

viewed from a stand point of quality control like in the case of health care, that a concept depending on quality systems is a base for quality control, that, without the concept of quality systems, succession of good products and technologies is impossible, and that all people involved in quality control should follow the established quality systems as their social duty.

- 2) As texts for education on establishment and implementation of quality systems as described in (2)-2) above, the "The Interpretation of ISO 9002 - Quality System Implementation Guide" shown in Annex 5-11 should be used.

Outline of the 2 texts described above is described in 5.2.4.

(5) Examination of Contents of the Texts

Contents of these texts should be examined by the technical committee described in 5.2.2.

5.2.4 Program for Consolidation of Texts and Curriculum for Education and Training

The first requirement in introduction of organizations for Quality Control/TQC based on establishment of quality system is bringing up people responsible for establishment of the new organization in each company.

For that purpose, it is necessary to prepare the two types of text and curriculum for education and training as described below and bring up people responsible for introduction of organizations for quality control and TQC. Contents of a program for preparation of texts and curriculum for education and training are as described below.

(1) Responsible organization

The responsible organization is INN. INN should consult with the

technical committee for innovation of organizations for Quality Control/TQC education (The contents is described in 5.2.2-(1)).

Practically, however, INN will make coordination between each related organization and play the role of promoter.

(2) Contents of texts and curriculum for education and training

1) Name of text and curriculum (1)

"Organization for Quality Control/TQC based on quality systems"

(a) Contents

The contents basically include the matters described in 3.4.1.

a) Worldwide trend in the field of quality control

b) "Defensive aspect" and "Positive aspect" in TQC activity

c) Quality system

d) Worldwide trend in concept for quality system

e) Understanding of ISO 9000 Series

f) Introduction of organizations of quality systems based on ISO 9000 Series for quality control

g) Positive aspect of TQC activity

h) Various steps in advance of Quality Control/TQC activities

(b) Purpose and object of education

a) Purpose of education

The purpose of education is to make top management and personnel responsible for promotion of Quality Control/TQC understand the purpose and significance of quality systems introduction into the company.

b) Object for education

i. Top executive and management of companies

In education of top executives and management of a company, also the existing texts for education of Quality Control/TQC to top executives and management should be used, and also the necessity of general Quality Control/TQC activity should be taught.

ii. Personnel responsible for promotion of Quality Control/TQC

(c) Time for education

3 hours

2) Name of texts and curriculum (2)

"The Interpretation of ISO 9002 - Quality System Implementation Guide"

(a) Why quality systems based on ISO 9002?

a) Concept for usage of ISO 9000 Series

In the provision in the ISO 9000, which should be a guideline for provisions in each standard in ISO 9000 Series and their usage, usage of ISO 9001, 9002, 9003

and 9004 are not clearly described.

Here, the following concept is employed.

i. Concept for ISO 9004

If the basic concept for ISO 9004 is employed, it may be said that the ISO 9004 is explanatory provision for organizations which each company should maintain in a sound state in relation to quality control even if not asked from any external body.

For this reason, provisions in ISO 9004 cover all of provisions in ISO 9001, 9002 and 9003. And all company managers should decide based on their own judgment whether the provisions in ISO 9004 should be introduced or not.

- ii. ISO 9001, ISO 9002 and ISO 9003 provide that, when a purchaser procures products or services, the purchaser can ask the supplier for "especial control of this point" so that the purchaser will not be able to get hidden-defective products or services but those as the purchaser required. Once a contract is closed, requirements in the contract based on the above provision are, different from the provisions in ISO 9004, items to be carried out by any means. But this does not mean that "matters other than provisions in ISO 9001, ISO 9002 and ISO 9003 may not be carried out when not required in the contract".

The idea of the ISO 9000 Series is not that "nothing may be done for items not required in the contract for ISO 9001, ISO 9002 and ISO 9003", but that, as described in Section a. above. "quality control based on ISO 9004 should preferably be done

spontaneously". It is a misunderstanding, for instance, that, in order to introduce the ISO 9003, only items related to testing and inspection should be consolidated, and other items may not be carried out because they are not required.

iii. Mutual relations between standards in ISO 9000 Series

Thus, ISO 9001, ISO 9002 and ISO 9003 assume a company which has spontaneously established and maintained quality systems based on ISO 9004 beforehand, and require implementation of some portion of the provisions based on ISO 9001, ISO 9002 and ISO 9003. This calls for the necessity to understand the "mutual relations between standards in ISO 9000 Series".

(b) Contents of texts and curriculum

The texts and curriculum are prepared based on contents of the "The Interpretation of ISO 9002 - Quality System Implementation Guide", and decided after examination by the technical committee described in 5.2.2.

The contents include answers to questions as to how each provision in ISO 9002 should be realized in each company to satisfy the demands, and consist of the following items.

- a) Establishment of a company manager's policy for quality control and quality control activities based on the policies (Significance, importance and a way of control based on the policies)

- b) Organizations for Quality Control/TQC activities
 - i. Roles of each department in administration of quality systems (Preparation of a quality system function table)
 - ii. Preparation of an organization table
 - iii. Personnel responsible for promotion of Quality Control/TQC
- c) Quality systems
 - i. How to prepare a manual for a quality system
 - ii. Education depending on and diffusion of a quality control manual
- d) A way of standardization in a company
 - i. Establishment of rules for standardization in a company (Method for classifying in-house standards, format, contents, department responsible for each standards, etc.)
 - ii. A way of in-house standard control
- e) Manufacturing activity
 - i. Preparation of an organizational flow of manufacturing management
 - ii. How to monitor and control progress in each process from order entry/acceptance of raw materials - manufacturing - inspection of products - shipment and issue of certificates

iii. Control of specific processes (Definition of a specific process, accreditation of staff's skill concerned, etc.)

iv. Identification control and traceability

v. Testing/inspection and identification of lots

vi. Packing, handling, storage, shipment

vii. Control of records on product quality

f) Purchase control

i. Establishment of in-house standards for purchase control and implementation of the standards

ii. Method for accrediting suppliers

iii. Method for auditing suppliers' quality control system

iv. Acceptance check

g) Nonconformity control and corrective action

i. Establishment of in-house standards for nonconformity control and implementation of the standards

ii. Treatment of nonconformities and prevention of recurrence

iii. Study for prevention of nonconformities by QC circle activities

- h) Maintenance of equipment and facilities
 - i. Maintenance of production facilities (preventive maintenance, periodical repairs, daily checking, etc.)
 - ii. Instrument control (Calibration of instruments according to the importance)
- i) Auditing in-house organizations for quality control
 - i. Organizing an auditing team
 - ii. Preparation of a check list
 - iii. Audit report, demands for corrective actions, etc.
- j) In-house education
- k) Accreditation of personnel skill
 - i. Establishment of in-house standards for personnel skill accreditation and implementation of the standards
 - ii. Test system for in-house accreditation of workers' skill

(c) Purpose of and object for the education

a) Purpose of education

Acquisition of practical techniques for establishing and implementing quality systems in a company

b) Object for the education

Personnel responsible for promotion of Quality Control/TQC activities

(d) Time for education

50 hours 3 months

5.2.5 Program for Acquisition of Competent Lecturers and Trainers

(1) Purpose

In order to carry out education for the public according to the curriculum based on the "Organization for Quality Control/TQC Based on Quality Systems" and "The Interpretation of ISO 9002 - Quality System Implementation Guide", the first thing to be done is enhancement of lecturers and trainers.

