automobile Engineers).

6.2.3 Expectations for promotion of standardization and major issues

One of major issues related to standardization is the lack of necessary product standards. For instance, there are 33 product standards related to petroleum in JIS, compared to only two in Viet Nam. At present, petroleum products are handled by a relatively small number of state enterprises which maintain internal standards to ensure product quality. Nevertheless, basic standards need to be established in anticipation of growing demand. In particular, mandatory standards should be considered from safety and environmental viewpoints.

It should be pointed out that automotive gasoline standards need various improvements (see Table 6-3 "Gasoline Standards"). First of all, octane rating standards are based on MON and RON, while Japan and Southeast Asia (the Philippines, Malaysia, Indonesia, and Thailand) use RON numbers only, resulting in some inconvenience when automotive gasoline is imported from these countries.

Secondly, current standards are old and deviated from ASTM which is widely used by companies. For instance, the testing method for octane rating (RON) was established in 1978 (TCVN2703-78) and has not been revised.

Finally, automotive gasoline used in the country has a relatively high led content which presents an environmental problem. With the world trends toward the use of non-leaded, low sulfur and benzene content gasoline, the Vietnamese government intends to covert to non-leaded gasoline. Nevertheless, the conversion process is slow due to considerable time and effort to require the increase in number of motor vehicles capable of

running on non-leaded gasoline and the accompanied upgrading of related facilities and equipment.

Diesel fuel also has a relatively high sulfur content (Table 6-4) compared to European and U.S. standards, raising environmental concern.

Naturally, quality standards for fuels such as automotive gasoline and diesel fuel should vary between countries as quality requirements vary with climate and geographical conditions under which vehicles are operated[1]. At the same time, atmospheric pollution in large cities is a major issues to be tackled in many Asian countries, and the improvement of fuel quality is becoming a common goal. In this context, Viet Nam is also expected to revise their standards with reference to other countries having advanced technology and knowledge, while ensuring the consensus of user communities and related industries.

There is great needs for inquiring international and foreign standards in the industry. Furthermore, it is necessary to upgrade and study these information for future standard developments.

In fact, many enterprises complain about obsoleteness of testing standards as well as many GOST-based standards. Although they propose new standards to STAMEQ, the pace of development is very slow due to the limited ability of STAMEQ and the difficulty in gaining consensus within the industry.

6.2.4 Testing and Inspection system

Generally, a petroleum product is tested for specific items when a tank becomes full. If the product is found to meet standards, it can be shipped to the market. Thus, quality is assured for each tank which is assumed to store the product having same properties.

Some products are made by blending semi-products in certain proportions by the inline blender and are shipped directly to users. In this case, small samples are collected at a specific interval for testing.

(1) Current state of the testing and inspection system in the sector

PetroVietnam has research institutes in the north and south, capable of testing crude oil and petroleum products. Also, Petrolimex, handling 60% of petroleum products distributed throughout the country, has its own laboratories for testing and inspection.

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[1] For instance, ASTM specifies the average of RON and MON as octane number, whereas CEN (European Committee for Standardization) sets forth minimum RON and MON numbers for non-leaded premium and regular gasolines.

These facilities are staffed by personnel trained in and outside the country.

Among the lubricant oil blenders, joint ventures with foreign partners have testing equipment required to comply with OEM standards specified by their parent companies. Also, staff is trained by a group company's training facility.

On the other hand, some of private enterprises in the blending business do not have sufficient testing equipment and are not capable of analyzing content and performance of lubricating oil. As a result, they face difficulty in maintaining qualities indicated for each product.

(2) External testing resources

As pointed out earlier, QUATEST is required to conduct a certain set of testing and inspection on imported automotive gasoline and lubricating oil. For other test items, however, much less requests are made to QUATEST as large enterprises generally have better testing equipment. Also, enterprises have more experienced staff as the mandatory testing on imported products has started recently.

For petroleum products other than automotive gasoline, large enterprises and foreign-affiliated joint ventures mainly have testing equipment, some of which can conduct tests that are beyond the ability of QUATEST. Generally laboratories owned by state companies are capable of performing supplemental tests for other enterprises. Nevertheless, there is a potential need for contract testing by fully equipped laboratories, particularly among lubricating oil manufacturers, while some of companies have apparently the shortage of testing equipment.

Table 6-1 Viet Nam Current Oil Consumption

Year	Import (Million tons)	Consumption (Million tons)
1990	2.86	2.79
1991	2.57	2.64
1992	3.33	3.16
1993	3.80	3.70
1994	4.50	4.40
1995	5.40	5.20
2000*	11.00	10.00

Note: * Forecast

Source: PVPDC

Table 6-2 Production and Trade of Petroleum Products

	1990	1991	1992	1993	1994	1995
Crude Oil						
Production (Mill. tons)	2.7	4.0	5.5	6.3	7.1	7.6
Export ('000 tons)	2,617.0	3,917.0	5,446.0	6,153.0	6,949.0	7,652.0
Petroleum Product import ('000 tons)*	2,860.8	2,572.5	3,142.0	4,090.7	4,531.4	
Gasoline import ('000 tons)	680.3	554.3	642.1	909.8	1,052.0	
Diesel Oil import ('000 tons)	1,248.4	1,133.5	1,188.0	2,002.9	2,193.2	
Kerosene import ('000 tons)	228.9	178.9	160.9	209.2	285.1	
Lubricating Oil import ('000 tons)	108.5	109.2	209.0	153.0	178.5	

Note: * Refined

Source: Statistic Yearbook – Viet Nam 1995

Table 6-3 Automotive Gasoline Viet Nam Standard (TCVN 5690 - 92)

ID	Specification	Test Method	Normal		
			Regular	Supper	Special
1	Octane Number				
	Motor (MON)	2702-78	MIN 76	MIN 83	MIN 89
	Research (RON)	2703-78	MIN 83	MIN 92	MIN 98
2	Lead Content, G/L	4247-86	MAX 0.15	MAX 0.15	MAX 0.4
3	Distillation, ℃	2698-78			
	IBP		MIN 40	MIN 40	MIN 35
	50% Vol.		MAX 120	MAX 120	MAX 115
	FBP		MAX 205	MAX 205	MAX 195
	Residue, % Vol.		MAX 1.5	MAX 1.5	MAX 1.5
4	Corrosion, 3H/50 ℃	2694-78	MAX N-1	MAX N-1	MAX N-1
5	Existent Gum, Mg/100 ml	3178-79	MAX 4.0	MAX 4.0	MAX 4.0
6	RVP, 37.8 ℃, KPA	3790-78	MAX 67	MAX 67	MAX 74
7	Total Sulfur, % WT	2708-78	MAX 0.15	MAX 0.15	MAX 0.1
8	Oxidation Stability	3791-83	MIN 480	MIN 480	MIN 900

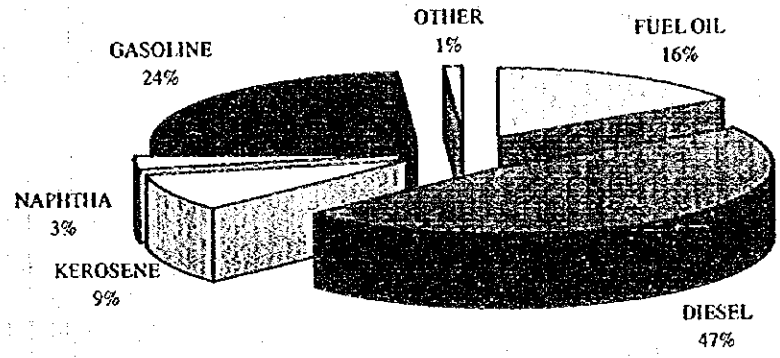
Source: PVPDC

Table 6-4 Viet Nam Standard 5690 - 1992 for Diesel Oil

ID	Specification	Unit	Limit	Test Method
1	Cetane No.		45	3180-79
2	Distillation			
	50%, MAX	℃	290	2698-70
	90%, MAX	℃	370	4247-86
3	Viscosity, 20 ℃	CST	3.5 - 6.0	3171-73
4	Flash Point (Closed Cup)	℃	50	2693-78
5	Summer Freeze Point (1.4 - 30.9) MAX	℃	5	3753-83
6	Ash, MAX	%WT	0.02	2690-78
7	Physical Appearance	%WT	NIL	2706-78
8	Water	%WT	NIL	2692-78
9	Existent Gum	Mg/100ml	50	3178-79
10	Total Sulfur	%WT	1.0	2708-78
11	Sulfur Content, Mercaptan, MAX	%WT	0.01	2685-78
12	Coke in 10% Reside., MAX	%WT	0.3	2704-78
13	Cu Corrosion, 50℃, KPA/3 HR, MAX		N-1	2694-78
14	Acid Number	Mg KOH/100ml	10	2695-78
15	TBN		NIL	3176-79
16	Density at 20℃, MAX	G/Cm^3	0.860	3893-84