Bringing up lecturers and trainers are required before introduction of this curriculum because this curriculum relates to a completely new field, and as described in 3.4.9-(2), the survey showed that now there are very few lecturers and trainers who can take charge of this curriculum in Chile.

(2) Contents

1) Texts

The texts described above 5.2.4 are used, but matters discussed in the technical committee for innovation of organizations for Quality Control/TQC and documents describing movement of ISO in relation to ISO series are also used in this education.

2) Tutors for the lecturers enhancement program

An appropriate person should be selected from members of the above-described technical committee. If necessary, external tutors or specialists from foreign countries should be employed for this purpose.

3) Period of education

Education on a new curriculum for the lecturers should be provided for 6 months, and before the start of educational activities for the public based on the curriculum, lecturers who can well teach the contents of the curriculum, should be brought up.

4) Site of education

INN

5) Follow-up for education

Follow-up for the educational activities should be made by INN.

(3) Object for the education

Education based on the new curriculum is not suited to people who do not have any practical experience in quality control, so the education for lecturers should be carried out for managers for quality control or the equivalent who have some experience in this field, based on the contents decided through discussion in the technical committee.

When selecting lecturers for education for public based on the new curriculum, it is desired to get a recommendation from the related industrial organizations.

5.3 Program for Consolidation of and Diffusion of a Metrological System

A metrological system can be regarded as a basis for various types of activities in a modern society. In other words, a metrological system aims at establishing a unified and rational basis for economical activities, and ultimately at economical development and cultural improvement in citizens' daily life.

In addition, in recent years economical activities in each country have been becoming increasingly borderless, and economical and cultural interchange between countries have been becoming more and more active, so now it is necessary to unify contents of a metrological system in each country from a global point of view. For this reason, international conferences such as OIML have been held frequently, and the movement to form a common basis and establish a worldwide unified metrological system for further promotion of economical and cultural interchange between countries is very active nowadays.

Under the circumstances, the following program is recommended to consolidate and diffuse a metrological system in Chile.

5.3.1 Program for Enacting a Measurement Law

Basic Idea for Metrological System

Different from simple measurement, measurement in metrology is defined as that based on standards officially decided. For this reason, the metrological system is clearly defined in a law or as national standards. Each advanced country has a metrological system based on laws and restrictions having roots in the nationality, history and culture of each country.

When viewed from a macro point of view, the basic idea for a metrological system is represented by that in Germany, which is a preventive system based on the precondition that possible accuracy in measurement are insured for a certain period. On the other hand, a

metrological system represented by those in the United States and England is so-called a repressive system in which accuracy in measurement must be observed by users themselves.

Although weight in legal restriction differ from country to country, concrete restrictions are rather in a mixed form of a preventive system and a repressive system, and the restrictive form is divided to restriction by structure of measuring instruments and by application.

(1) Organizations responsible for a metrological system: MINECOM. However, INN is playing a role of promoter in such works as preparation of draft of the law and preparation of bylaws for implementation of the law, making coordinations between related departments and organizations.

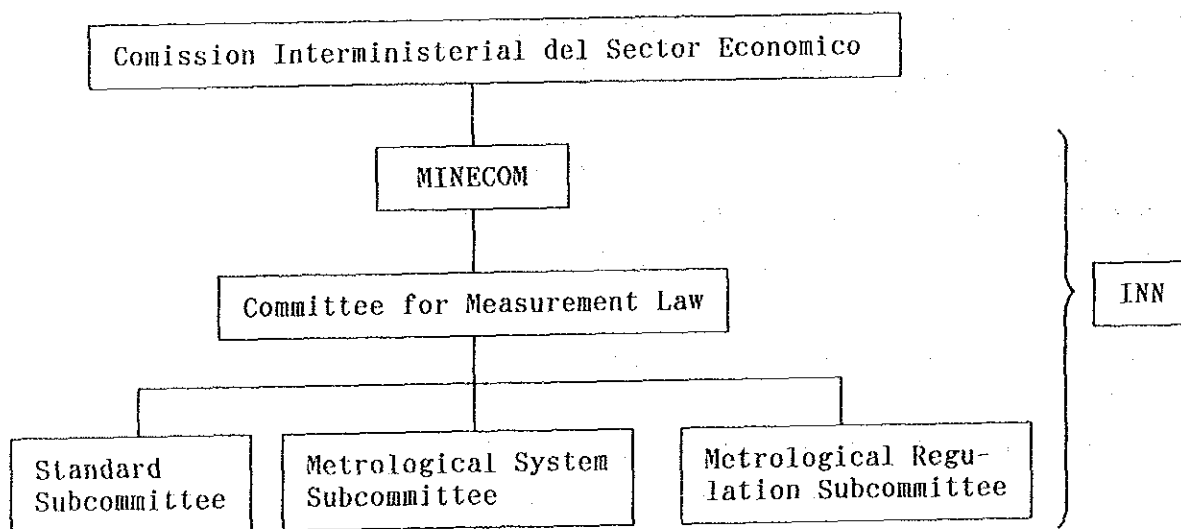


Fig. 5.3-1 Position of INN

(2) Contents of the program

1) Decision of a draft of the measurement law

A committee for metrological law is set up in MINECOM to decide a draft for the measurement law and make a recommendation to the Economy Minister. It is desired that the council will consist of representatives of each of the

following organizations and men of knowledge so that discussion in the committee reflects international trends in the field of metrological systems and the optimal measurement system for Chile will be introduced.

- (a) Related government institutions
- (b) Private organizations
- (c) Consumers' groups
- (d) Testing/inspection and certifying organizations and universities (Especially those having functions for measurement and testing)

Staff having appropriate capability and knowledge should be assigned to works for the committee so that works in the council will be carried out smoothly. At least 3 persons are required for works in the committee.

The draft for the law should be made and presented to the Parliament as soon as possible.

2) Remarks in enacting a measurement law

When enacting a measurement law, attention should be paid to the following points.

- (a) Attention must be paid to protection of users of measuring instruments and especially to consumers.

A purpose of restrictions over measuring instruments is to provide better and cheaper measuring instruments to users, because it is practically difficult for ordinary users to check accuracy and performance of measuring instruments.

- (b) Response to technological innovation

It is necessary to utilize achievements in technological innovation such as higher accuracy of measuring instruments, better performance, and enhancement of

manufacturers' capability to produce products and control their product quality, and furthermore to establish a system which does not impede technological innovation in the future.

(c) Response to internationalization

It can be considered that internationalization of economic activities will proceed more and more in the future, and that unification of standards and criterias for certification will be required at a worldwide level. So also it is necessary to introduce restrictions concerning metrological equipment based on full considerations to the trends described above.

Note that it should be recognized that every restriction accompanies troubles as its side effect. For this reason, it is necessary to decide a range of object metrological equipment for the restriction and a method for restrictions, taking into account the necessities of maintenance of life and health of citizens, stability in business transaction and realization of social fairness.

Also, a choice of restrictions to each metrological equipment depends on the basic concept of the metrological system, it is necessary to hear opinions from as many people as possible and form a social consensus. The restrictions are largely classified to the following types.

3) Preventive system

(a) Restrictions over manufacturers, repair shops and sellers of metrological equipment

(b) Introduction of verification and periodical inspection systems, and establishment of technical criteria for measuring instruments used at home

(c) Restrictions over various types of usage of metrological equipment, and restriction over measuring method

(d) Standardization of measurement scale for commodities

4) Repressive system

(a) Introduction of an official job site system for use of metrological equipment

(b) Introduction of a metrological engineer system

(c) Introduction of an inspection system

(d) Introduction of a specific vessel system (capacity)

To implement restrictions based on the measurement law and achieve practical effects of the restrictions, it is essential to establish organizations for maintenance and control of national standards for metrology, organizations for accreditation and calibration for legal metrology, organizations for calibration for industrial metrology, and organizations for bringing up metrological engineers, and it should be recognized that direct or indirect support to consolidation of the organizations as described above is a duty of the government which enacts and controls the measurement law.

(3) Recommendation for contents to be introduced into the measurement law and problems to be studied

For detailed contents of this section, refer to Annex 5-12.

5.3.2 Program for Establishing the National Metrological Institute

In order to effectively introduce a measurement law, it is necessary to organize or enhance administrative bodies in the central

and local governments responsible for registration, certification and control of manufacturers, repair shops and sellers of measuring instruments and at the same time set up the National Metrological Institute (tentative name) chiefly taking charge of establishment, maintenance and control of national standards. Generally the investment in facilities for that purpose and cost for administration of the facility should be borne by the government which enacts the measurement law. For these reasons, in most cases the facility should be positioned as a national facility and run depending on the national budget.

The following works should be carried out by the National Metrological Institute.

- 1) Management of a kilogram primary standard supplied from BIPM
 - 2) Establishment, maintenance and control of national standards
 - 3) Works for calibration of reference devices or standard devices in laboratories of specified verification organizations, certifying/ calibrating organizations, national, public or private testing or research institutes
 - 4) Research in the field of scientific metrology
 - 5) Education and training of metrological engineers
- (1) Responsible organization: MINECOM: INN will become an secretariat to promote this project.

As the project of setting up the National Metrological Institute has close relations with administration by the central government and at the same time specific technological capability is required to researchers in the laboratory, it will be necessary to acquire engineers and scientists having a certain degree of practical experience in this field, asking assistance from organizations related to calibration works for industrial metrology such as Facultad de Ciencias Fisicas y Matematicas - Universidad de Chile,

CESMEC and INTEC. It can be expected that the staff thus acquired will become core staff of the institute. To carry out the program of establishing the National Metrological Institute, the following organizations would be required to prepare original plans such as a basic design, and also it would be necessary to establish a consensus before starting the project.

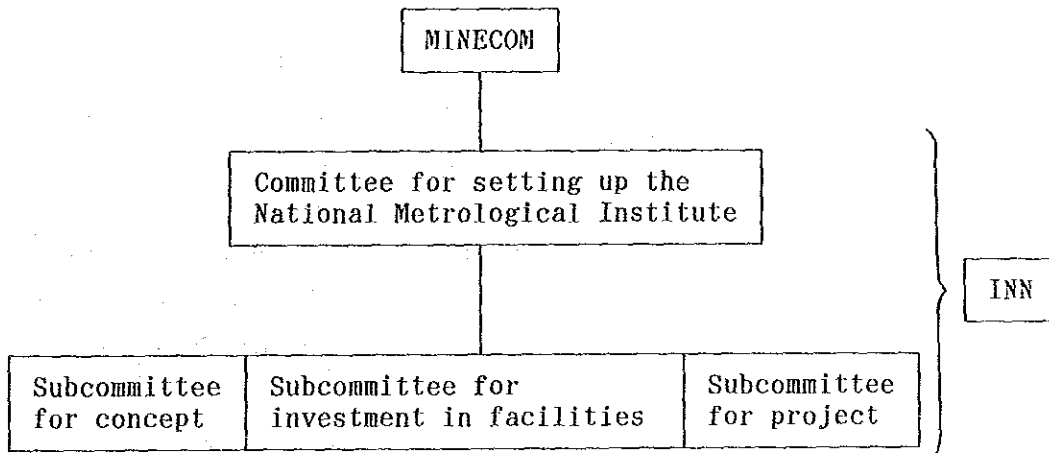


Fig. 5.3-2 Committee for Establishing the National Metrological Institute

(2) Contents of the program

1) Decision of setting up the National Metrological Institute

A committee for setting up the National Metrological Institute should be set up in MINECOM, and the committee should decide a concrete plan for setting up the institute and made a recommendation for it. This committee will make an assessment of technological level of Chile in this field, set up necessary subcommittees such as concept subcommittee, that for investment in facility, and project subcommittee under the control by the committee to prepare feasible plans, make technological studies on each of the plans including concept designing, surveys on the actual situation of measuring equipment and facilities in Chile, the method for collecting them, preparation of an original plan for new investment in facilities, functions of the central institute and utilization of capability of private companies and facilities, and make a

recommendation for the concrete plans to the committee.

It is desired that this committee and the subcommittee consist of the representatives from each of the following organizations and men of knowledge.

- (a) Related government institutions
- (b) Industrial organizations
- (c) Consumers' groups
- (d) Testing/inspecting/certifying organizations, and those for measurement calibration (including universities)

Also INN as a secretariat for this project should assign at least 3 staff who have specific capability and knowledge required to smoothly carry out the works of the committee to this project.

- 2) Metrological standards and standard devices for calibration to be owned by the National Metrological Institute

Of the legal units for measurement specified in the measurement law, for basic measurement units and derivated ones which require display of the standard, the national standards must be maintained and controlled by the National Metrological Institute other national laboratories.

However, as it is financially difficult and accompanies technological difficulties to install, maintain and control such standards from just after the laboratory is set up, so it would be practical to make investments selectively from the following viewpoints and expand the facility by and by.

- (a) Metrological standards related to legal metrological instruments, which are objects for verification or model approval, and devices for calibration should be arranged at first.

Example: Quantities for length, mass, time, temperature and electricity

- (b) Metrological standards for calibration of measuring instruments used at site where products requiring quality certification based on NCh standards (referred standards in ISO 9000 Series) should be acquired and installed as soon as possible.

Example: Quantities for temperature, current, voltage, and other units relating to electricity such as impedance, as well as for force.

- (c) It may be considered that consolidation of measurement standards for environmental protection has a high priority because administration for environmental protection has been becoming increasingly important in recent years.

Example: Quantities for density and noise level and other quantities related to gas

- (d) The institute must be able to provide measurement standards required for modernization of industries to improve their competitiveness in the international markets and development of products.

It is necessary to design concepts for a scale of this institute and equipment and facilities to be owned by this institute studying these factors and also taking into account the technologies now available in the country. It is recommended here that the highest priority should be put in arrangement of standards at a national level for basic units for length, weight, time, temperature and mass, light

intensity and electricity, and secondary standards and other equipment required for calibration.

The metrological system drawing for each unit recommended here is for standards, for which the traceability technology has been established not only in Japan but also internationally, and it should be noted that the required equipment have been designed according to specifications based on this system.

3) Concrete suggestions for the National Metrological Institute

(a) Building

When deciding the total floor area of the building, it is necessary to take into account the spaces for office rooms, drawing room, document room, library, conference room, machine room (power supply room and space for air conditioners), warehouse, diningroom, room for health care and medical services, corridor, bathroom and other indirect spaces for estimation the required area for works there. Also, it is necessary in designing structure of the building to take into account conditions for air conditioning, prevention of vibration and noise. For reference, an example of space allocation is a similar project is shown in the table below.