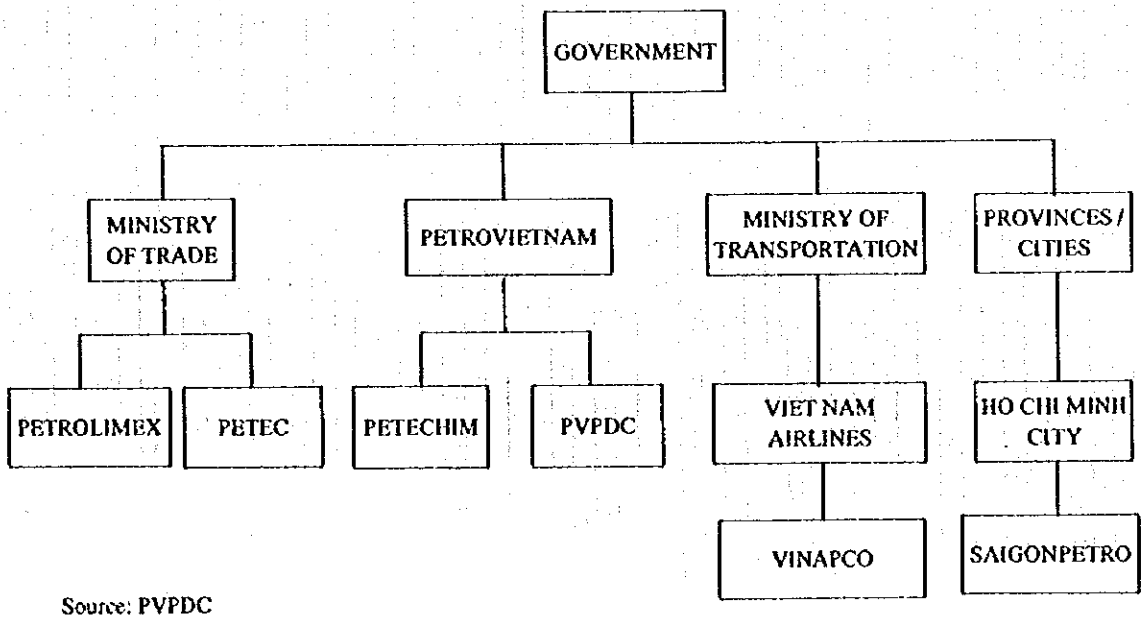
Source: PVPDC

Figure 6-1 Viet Nam Oil Consumption by Product In 1995



Source: PVPDC

Figure 6-2 Viet Nam Petroleum Import-export Organization



Source: PVPDC

Annexes

Annex 1 Detailed Description of Metrology/Calibration Bodies and Testing/Inspection Bodies

1.1 VMI (Viet Nam Metrology Institute)

1.1.1 Profile and function

VMI is the highest technology and research institute in the field of metrology under STAMEQ, located in Nghia Do, Hanoi, and is responsible for the following activities:

(1) Planning for metrology development according to meet the demands of national economy, science and technology

(2) Organizing the development of legal document on metrology and research on metrology management

(3) Researches on scientific and technical matters of metrology and measurement standards

(4) Settling up, management, and maintenance of measurement standards

(5) Calibration of measurement standards and measuring equipment, and certification of standard reference materials

(6) Research, development and manufacture of measurement standards, and verification of new measuring instruments

(7) Carrying out technical audit serving the state management on standardization, metrology and quality

(8) Elaborating metrology-related programs and manuals, and carrying out training on professional skills and techniques

(9) Information and promotion activity on metrology

(10) International cooperation in the field of metrology

1.1.2 Organization and manpower

VMI consists of the administrative section and nine laboratories, employing 103 staff including 64 senior staff (see Table A1-1 and Figure A1-1).

1.1.3 Facilities and equipment

National measurement standards maintained by VMI are listed as follows:

Mechanical:	Length(m), Angle (rad), Mass (kg), Volume (m^3), Density (kg/m^3), Viscosity (m^2/s), pH (pH), Force (N), Hardness (HR), Pressure (Pa)

Electrical:	DC Voltage (V), DC Resistance (Ω), Capacitance (F), Inductance (H), HF Voltage (V), HF Power (W), Sound Level (dB), Attenuation (dB)
Time & Frequency:	Time interval (s),Frequency (Hz)
Others:	Temperature (K), Flow (m^3/s), Humidity (%)

VMI occupies 3,500m^2 of floor area, which is divided according to function, as follows:

Laboratories	2,500m^2
Administrative and supporting facilities	1,000m^2
Total	3,500m^2

1.1.4 Finance

In 1996, VMI obtained the government budget of US$290,000 and service turnover of US$200,000 which includes about 15% of revenue. Service turnover mostly came from mandatory verification of measuring instruments such as mass, length and volume. Although VMI's involvement in legal verification is somewhat arguable, it certainly constitutes a major financial source for the organization, accounting for more than 10% of its annual budget.

1.2 QUATEST 1 (Quality Assurance and Testing Center 1)

1.2.1 Profile and function

QUATEST 1, under STAMEQ, is a professional scientific organization serving the State management on standardization, metrology, quality and other requests from industries. It is located in Nghia Do, suburbs of Hanoi. It serves 28 designated cities and states in the northern region. Its primary functions are summarized as follows:

(1) State quality control of export and import goods
(2) Factory audit of quality control and product certification
(3) Testing and inspection service
(4) Calibration and verification of measuring instruments and testing equipment
(5) Education and training of testing, inspection, calibration and maintenance personnel
(6) Consultancy on metrology, testing and inspection
(7) International cooperation and promotion related to metrology, testing and inspection

1.2.2 Organization and manpower

QUATEST 1 has 5 laboratories, 4 calibration laboratories, 3 inspection departments, having around 100 employees (Table 2-10 and Figure 2-12 in Part II).

1.2.3 Facilities and equipment

Equipment and instruments owned by QUATEST 1 for mechanical and material testing are listed in Tables A1-2, A1-3 and A1-4.

While they form a basic set of mechanical testing equipment, these equipment and instruments are old, mainly made in the former USSR and East Germany. In fact, many of them are not operable. There is the apparent lack of equipment which meets the changing needs. As for testing equipment to measure metal strength, the universal testing machine owned by QUATEST is limited to 500KN, which is not sufficient to test recent steel materials with higher strength. Besides Brinell hardness tester and impact testing machine in existence, additional equipment will be required to handle diverse types of materials, including portable hardness tester, Shore hardness testers, and micro Vickers hardness testers. For the measurement of dimensions and shape, a 3D coordinate measuring machine currently owned by QUATEST 1 has an insufficient capacity. A surface roughness tester is not serviceable, while there is no roundness tester, profile projector, and contour measuring machine. A metallurgical microscope is of old type and does not work. There is no equipment to conduct chemical analysis of metallic materials, nor X-ray equipment for non-destructive testing.

The electrical/electronics laboratory has a sufficient set of equipment to check safety of electric fans, cables and wires under legal requirements[1]. They are generally old but have testing capabilities under mandatory standards. In addition, measurement instruments used for performance testing of power transformers and motors do not have sufficient accuracy levels to meet IEC and ANSI requirements.

1.2.4 Finance

QUATEST 1's 1996 revenues consist of VND 2,660 million from the government budget and VND 2,702 million from service turnover (testing, inspection, verification, and certification).

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[1] Main testing items for electrical fan and cable/wire are;
Electrical fan: temperature test, insulation registance test, withstand voltage test, leakage currents test, test for measuring power input, moisture resistance test, air-measuring test
Cable/wire: dimensions test, conductor resistance test, insulation registance test, withstand voltage test, aging test

Nearly one half of service turnover comes from inspection service, most of which is related to mandatory certification of imported products. Turnover from verification service (legal metrology and calibration) amounts to VND 397 million.

Revenue from the government budget has been on the decline, and service turnover make increasing contribution to QUATEST 1's operation. For metrology/calibration and testing/inspection sections, service turnover, both mandatory and voluntary, are expected to increase.

QUATEST 1 is primarily handling mandatory testing, rather than voluntary tests requested by enterprises. Mandatory tests include calibration and verification of balance scales, truck scales, calorific volume measuring instruments, etc. One of mandatory tests considered important is the safety analysis of foodstuff, for which analytical equipment was obtained under French support in 1996. Also, QUATEST 1 increasingly receives request for analysis of water quality and soil from local governments and private enterprises under recommendation by Environmental Protection Agency.

Similarly, voluntary inspection on construction materials (e.g., cement and metallic material) increases as a result of the construction boom.

Most of electricity-related tests are mandatory safety tests for electric fans, cables and wires. There are few requests for voluntary electrical and electronic tests by state or private enterprises for quality control and/or product development purposes.

Most of metrology personnel at QUATEST 1 have formerly worked with VMI, and current staff is sufficient to meet legal metrology and inspection service requirements. Staff training is carried out both locally and overseas.

On the other hand, there is the shortage of personnel and equipment for voluntary non-destructive testing, and QUATEST 1 can only provide a limited range of service. There is no person who is certified to NDT Level 3 skills.