Table 5.3-1 Required Area for National Metrological Institute

Name of laboratories, etc.	Required area
Length laboratory	200m ²
Mass laboratory	150m ²
Force laboratory	150m ²
Pressure laboratory	150m ²
Temperature laboratory	150m ²
Time laboratory	110m ²
Physical quantity laboratory	70m ²
Electricity laboratory	200m ²
Light laboratory	100m ²
Common laboratory	200m ²
Working room	150m ²
Office, conference room, etc.	300m ²
Corridor, bathroom, dining room, etc.	1,100m ²
Total	Approx. 3,000m ²

(b) Required number of workers

As described above, the main functions of the National Metrological Institute are maintenance and control of national standards for measurement, scientific research in the field of measurement, calibration of standards, and bringing up metrological engineers, so that the required number of staff in this institute is calculated taking into account the volume of works to be carried out here.

At least the number of staff as shown in the table below should be employed to run this institute.

Table 5.3-2 Required Number of Staff in the National Metrological Institute

Laboratories	Required number of staff for research of standards	Staff for calibration	Total
Length of laboratory	2	1	3
Mass laboratory	2	2	4
Power/pressure laboratory	2	1	3
Temperature/light laboratory	2	1	3
Time laboratory	1	0	1
Physics laboratory	1	1	2
Electricity laboratory	3	3	6
Management and secretaries			4
Total			25

For reference:

It can be assumed from our experience that a building space required for one person working in this institute will be in a range from 70m² ~ 100m². Assuming the number of staff as shown in the table above, it may be said that the building space is a little larger than that required for the current number of staff, but expansion of services (increase of types of quantity for measurement) and increase in a volume of jobs should be taken into considerations.

(c) Cost for administration

It is necessary to secure necessary costs including labor cost in the budget. To secure the costs, a calibration fee and a research fee can be expected. But, maintenance, control of and research for national standards for

measurement should be carried out by the government, so generally the costs required in the institute should be paid from the national budget.

Expected income from services and other projects largely change depending on a volume of jobs for calibration of standard devices and other fluctuating factors, but at most approx. 3% of the total cost can be covered by such incomes.

The table below shows cost items excluding labor cost and conditions for cost estimation.

Table 5.3-3 Main Cost Items Excluding Labor Cost and Conditions for Cost Estimation

Main items	Conditions for cost estimation
Repair cost, expenditures for consumable equipment, etc.	Around 3% of investment in equipment (Note 1)
Transportation fee, communication fee, etc.	Around 2% of labor cost
Insurance fee, corporation tax, expenditure for welfare of employees, etc.	Around 3% of labor cost
Expenditure for office supplies, conference cost, etc.	Around 1% of labor cost
Utility fees	Sum obtained by multiplying the consumption rate to the unit cost
<p>Note 1: A period of guarantee should be taken into considerations just after installation of each equipment. In the initial period, few failures occur, so that the repair cost is low.</p>	

(d) Metrological standards and equipment for calibration

If limited to the metrological standards recommended above and works for calibration in relation to the standards, a metrological standard system and list of equipment

required for introduction of the equipment will be presented, assuming that the necessary technologies will be imported from foreign countries where the system have been established.

For details, refer to Annex 5-13.

5.3.3 Program for Consolidation of Specified Verification Organization

In this program, works for verificating equipment for legal metrology as a core for a metrological system defined by laws are performed in this program. For this reason, it is important to clearly define organizations of the verificating facillties, equipment and facillties used for verification and qualification of verification inspector in laws and set up prestigious organizations for verification.

Supply of correct and accurate metrological equipment is essential for administration over accurate and fair measurement, and also a duty to make a correct measurement must be borne by related people.

The following works are done in the specified verification organizations.

- (1) Works for verificating measuring instruments for legal metrology
- (2) Works for inspecting measuring instruments requiring formal certification for measuring instruments for legal metrology
- (3) Works for inspection based on requests from head of local governments
- (4) Control of standard devices
- (5) Consulting and guidance for verification and type approval

- (1) Responsible organizations: Ministry of Economy. INN functions as an secretariat and performs works for specifying verification organizations. It is necessary to decide requirements for verification organizations, equipment and facilities used for authorization and qualification of verification inspector based on laws as well as to decide requirements for organizations certifying quality systems, equipment and facilities for that purpose, and qualification of assessors.

To efficiently carry out this vast quantity of works and form a consensus among related people, it is desired for representatives from related government institutions, local governments, people of knowledge and staff of organizations accrediting metrological equipment requiring compulsory inspection to participate in this program. It is desired that the work will be carried out under the following organization.

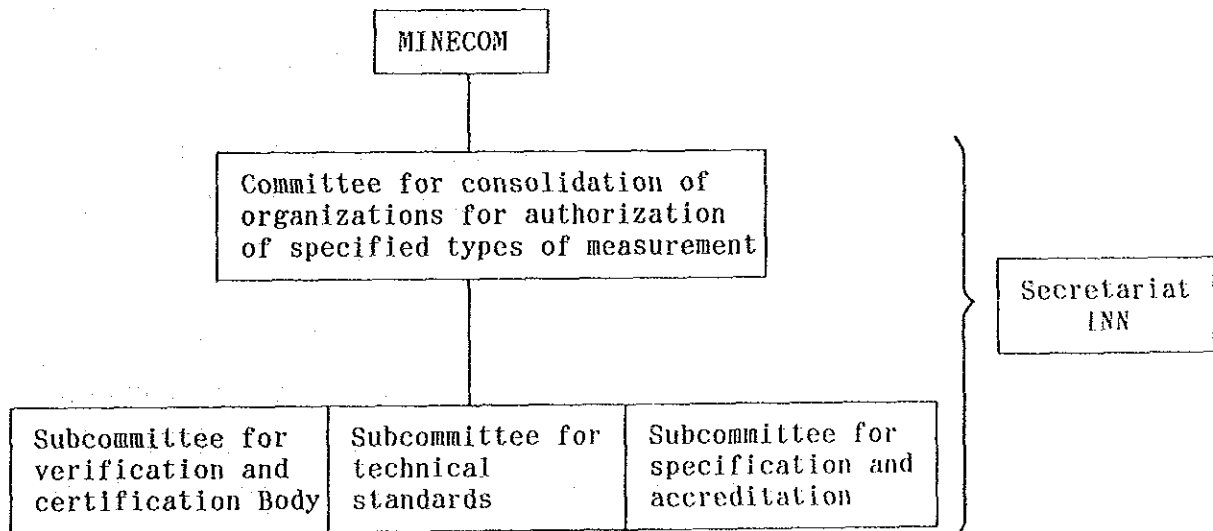


Fig. 5.3-3 Committee for Verification Organizations

(2) Contents of the program

- 1) Requirements for verificating and certifying organizations ...
Subcommittee for verification and accreditation

It is desired to study various requirements for verification organizations defined in the measurement law, organizations for certification of quality system and equipment for verification and inspection to be owned, prepare an original plan and, if possible, clearly define under a decree by the Ministry of Economy.

- 2) Preparation of technical standards required for verification and certification ... Subcommittee for technical standards

This subcommittee will study requirements for verification organizations and quality system certifying organizations and assessors and prepare a certification manual used in implementation of the certification system.