1.3 QUATEST 3 (Quality Assurance and Testing Center 3)

1.3.1 Profile and function

QUATEST 3, also under STAMEQ, serves 24 designated cities and states in the southern part of the country. Its head office is located in the central part of Ho Chi Minh City, with a major testing and inspection facility in the Bien Hoa district. Its functions are same as those assumed by QUATEST 1 (see 1.2.1), plus some duties of VMI.

1.3.2 Organization and manpower

QUATEST 3 has 15 testing and inspection sections, consisting of 197 staff (Table 2-11 and Figure 2-13 in Part II).

1.3.3 Facilities and equipment

Equipment and instruments owned by laboratories of QUATEST3 are listed in Table A1-5.

Mechanical testing and inspection equipment, and measuring instruments have been steadily added and replaced under the aids of UNIDO and various countries. They are now better than those owned by QUATEST 1 and are capable of meeting most of requests for mandatory metrology and general testing and inspection services. However, QUATEST 3 does not have equipment to perform chemical analysis of metallic materials. Dimensional and shape measuring instruments can meet present demand, but they are not sufficient to meet requirements by precision parts suppliers for automotive and electric/electronic industries, if they grow as planned. Also, these instruments will be increasingly demanded as more and more enterprises apply for ISO9000 certification in the machinery area.

As for non-destructive testing, QUATEST 3 has full sets of equipment to perform magnetic particle, liquid penetrant, radiographic (X-ray, γ -ray), ultrasonic, and eddy current tests, and together with qualified staff, capable of providing a wide range of service.

In the electrical and electronic fields, measuring instruments for safety testing of electric fans, cables and wires are available. Testing of cables and wires (24KV or less) and household appliances (electric fans, irons, ranges, switches, and sockets) is carried out in accordance with TCVN, together with safety standards of IEC. For instance, circuit breakers are tested under IEC standards. Cable and wire tests account for 60% of total tests conducted, and the remaining 40% product and parts tests including electric fans. 50 electric fans are tested monthly, and 10% fail to satisfy test requirements. No short-circuit/cutoff test is conducted for circuit breakers due to the lack of equipment.

QUATEST 3 has a basic set of electric measuring instruments for calibration, e.g., power meters, ammeters, and resistance meters, but not frequency meters due to the lack of a measurement standard. QUATEST 3 receives calibration request for 5-10 instruments each day.

All of testing equipment are maintained and used in air-conditioned rooms.

1.3.4 Finance

The government budget allocated to QUATEST 3 in 1996 grew slightly to VND 2,500 million, while service turnover increased rapidly to VND 7,000 million. Mandatory calibration service accounts for large portions while voluntary calibration service much less. As for calibration of electric measuring instruments, voluntary and mandatory services are divided equally, although the former is on the rise with increasing requests from enterprises.

1.4 SMQ (Department for Standardization, Metrology and Quality Control) - Hanoi

1.4.1 Profile and function

SMQ Hanoi belongs to DOSTE (Department of Science, Technology and Environment under Hanoi People's Committee) and is primarily responsible for the following functions in Hanoi area, under technical assistance and guidance from STAMEQ:

1) Activities of standardization, including promotion of TCVN and quality system to enterprises, and enforcement of mandatory standards
2) Inspection required for quality registration and product certification
3) Inspection on exported and imported products on behalf of QUATEST
4) Legal verification of measuring instruments
5) Voluntary testing and inspection service

Service provided by SMQ Hanoi in mechanical and electrical fields is mainly legal verification.

Physical and technical laboratory performs verification of watt-hour meters, while mass & volume verification section carries out calibration of weights for balances, and verification of measuring instruments by using standard containers.

1.4.2 Organization and manpower

SMQ Hanoi has the following five sections, consisting of 50 staff.

1) Administration section
2) Professional section
3) Chemical & biological laboratory (8)
4) Mass & volume verification section (13)
5) Physical & technical laboratory (6)

1.4.3 Facilities and equipment

SMQ Hanoi has a necessary set of measurement standards for legal verification (pressure, volume, and mass).

However, VMI's certification has been confirmed for standard containers for volume verification, while other standards, including weights and standard pressure gauges, do not have VMI certification record nor certification has expired.

Although staff do realize the need for periodical VMI certification, it has not been practiced.

1.5 SQM - Ho Chi Minh City

1.5.1 Profile and function

SMQ Ho Chi Minh City belongs to DOSTE Ho Chi Minh City and assumes the same scope of responsibilities as SMQ Hanoi (1.4.1).

Its laboratories perform legal verification of mass, volume, pressure, and watt-hour meters, and mass accounts for the largest share. On-site verification accounts for 80%, and laboratory verification 20%.

SMQ Ho Chi Minh City performs few voluntary calibration service.

1.5.2 Organization and manpower

SMQ Ho Chi Minh City has a metrology division and 5 laboratories, manned by 96 staff:

1) Administrative Div.
2) Planning Div.
3) Consulting Div.
4) Testing Div. (5 laboratories, 20 staff)
   a) Chemical Laboratory
   b) Micro Biological Laboratory
   c) Mechanical Laboratory
   d) Electric/Electronic Laboratory
   e) Sensory Laboratory
5) Metrology Div. (Approx. 10)
6) Technology Div.
7) Information Div.

8) Library
9) Quality Management Div. (Approx. 5)

1.5.3 Facilities and equipment

Measurement standards are held by Metrology Division. Mass standard has obtained a test certificate (accuracy level 0.002mg/20g, E2) of their manufacturer, Satorius. It was not calibrated by one held by QUATEST 3, which is the same E2 class. On the other hand, volume standards and standard pressure gauges are calibrated by QUATEST 3. Measurement standards and related equipment are maintained in good conditions. Thus, SMQ Ho Chi Minh City has a necessary set of equipment for legal verification.

1.6 SMQ Hai Phong

1.6.1 Profile and function

SMQ Hai Phong belongs to DOSTE Hai Phong and assumes the same functions as SMQ Hanoi (1.4.1).

1.6.2 Organization and manpower

SMQ Hai Phong has 37 staff and 6 laboratories within metrology and testing center:

1) Administrative Dept.: 6 (Incl. 3 academic staff)
2) General Dept.: 7 (All academic staff)
3) Metrology and Testing Center: 24 (the following six departments)
   a) Pressure & Volume Testing
   b) Mass Testing
   c) Mechanical Testing
   d) Chemical & Microbiology
   e) Environmental testing
   f) Electric Testing

In 1996, SMQ Hai Phong calibrated and verified 22,5000 meters and gauges (mass, volume, pressure, length, hardness, etc.) and 20,000 water meters for 375 factories.

It also provides maintenance service for meters and gauges.

1.6.3 Facilities and equipment

Mechanical Testing Lab has tensile and abrasion testers for textile and rubber, tensile testers for metallic materials (30 and 100 tons) testers, hardness testers and spring testers.

As for measurement standards, it holds a weight set (1kg-2kg/F2.1g-500g/F1&F2) and standard pressure gauges. Electric Testing Lab has a set of equipment for legal verification of power meters, cables and wires, and electric fans.

1.7 SMQ DongNai

1.7.1 Profile and function

SMQ DongNai is also under DOSTE DongNai Province and fulfills the same function as SMQ Hanoi (1.4.1).

1.7.2 Organization and manpower

(1) Organization

SMQ DongNai has 10 staff, headed by a director with supportive staff of two vice directors and one secretary, under which two laboratories are managed, testing (3) and metrology (3).

(2) Testing record

- Engineering tests: brick, concrete, etc.
- Food tests: potable water, ice cream, etc.
- Environmental tests: river water, waste water, dust, etc.

(3) Verification record

- Plateform balance (500mg max, 200pcs) & spring scale (1,000pcs)
- Small-size flow meter for petrol (650pcs/6 months)
- Pressure gauge (300pcs/6 months)
- Watermeter

Watt-hour meters are verified at Electrical Testing Center 2, HCM City (Elec. Supply Co., HCM City).

1.7.3 Facilities and equipment

(1) Environmental laboratory

Procurement of new equipment is progressed under UNDP's aid (US$60,000), including spectrophotometer, conductive meter, pH meter, and portable water quality monitor (capable of measurement in five parameters, including temperature, pH, and transparency).

(2) Mechanical laboratory

Concrete compression strength testing machine
(made in China, max. 600KN) 1 unit
Concrete flexural testing machine (made in China) 1 unit
Standard containers (steel) - 5, 10, 20, 50 and 100 liters

(3) Verification laboratory

Weights for balances used at gold shops (F2 - 200g)
Having several M2 class 10kg weights

1.8 INST (Institute of Nuclear Science and Technique)

1.8.1 Organization and manpower

INST's Center for Radiation Protection is a laboratory owning national measurement standards related to radiation measurement (α, β, γ, X ray).

INST is a member of Viet Nam Atomic Energy Commission under MOSTE and was founded in 1990 for R&D in atomic power and engineering.

The head office and most of its research arms are located in the Nghia Do district, consisting of 8 departments.