- 3) Specification of verification and certifying organizations and promotion of certification ... Subcommittee for specification and accreditation

The organizations for verification and certification of quality systems are required to study distribution of manufacturers of equipment for legal metrology and repair shops and to specify and certify them taking into considerations convenience for applicants. It will be necessary to set up at several organizations for verification and certification of quality systems in Santiago and at least one Concepcion.

5.3.4 Program for Consolidation of Organizations for Calibration

An organization for calibration of measurement specified in the measurement law plays an important role in modernization of production

facilities, introduction of a quality certification system, and diffusion of quality control. It was turned out through the survey that the standard devices centering on those concerning length installed in Facultad de Ciencias Fisicas y Matematicas - Universidad de Chile, Universidad de Concepcion, Universidad de Santiago, Pontificia Universidad Catolica de Chile, and such institutes as CESMEC, INTEC and DICTUC are of the second class.

Specification of organizations for measurement calibration specified in the measurement law is made for each type of measurement, and it can be expected that the technical level in these facilities and institutes are fairly high.

Conditions required for the organizations are as follows.

- (1) The organization must have knowledge and technology in the field of measurement specified.
- (2) The organization must have standard devices and equipment for calibration in the specified field (including a calibration system), and the level must be in the second class in the list of equipment to be owned by the National Metrological Laboratory described in 5.3.2. If possible, the organization must have equipment for calibration traceable for national standards.
- (3) The equipment for standard equipment must be periodically calibrated according to the national standard.
- (4) The organization must have staff who have a wide range of knowledge and experience required for calibration in the specified measurement field.

**CHAPTER 6 IMPLEMENTATION PLAN AND IMPLEMENTATION
ORGANIZATIONS**

6.1 Implementation Plan

6.1.1 Basic Consideration in Executing the Implementation Plan

The creation and promotion of an industrial standardization is essential for establishing the basis on which industrial development can be achieved and public welfare improved. The measures to be devised cover a great diversity. In this study, the following four items have been taken up in accordance with the S/W:

- (1) Formulation of a Unified Certification System
- (2) Programs for the Propagation and Promotion of the above Unified Certification System
- (3) Programs for the Propagation and Promotion of TQC and Company Standardization
- (4) Proposal of the Metrological Framework Related to the above Certification System

There is a very large range of measures calling for implementation action, even if we confine ourselves to these items alone. To achieve the objectives of industrial standardization, however, it is essential to realize that all aspects form part of an inseparable whole requiring implementation as an integral "package."

We have already seen in the previous chapter referring to the individual programs, that these are mutually linked and interrelated and some programs, it was stated, cannot be realized unless some other program or programs have been achieved first.

This particular nature of the problem must be taken into account when establishing and implementing program, with an absolute need to devise a coherent and consistent control system for the systematic execution and adjustment of individual programs. In this context, it is necessary therefore to establish implementation programs on the basis of a very careful prior study concentrating on the following

aspects:

- (1) Some programs will require large investments as will be the case with the creation of a metrological system, in other cases the organizations and authorities involved will cover a wide scope, and some other program may require a large number of decisions being taken in the preparatory stage of implementation. The efforts to be made for the diffusion of quality control, however require programs that are comparatively easy to implement seeing that the cooperation of the technical cooperation entities is easy to obtain for activities such as training and instruction.
- (2) Some programs will necessarily be carried out by the government or through substantial government involvement as will be the case with the creation of a metrological system and the propagation of the certification system in the initial phase. On the other hand, there will be some other programs capable of being implemented by the private sector on the basis of a voluntary commitment, provided that certain economic conditions are met. Even for the latter types of programs it will be most desirable to have public-sector support and sponsorship, at least in the initial stages. Any assessment of the priority order in which programs should be implemented must therefore be based on a critical consideration of the level of need for public-sector support (or the degree to which such support would be effective in assuring program implementation).
- (3) While some programs will require urgent implementation such as the program to create a metrological system, it will be necessary to examine practical programs for development in gradual steps in such a manner as to start the implementation process with those parts that are considered as being particularly high on the priority list (high degree of urgency). This approach is required because of the very long time required to implement all program items.

6.1.2 Preparatory Actions for Program Implementation

To implement any one and all of the programs, it will be necessary to conduct certain preparations. If we break down the programs into the major categories, we can isolate the following preparations needed:

(1) For programs requiring major investments

In this case, the following preparations will be required as the minimum:

1) Establishment of an implementation framework

To make the preparations for the implementations of this type of programs, the following examinations will be required at various steps to enlist the agreement or cooperation of the organizations concerned. It will thus be necessary to establish the implementation framework for advancing the programs in a comprehensive manner.

For the implementation of the programs, it will be desirable to enlist the support of organizations experienced in this type of work and the assistance of specialists (including consultants) in the particular field or specialty.

Fig. 6.1-1 Implementation Schedules for the Various Programs

Programs and Implementation Items	1992	1993	1994	1995	1996
1. Plan for the Introduction and Diffusion of the Unified Certification System					
1.1 Establishment of Standby Committee	—				
1.2 Establishment of Preparation Committee Determining the Basic Framework of the Certification System	—				
1.3 Establishment of Laws and Regulations	—				
1.4 Establishment of Accreditation System for Certification Bodies					
1.4.1 Providing the Organizational Structure of the Accreditation System	—				
1.4.2 Establishment and Public Announcement of the Accreditation Scheme					
(1) Accreditation criteria	—				
(2) Application procedures	—				
(3) Surveillance	—				
1.4.3 Start of Accreditation Service			—	—	—
1.5 Establishment of Certification System					
1.5.1 Providing the Organizational Structure of the Certification System	—				
1.5.2 Establishment and Public Announcement of Certification Scheme					
(1) Accreditation criteria	—				
(2) Application procedures	—				
(3) Surveillance	—				
1.5.3 Start of Certification Service					
(1) Application to designated industrial fields			—	—	
(2) Application to other industrial fields				—	—

Programs and Implementation Items	1992	1993	1994	1995	1996
1.6 Establishment of Registration System for Qualified Auditors					
1.6.1 Providing the Organizational Structure of the Auditors' Registration System		—			
1.6.2 Establishment and Public Announcement of Auditors' Registration Criteria		—			
1.6.3 Establishment and Public Announcement of Auditors' Registration Scheme		—			
(1) Registration procedures		—			
(2) Period of validity of registration		—			
1.6.4 Start of Auditors' Registration Service			—		
1.7 Establishment of Training System for Qualified Auditors					
1.7.1 Providing the Organization Structure for Auditors' Training System		—			
1.7.2 Preparation of Programs and Curricula for Training/Teaching		—			
1.7.3 Acquisition of Approval by the above Registration Body		—			
1.7.4 Start of Teaching/Training			—		
1.8 Diffusion of the Unified Certification System			—		
2. Diffusion/Promotion Plan for TQC and In-house Standardization					
2.1 Appointment of Technical Committee for Quality Control/TQC Teaching System	—				
2.2 Establishment of Programs for the Reform of Quality Control/TQC Teaching System by the Technical Committee		—			
2.2.1 Examination of teaching Materials and Curricula for Quality Control/TQC Teaching System	—				