1) Administration Dept.
2) Planning & Inter. Affairs Dept.
3) Center for Nuclear Power Planning
4) Center for Application of Nuclear Methods and Techniques
5) Irradiation Center
6) Center for Radiation Protection
7) Department of Theoretical Physics
8) Department of Applied Informatics

The center is mainly responsible for calibration of a dozen radioactive isotope, cobalt 60 equipment and a number of x-ray equipment owned by medical institutes and bodies, as well as the measurement of radiation dose for workers under radioactive exposure, and the monitoring of radioactivity in the environment.

Calibration service is also provided by Nuclear Research Institute, Da Lat City, which has reference standards, thereby covering the southern region.

1.8.2 Facilities and equipment

INST's Center for Radiation Protection has the following radiation-related standards:

Parameter	Unit	Standards	Uncertainty
Activity radiation	Gy	α (Am^{241}) & β (Sr^{90}) ray activity radiation measurement method	5%
Ionizing radiation	Bq	γ (Cs137, 20Ci) Ionizing radiation measurement method	5.10^{-2}
		X ray (150KeV) radiation measurement method	5.10^{-2}

1.9 The Hanoi University of Technology

1.9.1 Function and role

The Hanoi University of Technology was established in 1956 as the first state university of technology. Since then, it has been producing graduates with around 35,000 bachelor degrees (engineers) and 300 master or doctor degrees, who are now contributing to the country's development and modernization in a variety of fields, including politics, culture, and social life, not to mention scientific and engineering fields. With introduction of market economy structure, since the university started to offer a re-education program for workers (the special education program) in 1988, more than 3,700 students graduated over the past decade. It also strives to raise academic and technological levels under assistance of international organizations such as UNIDO, UNDP, and UNESCO, and more than 20 foreign enterprises, and through cooperation and interaction with universities in more than 10 countries.

Furthermore, the university is carrying out joint R&D projects with government organizations and enterprises. In 1994, such projects totaled VND 111 billion at a state/provincial level, and VND 45 billion at the university level.

1.9.2 Organization and manpower

The university is made up of 10 faculties (information engineering, electricity/electronics, metallurgy/material science, mechanical engineering, energy, chemistry/food/biology, engineering physics, economics and management, textile engineering, and applied mathematics), 11 research centers such as automatic control, precision machinery, polymer, and biotechnology, and 3 education and training centers including a foreign language center.

It offers five-year bachelor grade programs with the total enrollment of approximately 22,000. There are 500 master or doctor degree students and 300 in the special education program. The teaching staff are around 940 (nearly one half are Ph.D holders and professors).

1.9.3 Facilities and equipment

Major equipment held by the metallic material lab under Department of Metallurgy and Material Science is summarized as follows:

- metallurgical microscopes (BMT-3, 10 units made in the former USSR, and 1 unit made by Zeiss in the former East Germany)
- Hardness testers (One Rockwell TK-14 made in the former USSR, one VickersHP0-250 made in East Germany, and one Brinell T-2M made in the former USSR)

Thus, the lab's equipment was mostly made in the former USSR and East Germany and is very old. Originally, it was used for educational purposes, but it is used for testing when requested by enterprises.

1.10 The Ho Chi Minh City University of Technology

1.10.1 Function and role

The Ho Chi Minh City University of Technology (HUT) is located within HCM City and one of the leading universities of technology in the country.

In addition to the educational function, it also offers an educational and technical training program in response to industrial demand, which provides reeducation of human resources. At the same time, it keeps interaction with industry circles, including technical assistance from foreign enterprises.

Furthermore, it serves as a testing and inspection body to provide voluntary testing and

inspection services required by manufacturing and construction industries.

1.10.2 Organization and manpower

At present, the HUT has 8,000 full-time students enrolled in the following seven faculties (including 600 in Master and Ph.D programs) and 4,000 part-time students, with 500 teaching staff:

1) Chemical Technology & Petroleum
2) Civil Engineering
3) Information Technology
4) Electrical and Electronic Engineering
5) Geology and Petroleum
6) Industrial Management
7) Mechanical Engineering

In addition, the faculties have 40 laboratories, and there are 9 research centers independent from the faculties.

1.10.3 Facilities and equipment

Facilities and equipment in the areas of mechanic and electricity, owned by laboratories of three faculties, Mechanical Engineering, Electrical and Electronic Engineering, and Civil Engineering, are summarized below.

In 1996, the university spent VND 9 billion on testing facilities and equipment (VND 2 billion from government, and VND 7 billion from its own financial source).

(1) Faculty of Mechanical Engineering

The faculty (86 teaching staff including 3 professors, 19 Ph.D holders, and 6 master degree holders) consists of 8 departments (design fundamentals, machine building, textile engineering, welding engineering, mechanics of communication, automatic control, mechanics of water supply, enterprize mechanism), and 4 laboratories.

Major testing equipment owned are vibration and balance measurement devices for rotating machines, which has been used for balance adjustment service upon request of individual enterprises. They are small and old.

(2) Faculty of Electrical and Electronic Engineering

The Faculty of Electrical and Electronic Engineering (97 teaching staff faculty members including 3 assistant professors, 18 Ph.D holders, and 10 master degree holders) consists of 7 departments (electrical engineering, power system engineering, electrical equipment, power supply electronic engineering, telecommunications, and automatic control), and 9 laboratories. Its contract service for enterprises is limited to dielectric testing for insulations.

(3) Faculty of Civil Engineering

The faculty has a cement and concrete testing laboratory of which equipment is equivalent or better than that owned by QUATEST 3, and performs a large number of voluntary tests for enterprises.

Also, it has a variety of mechanical testing equipment for steel materials, including an Amsler tensile tester, a Charpy impact tester, and a Brinell hardness tester, which are used for tensile and bending tests on reinforcement steel bars to be embedded in concrete on a contract basis. However, these equipment is fairly old and inferior to that owned by QUATEST 3.

Table A1-1 Number of Staff by Status, VMI

	Doctor	Master	Graduate	Secondary	Technician	Total
Director board	2		1			3
Administration and personnel section			3	2	13	18
General affairs and legislation section	1		4			5
Professional section	1		3			4
Laboratory of length			3		1	4
Laboratory of mass			5		2	7
Laboratory of volume and flow			6			6
Laboratory of physico-chemical parameters and reference materials			3	1		4
Laboratory of force and hardness			3	1	3	7
Laboratory of pressure		1	3		2	6
Laboratory of electricity			7	1	1	9
Laboratory of electromagnetics			3	1		4
Laboratory of time and frequency			3		2	5
Laboratory of temperature			5			5
Support center for metrology technique			7	1	8	16
Total	4	1	59	7	32	103

Table A1-2 List of Equipments Mechanical and Material Testing Laboratory, QUATEST 1

Equipment	Model	Specification	Year	Manufactory	Quantity
Mechanical Testing					
Universal testing machine	P50	500KN capacity in tension	1974	USSR	1
Universal testing machine	P05	50KN capacity in tension	1981	USSR	1
Surface Roughness test	SURFTEST-3	Measuring range: Rz=320-10; 0.025-0.1 μm Ra=0.02-2.5 μm	1981, UNDP	Mituroyo, Japan	1
Coordinate measuring machine	OMICRON A001-D	Measuring range: 665 x 465 x 350mm	1991, UNDP	DEA, Italy	1
Universal measuring microscope	UMU	Measuring range: 150 x 50mm	1991		1
Painting coating thickness meter	179-700	0-50 μm	1985	Mituroyo, Japan	1
Painting coating thickness meter	170-721	0-500 μm	1985	Mituroyo, Japan	1
Painting coating thickness meter	ELCOMETER	0-2,000 μm	1992	England	1
Material of Metal Testing					
Metallurgical microscope W/Micro Vickers	NEOPHOT-21	Measuring range: 20x-2,000x	1985	Germany	1
Impact testing machine	PS-30	30kgm capacity in impact	1985	Germany	1
Hardness tester machine	HP-250	Measuring hardness Rockwell	1978	Germany	1
Hardness tester machine	FRANK	Measuring hardness Vickers	1985	Germany	1
Non Destructive Testing (NDT)					
Ultrasonic flaw detector	USIP-11	Range: 5-15,000mm	1985, UNDP	Krautkramer, Germany	1
Ultrasonic digital flaw detector	MS-330	Range: 2.5-10,000mm	1995	SONATEST, England	1
Ultrasonic thickness meter	DM2	Range: 1.2-300mm	1985	Japan	1
Ultrasonic thickness meter	CL-204	Range: 0.25-200mm	1985, UNDP	Krautkramer, Germany	1
Eddy current defectometer	FORSTER	Range: 0-1mm	1985, UNDP	FORSTER, Germany	1
Construction Material Testing					
Digital concrete hammer	58-C181/F	Concrete hammer impact energy: 2,207 Joule	1995, UNDP	Control, Italy	1
Ultrasonic concrete tester	58-E46	Frequency range: 20KHz to 1MHz	1995	Control, Italy	1

Table A1-3 List of Equipment Volumetric and Mass Calibration Laboratory, QUATEST 1

	Name of equipment	Measurement range, Accuracy
1	Comparator 6B – MA (Russia)	0.0005%
2	Thermostat oil bath (Germany)	0–280℃, 0.02℃
3	Thermostat water bath (Russia)	0–100℃, 0.01℃
4	The second level standard masses	1mg – 500g
5	The third level standard masses	1 – 10kg
6	The third level standard masses	10kg, 20kg, 10,000kg
7	The second level standard balance	Max 200g, 0 – 40g: d = 0.01mg
		40 – 200g: d = 0.1mg
8	Standard balance	Max 6,200kg, d = 1mg
9	Volume standard balance	Max 200kg, d = 20g
10	Taximeter calibration system	(test run)

Table A1-4 List of Equipment Electric and Electronic Calibration Laboratory, QUATEST 1

1	Wheatstone bridge
2	High voltage tester
3	Digital ammeter
4	Universal measuring equipment for electric leakage current type 3226
5	Megger earth tester
6	Alternative and direct current three phase power meter
7	Digital one phase power meter
8	Alternative and direct current voltmeter
9	Resistance bridge

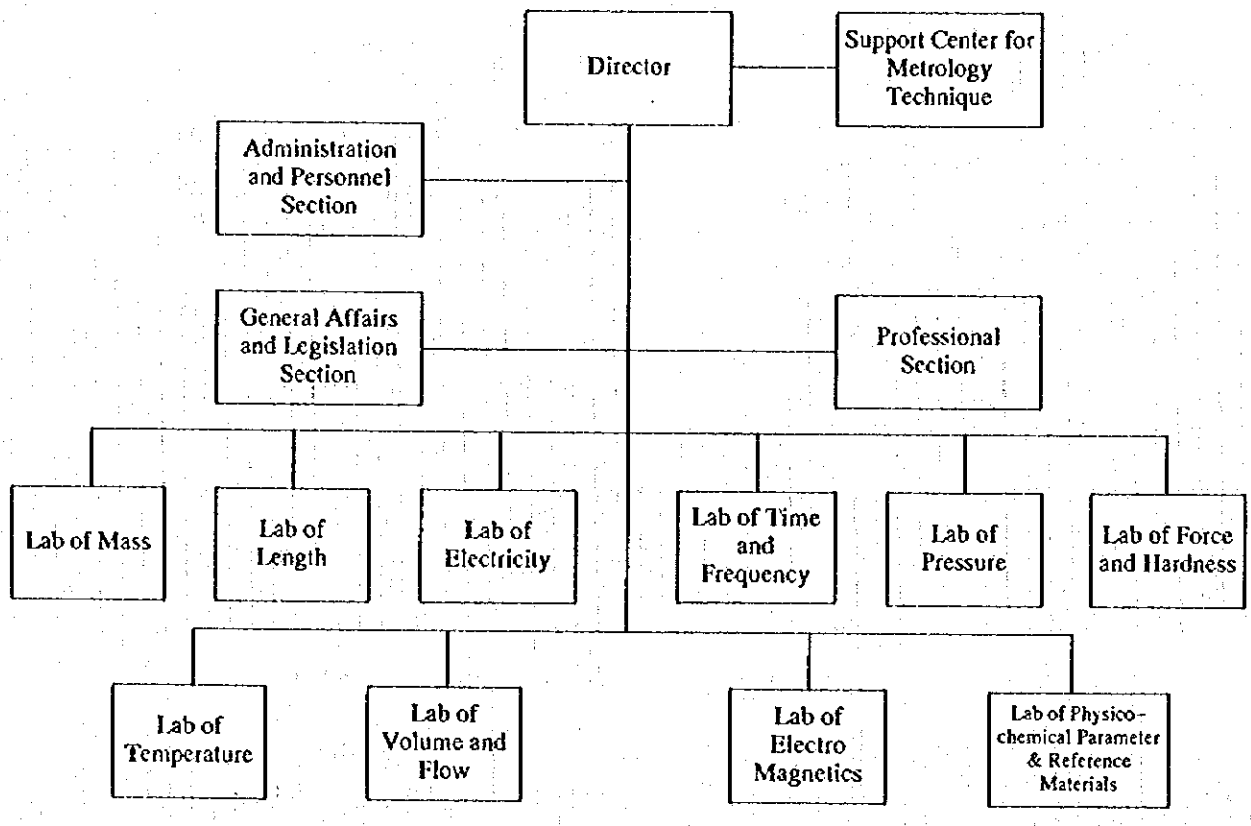
Table A1-5 List of Equipment Calibration and Testing Laboratory QUATEST 3 (1/2)

Name of Laboratory	Instrument/Equipment
M1 Lab. Calibration	* Universal voltmeter DHM 7562 * Standard AC/DC * Set of standard resistors * Standard providing rings * Thermocouple * Standard weights E2, F1 * Primary standard flask
M2 Lab. Instrumentation Services	* Hygrometer * Visicometer * Hydrometer, pycnometer * PH meter * Dissolved Oxygen meter * Visible V spectrophotometer * Conductivity / TDS meter * Turbidimeter
M3 Lab. Weight & Measure Verification	A. Pressure verification * Standard piston pressure gauge cc x 0.05 up to 550 bar * Piston pressure cc x 0.2 up to 550 bar * Set of pressure gauges cc x 0.4 up to 600 bar * Electronic pressure gauge to 700 bar cc x 0.05 from 1 bar to 0 bar cc x 0.05 B. Mass verification * Set of weights F1 up to 200g * Set of weights F2 from 1mg to 1kg * Set of weights E2 from 1g to 100g * Set of weights F2 from 1g to 5g * Secondary balance up to 200g * Primary balance up to 20g * Tertiary balance up to 6kg C. Volume verification * Set of secondary standard flasks from 5 to 5,000litre * Verification mobile water flowmeter cc x 0.2 up to 45m^3/h * Verification mobile petroleum tank dimension gauging equipment cc x 0.2 up to 200m^3 * Verification meter up to 40mm * Verification of stable bath containing
M4 Metrology Workshop	

Table A1-5 List of Equipment Calibration and Testing Laboratory QUATEST 3 (2/2)

	Name of Laboratory	Instrument/Equipment
T1	Lab. Construction Materials Testing	* 200kN bending and compression testing machine * 250kN compress testing machine * 10kN bending testing machine * 8kN tensile testing machine * Ultrasonic tester PUNDIT * Aggregate abrasion device * Profile meter
T2	Lab. Mechanical & Non-destructive Testing	* Universal testing machine * Knock testing equipment * Multi-meter microscope * Hardness measuring equipment * Ultrasonic examination equipment * X-ray photograph equipment * Gamma-ray photograph source * Magnetic particle examination equipment * Metallographical microscope * Equipment for analyses of metallic elements
T3	Lab. Light Industry Products Testing	* Tensile testing machine * Environmental chamber * FTIR machine * Color fastness testing machine * Equipment for analyses of mechanical and physical
T4	Lab. Electrical Testing	* High pressure testing machine * Resistance bridge * Environmental chamber * Megohmmeter * Tensile resistance testing machine * Watthourmeter; ammeter, millimeter, wattmeter, etc. * Incubator
T5	Lab. Chemical & Environment Testing	* Atomic absorption spectrophotometer (AAS) * Gas chromatography (GC) * High pressure liquid chromatography (HPLC) * Gas chromatography mass spectrometer (GCMS) * Flameless spectrophotometer * Potentiometer
T6	Lab. Petroleum Testing	
T7	Lab. Food & Micro-biological Testing	* Photometer * Polarimeter * Refractometer * Turbidimater * Mettle FP62 * Metallographical microscopes * Colony counter * Equipment for inoculation

Figure A1-1 Organization of VMI



Annex 2 Summary of Manufacturer Questionnaire Survey

1. Background

1.1 Objectives of the Survey

The objective of this Questionnaire survey is to understand the nature of each industrial sector designated in standardization, quality control and testing aspects. Other objective is to identify the needs of industries on the promotion of industrial standardization and quality control/ management.

1.2 Scope of Survey

The sample of survey is designed to include following industries:

1. Machinery
2. Electrical & electronics
3. Automobile assembling and components
4. Metal working
5. Textile & wearing apparel
6. Construction materials

The areas covered by the questionnaire survey are Hanoi and Ho Chi Minh City and peripheral areas of these cities.

1.3 Methodology

The list of companies for the questionnaire were made and were mainly based on "Vietnam Business Directory 1995-1996" issued by Chamber of Commerce and Industry of Vietnam, and "Vietnam Directory 94-95" issued by Vietnam Trade Information Centre. An original questionnaire in English was translated into Vietnamese for distribution. Around 800 questionnaires were mailed out and 135 filled questionnaires were collected by STAMEQ. 551 questionnaires were mailed out to state owned companies while 251 were mail out to non-state companies.

2. Survey Result

2.1 Profile of Respondents

(1) Number of respondents by sub-sector / products

Total number of returned questionnaires and sum of respondents in each sub-sector is not equal because of some companies cover more than one field of products. Largest number of response is 40 from Textile, wearing apparel sub-sector followed by 39 from Machinery and 36 from Metal working. The percentage of respondents out of number mailed out is about 17%.