Programs and Implementation Items	1992	1993	1994	1995	1996
2.2.2 Examination of Plans to Reinforce the Lecturing Staff for Teaching under the New Curriculum		—			
2.2.3 Establishment of New Teaching Curriculum		—			
2.2.4 Diffusion of New System to companies, including Financial Aid Schemes for Medium/Small Companies and Corresponding Support/Aid Programs		—			
2.2.5 Deciding and Approving the Reform Programs above for Teaching Quality Control/TQC		—			
2.3 Training Lecturers to Teach under the New Curriculum			—		
2.4 Teaching for Managers under the New Curriculum and Teaching for General Participants				—	
2.5 Establishment of Quality Control/TQC System in Companies by Company Staff trained under the new Curriculum				—	
2.5.1 Establishment of New system in Large Companies (Establishment of Quality System)				—	
2.5.2 Establishment of New System in Medium/Small Companies (Establishment of Defect Control System)				—	
3. Establishment/Diffusion of Weights and Measures System					
3.1 Enactment of Measurement Law				—	
3.1.1 Establishment of Committee	—				
3.1.2 Examining and Determining the Concept of the Weights and Measures Law		—			
3.1.3 Examination and Preparation of a Report on Weights and Measures Law			—		
3.1.4 Examination and Preparation of a Report on Ministerial Ordinances/Decrees Concerning the Weights and Measures Law				—	

Programs and Implementation Items	1992	1993	1994	1995	1996
3.2 Establishment of the National Metrological Institute					
3.2.1 Appointment of Committee for the Foundation of Weights and Measures Research Center					
3.2.2 Examination and Decision of Role and Function of Weights and Measures Research Center					
3.2.3 Basic Design of Building					
3.2.4 Basic Design of Machinery					
3.2.5 Examination of Policies for Securing Human Resources					
3.3 Consolidation of Specified Verification Organizations					
3.3.1 Study/Analysis of Verification Needs Determination of Location for Erection of Verification Body					
3.3.2 Preparation of Draft Ordinances and Decrees and Filing of Reports on Conditions to be Met by the Verification Body (Organization, Equipment, Qualifications of Inspectors, etc.)					
3.3.3 Designation and Establishment of Verification Body					
3.4 Consolidation of Organizations for Calibration					
3.4.1 Examination and Determination Concerning Conditions to be met by the Calibration Body (Organization, Equipment, Qualifications of Inspectors, etc.)					
3.4.2 Designation of Calibration Body					
3.5 Designation of Quality System Certification Body (Linked with Quality Certification System)					

2) Drawing up of Implementation plans

To draw up implementation plans, the most careful consideration must be given to the basic aspects of implementation by aiming for the achievement of the maximum effect that can be reached with and from the implementation of the project. The problem of securing the funding requirements will be of particularly great importance. Program implementation must also be considered on the basis of the maximum possible utilization of existing organizations, human resources, and equipment facilities. Thus the implementation plan should be drawn up by bearing the following in mind to ensure the success of the programs:

- (a) The most desirable type of implementation organization should be decided from the administration and implementation viewpoint. (Example: Decision to the effect that a government ministry, a public organization or a non-profit private organization is the most desirable implementation form.)
- (b) If the implementation organization is not a government ministry, it is necessary to decide which ministry is to supervise and control the implementation organization. This will be conditional, however, on the ability of the government ministry or agency to support the implementation organization.
- (c) For the implementation and backup of the programs concerned, it will be vital to enlist the consensus of the industrial associations and organizations concerned.
- (d) It will be essential to draw up finance plans ensuring financial self-supportiveness. If the criterion of financial self-supportiveness cannot be met, it will be necessary to establish additional plans to provide the extra funds needed.

- (e) It will be necessary to establish the appropriate plans for securing the required staff meeting a given set of (recruitment) conditions and plans to minimize job transfers.

3) Implementation of basic design study

It will be necessary to draw up the optimum program on the basis of a feasibility study and some alternative plans. The basic design study must clarify at least the following factors:

- (a) Basic design
- (b) Required expenses (costs)
- (c) Feasibility of program from the economic and technical viewpoints
- (d) Fund procurement plan
- (e) Operating organization

4) Implementation of specifications study, including resources, plant, and materials

It will be essential to select the appropriate resources, plant, and materials. This study must clarify the following factors:

- (a) Facility and plant system and layout
- (b) Specifications of individual equipment and materials and required quantities
- (c) Estimate of overhead costs
- (d) Procedures for the transportation and installation of equipment and materials
- (e) Maintenance/control system

5) Preparation for procurement of resources, plant, and materials

- 6) Procurement of resources, plant, and materials and control of facilities
- (2) For programs requiring the establishment of new organizations or the amendment/change of existing legal regulations

The aspects requiring particularly careful examination in terms of the required organizational forms and legal provisions for the implementation of any one or all of the programs are described in the respective programs in Chapter 5.

- (3) For programs conceivably executable by organizations other than INN

Among the various programs included in this Study, those which are directly related to the unified certification system and quality control are expected to be implemented by INN as the core body for their execution, or under the supervision of INN. However, for other programs in which many other organizations are involved for their execution, any consensus is not yet reached among them on which organization should play a key role.

Even if INN has the rights and obligations, a large number of government bodies, public-sector entities, education/training organizations, and industrial organizations in the field will be involved in the provision of assistance for program implementation in terms of the necessary technical, financial, and/or equipment. For the execution of the program concerned, no agreement has been achieved indicating how the authorities concerned will assume responsibility for program implementation. For the implementation of programs, it is essential to eliminate unnecessary and unproductive duplication and the absence of important subsystems. To implement this program effectively in a systematic manner and on an appropriate timing schedule, implementation plan shall be established in accordance with the program details for the various programs given in Chapter 5. At the same time, it will be essential to establish the corresponding implementation system.

6.1.3 Execution Plan

- (1) Assuming that no serious problem will arise with the preconditions for the execution of this plan

The time for the commencement of the programs presented in Chapter 5 and the period for their execution schedule are shown in Fig. 6.1-1.

These execution plans have been established on the assumption that there will be no problem with the establishment, in the planned manner, of the various conditions controlling the execution of the plans such as provision of the legal system, the reinforcement of the secretariat or the procurement of funds. The time for the commencement of the diverse programs is fixed by allowing for the time relationships between the programs and the time requirements for the program execution from commencement to completion.

The basic factors considered in connection with the scheduling of the execution of this plan are as follows.

- 1) To ensure that the unified certification system will be internationally accepted, it will be essential that level of quality control meeting the quality assurance standards and guides prepared by the international standardization bodies should be implemented in a definite manner by the companies and that the testing and inspection equipment used for confirming conformity with the standards should be maintained and controlled under a metrological system accepted on a worldwide basis.

It will take a rather long time until a metrological system accepted on a worldwide basis will be established in Chile, seeing that a considerable number of problems will have to be resolved first, such as the recruitment of funds, and the provision of the appropriate legal system.

In contract, the execution of quality control is subject to comparatively fewer limitations so that it will be easier to bring quality control about in practice. One of the most important objectives of the certification system is the promotion of the introduction of quality control by the companies. Consequently, it will be desirable to take steps to introduce and diffuse the certification system at the earliest possible stage, even though there may be no well established metrological system. When a weights and measures (metrological) system has come about, there will be no major problem in taking steps to improve it in conjunction with the application of the certification system.