(2) Company status by ownership

111 out of 135 respondents filled the questionnaire are state own company. Only one private company (apparel) responded. The percentage of respondents returned from state owned companies is 20% while that of respondent return from non-state companies is less than 10%.

(3) Number of workers

Around 65% of the respondents had less than 500 employees, although there were 21 respondents (16%) that had more than 1,000 employee. These respondents with more than 1,000 employee are mainly Textile and wearing apparel companies which are a labor intensive industry.

(4) Productive capital

55 respondents (41%) had productive capital of more than 10,000 million dongs while 11 respondents (8%) had productive capital less than 1,000 million dongs.

(5) Annual sales

77 respondents (57%) are companies with annual sales of more than 10,000 million dongs. There are only two respondents with annual sales of less than 1,000 million dongs.

2.1.1 Percentage of sales to export in the year 1996

65 respondents (48%) did not export any of their products to oversea market. There are 28 respondents (21%) with more than 50% of sales to export. 16 respondents export to former COMECON countries while 48 respondents export to other than COMECON countries.

2.1.2 Tie ups / affiliation with foreign companies

89 out of 135 respondents did not have any affiliation nor tie ups with foreign companies. Automobile and electrical/ electronics sub-sector shows higher percentage of tie ups and affiliation with foreign companies than that of other sub-sectors.

2.2 Industrial Standard

2.2.1 Industrial standards used

109 respondents (81%) were using product standards for products they sell. 81 and 49 respondents used product standard for raw material/components they purchase and for machinery/equipment they procure respectively. 70 respondents(52%), 61 respondents (45%) and 23 respondents (17%) were adapting method standards for product, raw materials and machinery respectively. Only one-fifth of respondents used basic standards. The result indicates that industries used less standards for machinery they purchased and basic standards for any purposes.

There is no distinctive feature among industries in usage trends of standards. However, sectors of electrical/electronics, machinery and office accounting & computing machinery shows slightly high percentage of respondents using industry standards for all purposes.

2.2.2 Difficulty in obtaining standards

79 respondents (58%) answered that it was easy to obtain TCVN, while 35 respondents (26%) felt that it was difficult. More respondents (77) feel that it is difficult to obtain foreign & international standards than those feel easy.

There were 62 respondents claimed that it was difficult to get information relating standards, standardization and certification against 43 respondents said that it was easy.

The trends of major four industries (more than 20 respondents) are described as follows;

(1) Machinery

Although 26 (67%) respondents said that it was easy to get TCVN, there are still 11 (28%) respondents felt difficulty. More than half respondents (26 and 23) claimed that it was difficult to obtain foreign & international standards and relating information respectively

(2) Electrical / electronics

75% of respondents said that it was easy to obtain TCVN and 52% of respondents felt easy to get information. Compare with other subsectors, industries has less difficulty in obtaining standards and information.

(3) Metal working

The subsector had difficulty in obtaining foreign & international standards and information although it seems that the sector has not much problems in TCVN.

(4) Textile, wearing apparel

Only one respondents said that there were no need for TCVN. The high percentage of no response in these questions may indicate that the industries had less needs of standards than others.

2.3 Quality Control / Management

111 respondents (82%) had QM department and 94 respondents (70%) carried out inspection in process. Only 8 and 16 respondents implemented or planned to implement ISO 9000 QM system. This table shows that using quality consultants, employee suggestion system, seven tools for QC and activating Five S were not popular quality control activities among respondents.

Relatively high percentage (53%) of respondents implemented QC circle. However, the concept of QC circle was not widely spread over the country according to the interview survey. Therefore, many of them might confuse QC circle with inspection group. 18 respondents did not know 5S and 84 respondents did not even response to the question. This probably indicated that many company were not aware of quality management (control) in Japanese way, since 5S is basic and common QC activity in Japan.

2.4 Testing and Calibration Facility

75 out 135 respondents used outside laboratories for testing in the past. 32 respondents used outside laboratories for chemical, 29 for calibration and 23 for mechanical testing. Outside laboratories are commonly used by metal working (26 out of 36 respondents), automobile assembling & components (6 out of 9 respondents) and machinery sub-sector (24 out of 39 respondents), while less than half respondents utilized labs in electrical/ electronics sub-sector including office, accounting & computing machinery, and textile, wearing apparel sub-sector.

2.1 Profile of Respondents (1/2)

Number of Respondents by Sub-sector / Products, Company Status and Number of Workers

	No. of Response	Company Status by Ownership							Number of Workers							
		State	Private	Foreign Capital	Joint Venture	Others	NR	Total	~20	~100	~300	~500	~1,000	1,000~	NR	Total
General purpose machinery	20	17	0	0	0	1	2	20	0	1	9	4	1	2	3	20
Agricultural and forestry machinery	14	12	0	0	0	1	1	14	0	3	7	3	0	0	1	14
Machine-tools	6	5	0	0	0	1	0	6	0	1	2	2	0	1	0	6
Machinery for metallurgy	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1
Machinery for food, beverage and Tobacco processing	6	5	0	0	0	2	0	7	0	1	2	2	1	0	0	6
Machinery for textile, apparel and leather production	8	7	0	0	0	1	0	8	0	0	4	2	1	1	0	8
Others special purpose machinery	12	11	0	0	2	1	0	14	0	1	6	2	0	3	0	12
Machinery Sub-total	67	57	0	0	2	8	3	70	0	7	30	16	3	7	4	67
No. of response	39	36	0	0	2	2	2	42	0	4	18	6	3	5	3	39
Office, accounting and computing machinery	4	2	0	0	1	0	1	4	1	3	0	0	0	0	0	4
Consumer product	13	5	0	1	2	1	4	13	0	4	3	3	2	0	1	13
Business / Industrial products	5	3	0	0	0	0	2	5	0	2	1	1	0	0	1	5
Component	7	4	0	1	2	0	0	7	1	2	0	1	2	1	0	7
Electric machinery / Equipment	9	5	0	0	1	1	2	9	0	3	0	3	0	2	1	9
Others	13	8	0	0	2	1	2	13	1	4	1	5	1	1	0	13
Electrical / electronics Sub-total	47	25	0	2	7	3	10	47	2	15	5	13	5	4	3	47
No. of response	25	14	0	2	4	1	4	25	2	5	5	6	3	3	1	25
Automobile assemblies	2	1	0	0	2	0	0	3	0	0	0	0	1	1	0	2
Bodies	1	1	0	0	1	0	0	2	0	0	0	0	0	1	0	1
Metal type components	5	5	0	0	0	0	0	5	0	1	2	1	0	0	1	5
Plastic type components	3	3	0	0	0	0	0	3	0	1	1	1	0	0	0	3
Other type of components	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Automobile assembling and components Sub-total	11	10	0	0	3	0	0	13	0	2	3	2	1	2	1	11
No. of response	9	8	0	0	2	0	0	10	0	2	3	1	1	1	1	9
Foundry	27	26	0	0	0	1	0	27	0	0	11	10	1	3	2	27
Stamping	23	21	0	0	1	2	0	24	0	3	6	7	2	3	2	23
Forging	24	23	0	0	0	2	0	25	0	1	9	7	2	3	2	24
Metal fabrication	8	7	0	0	0	1	0	8	0	0	2	4	1	1	0	8
Mold and die	18	17	0	0	0	1	0	18	0	0	6	7	1	2	2	18
Others	6	5	0	0	1	1	0	7	0	0	2	1	1	2	0	6
Metal working Sub-total	106	99	0	0	2	8	0	109	0	4	36	35	8	14	8	106
No. of response	36	33	0	0	2	2	0	37	0	3	16	10	2	3	2	36
Manufacture of fabricated metal products	17	15	0	0	2	1	1	19	0	2	7	4	3	1	0	17
Spinning, weaving and finishing of textile	18	13	0	1	1	1	2	18	0	0	2	1	3	9	3	18
Other textile except for apparel	5	5	0	0	0	0	0	5	0	0	1	3	0	0	1	5
Knitted fabrics	9	6	0	0	0	1	2	9	0	0	0	2	1	4	2	9
Wearing apparel / garment	30	24	1	2	1	1	2	31	0	0	1	7	4	14	4	30
Others	7	6	0	0	0	0	1	7	0	0	1	3	1	2	0	7
Textile, wearing apparel Sub-total	69	54	1	3	2	3	7	70	0	0	5	16	9	29	10	69
No. of response	43	31	1	2	1	1	4	40	0	0	4	10	6	15	5	40
Cement	4	4	0	0	0	0	0	4	0	0	2	0	1	1	0	4
Concrete	3	2	0	0	1	1	0	4	0	0	1	2	0	0	0	3
Stone products	6	5	0	0	0	1	0	6	0	0	1	3	2	0	0	6
Iron and steel products	3	2	0	0	0	1	0	3	0	0	0	3	0	0	0	3
Non-ferrous metal products	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1
Others	6	5	0	0	1	1	0	7	0	0	1	2	2	0	1	6
Construction materials Sub-total	23	18	0	0	2	5	0	25	0	0	5	11	5	1	1	23
No. of response	15	14	0	0	1	1	0	16	0	0	4	6	3	1	1	15
Others	27	24	0	0	3	3	1	31	0	2	12	6	5	1	1	27
Total	135	111	1	4	11	3	9	135	2	14	42	29	18	21	9	135