In any event, the preconditions on which the application of the certification system will rest is that the companies must ensure the proper execution of the corresponding quality control. This entails the necessity that priority should be given to those activities under each program which are related to the diffusion of quality control. Even if the greatest effort is made to frame the unified certification system in the finest detail, the time needed for this is not likely to be less than one year. It is best to use this preparatory period to bring the work for establishing the basis for the diffusion of quality control.

- 2) In connection with the measures taken to propagate the unified certification system it may not necessarily be appropriate to aim at the whole of the nation's industry immediately from the beginning. This conclusion follows from a careful consideration of the present status of quality control implementation in Chile's companies and the current level of the national standards (NCh) system. Rather than aiming at all industries in the widest possible sense, it is advisable to direct the diffusion efforts at certain designated industrial areas and the target areas should then be gradually widened and extended in accordance with the previous progress achieved. The industrial sectors which should be aimed at first in the quality diffusion effort are as follows:

- (a) The industrial sectors which have developed to such an extent that NCh standard are properly applied.
- (b) The industrial sectors in which there are already a high level of awareness of quality control and in which quality control is already executed to a fairly high degree.
- (c) The industrial sectors with the ability to attract human resources and procure financial and capital resources so that these sectors include a high proportion of companies that are capable of procuring the necessary funds for meeting the conditions required for certification approval.
- (d) The industrial sectors which stand to benefit greatly in economic terms from the implementation of company standardization and quality control.
- (e) The industrial sectors which are greatly affected by government procurement.
- (f) The industrial sectors with a large proportion of companies which either export already or which have plans to engage in exporting.
- (g) The industrial sectors exposed to fierce competition with overseas companies.

The choice of industry to be treated as the target of the initial diffusion attempts should be made from the above listing. The diffusion process should be continued in stages, by approaching one sector after another to spread the certification system. It is essential to always give particular consideration to conditions A and B above in all attempts to propagate the certification system.

- 3) It is important, especially in the initial phase, to produce visible and palpable results until the success of the unified certification system is assured. For this purpose, it is vital to implement the diffusion programs presented in 5.1.6. The most effective of these programs are 1), 3), 5) and 6) of (2), so that their implementation should be attempted without fail. Paragraph 1) is particularly important, and it is vital that such privilege should be applied immediately from the beginning to the companies having been granted certification.
- 4) The range covered by metrology system is extremely wide so that it will require substantial human and material resources. Because of the vast resources needed to achieve it, there will be no other alternative but to create in a selective and gradual manner. The metrology system should be established with urgency, and it is best to make the decisions about the metrology system in connection with the industrial sectors at which the certification system is aimed, as stated in 2) above.

In view of the current situation in Chile's industry and in anticipation of the future development of the nation's industry, it will be necessary to ensure the urgent provision of at least the physical and electrical standards.

- 5) For the propagation of quality control, there are no problems on the "hardware" side in terms of the availability of lecture rooms for training and instruction. We shall therefore not deal with these "hardware" aspects of building or extending lecture hall facilities.
- (2) Assuming that problems may arise with the preconditions for the execution of this plan

Notwithstanding the above, it can be anticipated that the implementation of this plan will be delayed in part if any of the following problems should arise.

- 1) Delay in the establishment of the legal provisions, delay in obtaining approval for the system changes or the new organization
- 2) Delay in budgetary measures and the consequential delay in the financial measures
- 3) Delay in training staff and delay in securing human resources

In any or all of the above instances, the implementation efforts should be started by beginning with those activities which are comparatively little affected by the above problems so as to ensure the speediest possible progress for the plan as a whole.

(a) Programs for the diffusion of quality control

The programs for the diffusion of quality control do not present any intractable problems in terms of new legislative provisions, establishment of new organizations or fund procurement because the existing organizations and systems can be utilized. The only problem that may be feared as likely to occur is the possible difficulty of securing lecturers. Initially, lecturers can be invited from abroad with a view to technology transfer. This is one way of solving the problem. This would mean that all programs related to the quality control diffusion programs could be achieved without problem if there is no difficulty in connection with the training of lecturer on the basis of technical cooperation from abroad.

(b) Programs relating to the introduction of the unified certification system

There are misgivings about the programs relating to the introduction of the Unified Certification System with fears as to whether the Legislation on industrial

standardization will be implemented as initially planned or not. However, the NCh standardization and the application of the certification system based on them is generally recognized in Chile as falling within the competence range of INN, so that this may not be an obstacle for the efforts aimed at the promotion and diffusion of the Unified Certification System.

If the objective is to introduce a certification system recognized on a worldwide scale, it will indeed be essential to have a well established metrology system as stated in 6.1.3-(1)-1). Similarly, it will be necessary to have a testing and inspection system fit to be internationally recognized or accepted. The establishment of a metrology system of an international level and the creation of a testing and inspection system equally of an international level requires a rather long time to bring about. Yet, there is no need to wait until these systems are completed in order to proceed with the establishment of the framework for the certification system which entails the following:

- a) Provision of an accreditation system
- b) Provision of a certification system
- c) Provision of a registration system for auditors
- d) Provision of a training/teaching system for auditors

Consequently, the framework of the certification system should be provided in the speediest possible manner, and even if it may not be of an international level, certification service activities may be started on the basis of this framework initially. As further progress is achieved in the establishment of metrology system and the testing and inspection system, the application of the certification system may be upgraded accordingly. The

correct way to proceed is to wait until these two systems (that is, the metrology system and the testing and inspection system) have been created to bring the certification system up to an international level.

(c) Program relating to the diffusion of the Unified Certification System

The following of the diffusion programs for the Unified Certification System are considered as presenting little problems so that their diffusion can be started as planned:

- a) Supply of overseas information to exporters
- b) Diffusion of the Certification (Conformity) Mark to the general consumer,

as these can be executed through the existing system or bodies. Similarly,

- c) Award of privileges to companies desiring to obtain certification approval
- d) Provision of technical guidance to companies

involve a considerable financial burden and may therefore give rise to problem in securing the appropriate sources of finance. In the case of F, it will also be necessary to engage consultants and advising staff.

- e) The procurement taken by the government or government bodies concerning should give priority to products bearing the certification (conformity) mark.

This measure has very strong incentive on the part of those companies applying for the certification system. As there are not additional financial costs for the

government or government bodies, for the execution of the program, it is strongly expected that this policy be implemented from the beginning. However, it is important that the procuring body makes payment for compensating inflationary price hike.

(d) Programs relating to the provision of metrology system

The various programs presented in Chapter 5 with respect to metrology system and the organizing plans for the implementation system are designed to ensure fair trading. They are also seen as absolutely essential for the efforts aimed at widening the scope of Chile's exports to overcome the present situation of being totally dependent on primary industrial product exports and to achieve and promote a new structure of exports involving products with a higher value-added content. These measures must also help promote the modernization of the existing industry. To create metrology system and national institute for standards out of nothing will require powerful administrative guidance and a wide consensus from all concerned. It is felt, however, that there will be many problems at all the many different stages from the initial appointment of the promoting organization to the deliberation and examination process. For this reason, it will be essential to uplift INN's potential. Much will also depend on the administrative and financial backup INN will receive, and it is hoped that this support will be a generous one.