Notes: Total may not be equal to the sum of number by subsector/product, due to duplicated responses.
NR: No response

2.1 Profile of Respondents (2/2)

Number of Respondents by Sub-sector / Products, Productive Capital and Annual Sales

	No. of Response	Productive Capital as of 1997								Annual Sales							
		~500	~1,000	~3,000	~5,000	~10,000	10,000~	NR	Total	~500	~1,000	~3,000	~5,000	~10,000	10,000~	NR	Total
General purpose machinery	20	2	1	4	4	2	6	1	20	0	0	4	1	2	12	1	20
Agricultural and forestry machinery	14	2	3	4	2	2	1	0	14	0	0	5	0	3	6	0	14
Machine-tools	6	0	1	1	2	1	1	0	6	0	0	1	1	1	3	0	6
Machinery for metallurgy	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1
Machinery for food, beverage and Tabacco processing	6	0	0	2	1	1	2	0	6	0	0	0	0	3	3	0	6
Machinery for textile, apparel and leather production	8	0	2	2	2	1	1	0	8	0	0	1	1	1	5	0	8
Others special purpose machinery	12	2	1	3	1	1	3	1	12	0	0	2	1	3	6	0	12
Machinery Sub-total	67	6	8	16	13	8	14	2	67	0	0	13	4	13	36	1	67
No. of response	39	2	4	8	5	7	11	2	39	0	0	7	3	8	20	1	39
Office, accounting and computing machinery	4	0	1	1	1	0	1	0	4	0	0	0	1	1	2	0	4
Consumer product	13	0	1	3	4	2	4	0	12	0	0	1	1	2	7	2	13
Business / Industrial products	5	0	0	2	1	0	1	1	5	0	0	0	0	2	2	1	5
Component	7	1	0	1	1	0	4	0	7	1	0	0	0	0	6	0	7
Electric machinery / Equipment	9	0	0	1	3	0	3	2	9	0	0	0	0	1	7	1	9
Others	13	0	1	1	3	2	6	0	13	0	0	0	2	1	10	0	13
Electrical / electronics Sub-total	47	1	2	6	12	4	18	3	46	1	0	1	3	6	32	4	47
No. of response	25	1	2	3	4	3	11	2	25	1	0	1	2	3	16	2	25
Automobile assemblies	2	0	0	0	0	0	2	0	2	0	0	0	0	0	2	0	2
Bodies	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
Metal type components	5	0	0	3	0	0	1	1	5	0	0	0	1	2	1	1	5
Plastic type components	3	1	0	1	0	0	1	0	3	0	0	1	0	1	1	0	3
Other type of components	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Automobile assembling and components Sub-total	11	1	0	4	0	0	5	1	11	0	0	1	1	3	5	1	11
No. of response	9	1	0	4	0	0	3	1	9	0	0	1	1	3	3	1	9
Foundry	27	0	2	8	3	5	7	2	27	0	0	2	3	5	16	1	27
Stamping	23	1	2	6	1	2	9	2	23	0	0	3	2	3	14	1	23
Forging	24	1	2	6	2	4	7	2	24	0	0	3	2	4	14	1	24
Metal fabrication	8	0	1	2	2	0	3	0	8	0	0	1	2	0	5	0	8
Mold and die	18	0	2	4	3	2	6	1	18	0	0	1	2	3	11	1	18
Others	6	0	0	0	0	0	5	1	6	0	0	1	0	0	6	0	7
Metal working Sub-total	106	2	9	26	11	13	37	8	106	0	0	11	11	15	66	4	107
No. of response	36	1	2	11	3	6	11	2	36	0	0	4	4	7	20	1	36
Manufacture of fabricated metal products	17	1	0	5	2	2	7	0	17	0	1	3	1	3	10	0	18
Spinning, weaving and finishing of textile	18	0	0	2	1	2	13	0	18	0	0	1	0	2	14	1	18
Other textile except for apparel	5	0	0	2	0	1	2	0	5	0	0	0	1	1	2	0	4
Knitted fabrics	9	0	0	0	2	0	6	1	9	0	0	0	0	0	8	1	9
Wearing apparel / garment	30	0	1	5	2	4	16	2	30	0	0	2	0	3	22	3	30
Others	7	0	0	2	1	1	2	1	7	0	0	0	1	0	5	1	7
Textile, wearing apparel Sub-total	69	0	1	11	6	8	39	4	69	0	0	3	2	6	51	6	68
No. of response	40	0	1	8	3	6	20	2	40	0	0	3	1	4	27	4	39
Cement	4	0	0	2	0	0	1	1	4	0	0	0	0	0	2	2	4
Concrete	3	0	0	0	1	0	2	0	3	0	0	0	0	1	2	0	3
Stone products	6	0	0	1	1	1	2	1	6	0	0	0	0	2	4	0	6
Iron and steel products	3	0	1	1	1	0	0	0	3	0	0	0	0	0	3	0	3
Non-ferrous metal products	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1
Others	6	0	0	0	1	1	3	1	6	0	0	0	0	2	3	1	6
Construction materials Sub-total	23	0	1	4	5	2	8	3	23	0	0	0	0	5	15	3	23
No. of response	15	0	1	4	1	1	5	3	15	0	0	0	0	3	9	3	15
Others	27	1	0	4	4	4	13	1	27	0	0	2	3	5	16	1	27
Total	135	5	6	28	14	20	55	7	135	1	1	14	10	22	77	10	135

Notes. Total may not be equal to the sum of number by subsector/product, due to duplicated responses.

NR: No response

2.1.1 Percentage of Sales for the Year 1996 to Export

	Non	To Former COMECON	To other Market	<25%	26 – 50%	51 – 75%	76 – 99%	100%	No Answer
Machinery	25	1	13	8	3	0	2	0	1
Office, accounting & computing machinery	3	1	0	0	1	0	0	0	0
Electrical / electronics	17	2	6	2	1	0	2	2	1
Automobile assembling & components	7	0	1	1	0	0	0	0	1
Metal working	27	0	7	5	2	0	0	0	2
Manufacture of fabricated metal products	13	0	3	2	1	0	0	0	1
Textile, wearing apparel	3	12	29	4	5	3	9	9	7
Construction materials	9	1	6	3	2	0	0	0	1
Others	17	3	7	6	2	1	0	1	1
Total	65	16	48	17	9	6	9	13	16

Note: Total may not be equal to the sum of number by subsector, due to duplicated responses.

2.1.2 Tie ups / Affiliation with Foreign Companies

	No. of Response	Tie ups/affilication with foreign firms					
		Yes	No	NR	% of Yes	% of No	% of NR
General purpose machinery	20	4	13	3	20.0	65.0	15.0
Agricultural and forestry machinery	14	1	10	3	7.1	71.4	21.4
Machine-tools	6	1	3	2	16.7	50.0	33.3
Machinery for metallurgy	1	0	1	0	0.0	100.0	0.0
Machinery for food, beverage and Tabasco processing	6	1	5	0	16.7	83.3	0.0
Machinery for textile, apparel and leather production	8	1	7	0	12.5	87.5	0.0
Others special purpose machinery	12	4	6	2	33.3	50.0	16.7
Machinery Sub-total	67	12	45	10	17.9	67.2	14.9
No. of response	39	9	25	5	23.1	64.1	12.8
Office, accounting and computing machinery	4	1	3	0	25.0	75.0	0.0
Consumer product	13	4	6	3	30.8	46.2	23.1
Business / Industrial products	5	2	2	1	40.0	40.0	20.0
Component	7	0	7	0	0.0	100.0	0.0
Electric machinery / Equipment	9	2	6	1	22.2	66.7	11.1
Others	13	6	6	1	46.2	46.2	7.7
Electrical / electronics Sub-total	47	14	27	6	29.8	57.4	12.8
No. of response	25	8	13	4	32.0	52.0	16.0
Automobile assemblies	2	2	0	0	100.0	0.0	0.0
Bodies	1	1	0	0	100.0	0.0	0.0
Metal type components	5	2	3	0	40.0	60.0	0.0
Plastic type components	3	1	1	1	33.3	33.3	33.3
Other type of components	0	0	0	0	0.0	0.0	0.0
Automobile assembling and components Sub-total	11	6	4	1	54.5	36.4	9.1
No. of response	9	4	4	1	44.4	44.4	11.1
Foundry	27	6	20	1	22.2	74.1	3.7
Stamping	23	7	15	1	30.4	65.2	4.3
Forging	24	7	15	2	29.2	62.5	8.3
Metal fabrication	8	2	6	0	25.0	75.0	0.0
Mold and die	18	4	14	0	22.2	77.8	0.0
Others	6	5	1	0	83.3	16.7	0.0
Metal working Sub-total	106	31	71	4	29.2	67.0	3.8
No. of response	36	8	26	2	22.2	72.2	5.6
Manufacture of fabricated metal products	17	4	11	2	23.5	64.7	11.8
Spinning, weaving and finishing of textile	18	2	13	3	11.1	72.2	16.7
Other textile except for apparel	5	0	5	0	0.0	100.0	0.0
Knitted fabrics	9	0	6	3	0.0	66.7	33.3
Wearing apparel / garment	30	5	19	6	16.7	63.3	20.0
Others	7	1	4	2	14.3	57.1	28.6
Textile, wearing apparel Sub-total	69	8	47	14	11.6	68.1	20.3
No. of response	40	5	28	7	12.5	70.0	17.5
Cement	4	0	4	0	0.0	100.0	0.0
Concrete	3	1	2	0	33.3	66.7	0.0
Stone products	6	0	5	1	0.0	83.3	16.7
Iron and steel products	3	1	2	0	33.3	66.7	0.0
Non-ferrous metal products	1	0	1	0	0.0	100.0	0.0
Others	6	2	3	1	33.3	50.0	16.7
Construction materials Sub-total	23	4	17	2	17.4	73.9	8.7
No. of response	15	3	11	1	20.0	73.3	6.7
Others	27	6	18	3	22.2	66.7	11.1
Total	135	27	89	19	20.0	65.9	14.1

Notes: Total may not be equal to the sum of number by subsector/product, due to duplicated responses.

NR: No response

2.2.1 Industrial Standards used

	No. of Response	Product			Raw Materials			Machinery		
		Product	Method	Basic	Product	Method	Basic	Product	Method	Basic
Machinery	39	36	22	11	27	20	10	21	10	9
Office, accounting & computing machinery	4	4	2	1	4	2	1	2	1	1
Electrical / electronics	25	23	15	8	20	17	8	10	8	4
Automobile assembling & components	9	9	5	2	6	2	2	6	3	2
Metal working	36	31	21	11	23	20	10	17	8	8
Manufacture of fabricated metal products	17	14	9	5	12	7	3	11	6	4
Textile, wearing apparel	40	30	20	9	20	14	8	10	5	6
Construction materials	15	10	9	5	9	8	3	5	5	4
Others	27	23	15	6	20	15	3	13	3	4
Total	135	109	70	31	81	61	28	49	23	21

	No. of Response	% of Product			% of Raw Materials			% of Machinery		
		Product	Method	Basic	Product	Method	Basic	Product	Method	Basic
Machinery	39	92.3	56.4	28.2	69.2	51.3	25.6	53.8	25.6	23.1
Office, accounting & computing machinery	4	100.0	50.0	25.0	100.0	50.0	25.0	50.0	25.0	25.0
Electrical / electronics	25	92.0	60.0	32.0	80.0	68.0	32.0	40.0	32.0	16.0
Automobile assembling & components	9	100.0	55.6	22.2	66.7	22.2	22.2	66.7	33.3	22.2
Metal working	36	86.1	58.3	30.6	63.9	55.6	27.8	47.2	22.2	22.2
Manufacture of fabricated metal products	17	82.4	52.9	29.4	70.6	41.2	17.6	64.7	35.3	23.5
Textile, wearing apparel	40	75.0	50.0	22.5	50.0	35.0	20.0	25.0	12.5	15.0
Construction materials	15	66.7	60.0	33.3	60.0	53.3	20.0	33.3	33.3	26.7
Others	27	85.2	55.6	22.2	74.1	55.6	11.1	48.1	11.1	14.8
Total	135	80.7	51.9	23.0	60.0	45.2	20.7	36.3	17.0	15.6

Note: Total may not be equal to the sum of number by subsector, due to duplicated responses.

2.2.2 Difficulty in Obtaining Standards

	No. of Response	TCVN				Foreign & International				Information relating standards, standardization & certification etc.			
		Easy	Difficult	No need	NR	Easy	Difficult	No need	NR	Easy	Difficult	No need	NR
Machinery	39	26	11	0	3	5	26	2	7	12	23	0	4
Office, accounting & computing machinery	4	3	1	0	0	2	2	0	0	3	1	0	0
Electrical / electronics	25	19	3	0	4	9	11	2	4	13	9	0	3
Automobile assembling & components	9	5	4	0	0	0	8	0	1	1	8	0	0
Metal working	36	25	8	0	3	6	21	2	7	9	23	1	3
Manufacture of fabricated metal products	17	11	5	0	1	2	12	1	2	7	9	0	1
Textile, wearing apparel	40	18	12	1	10	9	19	2	11	8	17	1	14
Construction materials	15	8	6	0	1	2	9	0	4	4	8	0	3
Others	27	15	7	0	5	3	17	1	6	6	14	1	6
Total	135	79	35	1	21	26	77	5	28	43	62	2	28

	No. of Response	TCVN				Foreign & International				Information relating standards, standardization & certification etc.			
		Easy	Difficult	No need	NR	Easy	Difficult	No need	NR	Easy	Difficult	No need	NR
Machinery	39	66.7	28.2	0.0	7.7	12.8	66.7	5.1	17.9	30.8	59.0	0.0	10.3
Office, accounting & computing machinery	4	75.0	25.0	0.0	0.0	50.0	50.0	0.0	0.0	75.0	25.0	0.0	0.0
Electrical / electronics	25	76.0	12.0	0.0	16.0	36.0	44.0	8.0	16.0	52.0	36.0	0.0	12.0
Automobile assembling & components	9	55.6	44.4	0.0	0.0	0.0	88.9	0.0	11.1	11.1	88.9	0.0	0.0
Metal working	36	69.4	22.2	0.0	8.3	16.7	58.3	5.6	19.4	25.0	63.9	2.8	8.3
Manufacture of fabricated metal products	17	64.7	29.4	0.0	5.9	11.8	70.6	5.9	11.8	41.2	52.9	0.0	5.9
Textile, wearing apparel	40	45.0	30.0	2.5	25.0	22.5	47.5	5.0	27.5	20.0	42.5	2.5	35.0
Construction materials	15	53.3	40.0	0.0	6.7	13.3	60.0	0.0	26.7	26.7	53.3	0.0	20.0
Others	27	55.6	25.9	0.0	18.5	11.1	63.0	3.7	22.2	22.2	51.9	3.7	22.2
Total	135	58.5	25.9	0.7	15.6	19.3	57.0	3.7	20.7	31.9	45.9	1.5	20.7

Notes: Total may not be equal to the sum of number by subsector, due to duplicated responses.

NR: No response

2.3 Quality Control / Management

	Quality Management (Quality control) Activities:	I know			Don't know	No response
		Implemented	Planned	not implemented / planned		
1	Product inspection	90	6	7	2	33
2	Inspection in process	94	8	6	2	28
3	SQC (statistical QC)	58	11	14	2	52
4	Establishment of QM department	111	7	2	0	17
5	Documentation of quality practice	62	11	11	3	48
6	ISO 9000 series QM system	8	16	40	11	61
7	Using quality consultant	15	6	41	7	66
8	Developing in-company standards	62	14	21	2	38
9	Activating QC circle	72	15	13	2	35
10	Employee suggestion system	18	11	23	8	75
11	Seven tools for QC	19	5	20	17	74
12	Activating Five (5) S	11	4	18	18	84
13	Implementing QM training	53	14	23	2	45

	Quality Management (Quality control) Activities:	I know			Don't know	No response
		Implemented	Planned	not implemented / planned		
1	Product inspection	66.7	4.4	5.2	1.5	24.4
2	Inspection in process	69.6	5.9	4.4	1.5	20.7
3	SQC (statistical QC)	43.0	8.1	10.4	1.5	38.5
4	Establishment of QM department	82.2	5.2	1.5	0.0	12.6
5	Documentation of quality practice	45.9	8.1	8.1	2.2	35.6
6	ISO 9000 series QM system	5.9	11.9	29.6	8.1	45.2
7	Using quality consultant	11.1	4.4	30.4	5.2	48.9
8	Developing in-company standards	45.9	10.4	15.6	1.5	28.1
9	Activating QC circle	53.3	11.1	9.6	1.5	25.9
10	Employee suggestion system	13.3	8.1	17.0	5.9	55.6
11	Seven tools for QC	14.1	3.7	14.8	12.6	54.8
12	Activating Five (5) S	8.1	3.0	13.3	13.3	62.2
13	Implementing QM training	39.3	10.4	17.0	1.5	33.3

2.4 Testing and Calibration Facility

	Use of labo. for testing/calibration		Testing Area					
	Yes	No	Calibration	Mechanical	Electrical	Chemical	Physical	Others
Machinery	24	10	8	14	6	13	9	2
Office, accounting & computing machinery	0	3	0	0	0	0	0	0
Electrical / electronics	13	10	6	2	11	1	2	1
Automobile assembling & components	6	2	2	4	1	4	5	0
Metal working	26	8	11	13	5	12	11	1
Manufacture of fabricated metal products	11	5	6	7	4	6	7	1
Textile, wearing apparel	17	11	7	1	1	3	2	5
Construction materials	10	5	3	2	1	6	5	1
Others	17	7	6	6	3	9	5	6
Total	75	39	29	23	16	32	21	14

Note: Total may not be equal to the sum of number by subsector, due to duplicated responses.