For designation or accreditation of metrology verification bodies and calibration bodies referred to 5.3.3 and 5.3.4, there are some universities and the research centers belonging to the universities and private testing and inspection bodies which have considerable capabilities. For the metrology system in the electricity, water, taxi, and gas meter fields, however, the existing facilities are not exactly adequate, but compulsory inspection is

conducted and the best way may be to proceed with the designation or accreditation work on a provisional basis and to ensure that metrology law is drafted first.

By this means, it will be possible to at least meet the calibration needs for quality system registered factories. Although these needs may not be completely fulfilled, the response to these needs is absolutely essential for the establishment of the quality system registration. For an internationally recognized quality system registration it is evidently essential that the testing and measuring equipment of applying for QS registration should be based on international standards or at least meet the requirement of being traceable to international standards.

6.2 Implementation Organizations

6.2.1 Progress Monitoring for the Plan as a Whole

As already stated, the introduction and diffusion of the unified certification system, the diffusion of quality control and the establishment of a metrology system are all activities that are mutually linked. Yet, the looked-for effect will not be attained unless the various programs relating thereto are achieved in a well-balanced manner. It is also important to realize that no matter how well the system or framework has been established, it will be difficult to spread these systems and plans to industry unless technical assistance and may-be also economic assistance or aid for diffusion in the form of special policy privileges is made available. For this reason, the following bodies should actively participate in the implementation of this project in order to lead this plan to a successful conclusion.

- (1) Industrial standardization (national standardization and certification based thereon): INN

- (2) Diffusion of quality control: training/teaching bodies on quality control such as INN and ASCAL.
- (3) Testing bodies: INTEC, CESMEC, CIMM, IDIC, IDIEM etc.
- (4) Metrology - MINECOM, INN and metrology and calibration bodies such as CESMEC
- (5) Technical Services: SERCOTEC, CORFO and testing/inspection bodies and universities, etc.
- (6) Tax and finance aid: CORFO, CIE, SENCE
- (7) Information Service: SERNAC, PROCHILE, etc.

It will thus be desirable that INN should appoint a committee composed of representatives from the bodies considered particularly important to monitor the progress of the project and to promote its implementation. Within the terms of this project, it seems most appropriate that the Chairman of INN's Council should become the Chairman of this committee. The committee's tasks will be the regular monitoring of progress and the specific materialization of the implementation plan. INN, for its part, should appoint several of its staff members who take care of the committee and extend its support to the committee as best it can to ensure the smooth discharge of its functions.

6.2.2 Implementation Organization for Each Plan

- (1) Body in charge of plan execution and its role

The body in charge of the execution of each plan and its particular role have already been dealt with in Chapter 5. In any event, it will be important that INN should assume the leading role as the plan promoter, even for those plans which are not directly under its competence. The bodies responsible for the execution of each program are listed in Fig. 6.2-1 which also

Programs	Executed by	Consulted with	Government	Inspection body	Teaching body	Industry body	Consumer	Expert
1. Introduction/Diffusion of Unified Certification System	MINECOM (In fact INN)	Industrial Standardization Law Bill Evaluation Committee		(CESREC)	(ASCAL)	(SOFOPA)	o	o
1.1 Establishment of Laws and Regulations								
1.2 Establishment of Accreditation System for Certification Bodies	INN	Committee for Certification Establishment	MINECOM	(CESREC)		(SOFOPA) (ASEXMA)	o	o
1.3 Establishment of Certification System	Certification body (Body seeking INN accreditation)	Inquiry Committee for the Establishment for the Certification System	MINECOM		(ASCAL)	(SOFOPA)	o	o
1.4 Establishment of Registration System for Auditors	INN	Committee for Establishment of Registration System for Auditors	MINECOM	(CESREC)	(ASCAL)	(SOFOPA) (ASEXMA)	o	o
1.5 Establishment of Training Systems for Inspectors	Teaching body (Body seeking INN approval)	Service Committee			(ASCAL)	(SOFOPA) (ASEXMA)	o	o
1.6 Diffusion of Unified Certification System	INN		MINECOM	INTEC	ASCAL	(SOFOPA)	o	o
2. Diffusion/Preparation Plans for TQC and In-house Standardization	INN							
2.1 Technical Committee for Teaching System Reform and Establishment of Sub-Committees		Establishing/Preparation Committee	MINECOM MEP	(DICTEC)	(ASCAL)	(SOFOPA)	-	o
2.2 Preparation of Programs for Teaching System Reform	INN	TC	MINECOM MEP	(DICTEC)	(ASCAL)	(SOFOPA)	-	o
2.3 Training of Lecturers for Teaching under New Training System	INN	TC	MINECOM MEP	(DICTEC)	ASCAL INN	(SOFOPA)	-	o
2.4 Teaching for Managers under the New Curriculum and Teaching for General Participants	INN	TC	MINECOM MEP	(DICTEC)	ASCAL INN	(SOFOPA)	-	o
2.5 Diffusion on New Quality Control System in all Companies (Quality System Configuration)	INN	TC	MINECOM MEP			(SOFOPA)	-	o
3. Establishment/Diffusion Plans for a Weights and Measures System								
3.1 Establishment of Weights and Measures Laws/Regulations	MINECOM	Weights and Measures Inspection Committee	MINECOM		INN	(SOFOPA)	o	o
3.2 Establishment of Weights and Measures Research Center	MINECOM	Weights and Measures Research Center Committee	MINECOM		INN	(SOFOPA)		o
3.3 Establishment of Weights and Measures Inspectorate	MINECOM INN	INN	MINECOM		INN	(SOFOPA)	o	o
3.4 Establishment of Weights and Measures Calibration System	MINECOM INN	INN	MINECOM		INN	(SOFOPA)		o
3.5 Establishment of Conditions Required for Quality System Certification Body	INN	INN	MINECOM		INN	(SOFOPA)		o

Note: (1) Bodies given in parentheses () are quoted as examples.

(2) Circled "o" indicates that participation is desirable.

Fig. 6.2-1 Bodies Responsible for Implementation - Execution Organization and Related Bodies

includes the implementation organizations concerned and the bodies whose participation is considered most desirable.

(2) Use of foreign experts for plan execution

For the execution of the plan, it is felt that foreign experts should be invited in those areas in which foreign technical cooperation is considered desirable.

The areas in which foreign technical cooperation is considered particularly desirable and their qualification conditions are as stated below.

1) Introduction and diffusion of the unified certification system

Hosting body: INN

Areas of cooperation:

(a) Establishment of an accreditation system for the certification bodies (Incl. product and quality system certification).

(b) Establishment of auditors' registration system (Incl. training/teaching programs and preparation of curriculum as well as preparation of implementation methods for qualification examination)

Qualification conditions of experts:

Experts should have specialist knowledge on international standards in the quality assurance field. He should also have specialist knowledge of product certification and quality system registration, plus adequate experience in the field. In addition, experts should have specialist knowledge of teaching/training, qualification examination, and registration for auditors, plus adequate experience in the field.

2) Diffusion of companywide quality control and in-house standardization

Hosting body: INN

Areas of cooperation:

- (a) Cooperation in the drafting of quality control/ TQC teaching/training system reform programs and development of new teaching materials and curricula relating to this.
- (b) Cooperation in the diffusion of new quality control system in companies (establishment of quality system)

Qualification conditions of experts:

Experts should have specialist knowledge and experience of quality system configuration and system operation. He should also have special experience in teaching/training (for high-level executives and engineers). Further, experts should have experience in guiding companies on quality system, in addition to the above qualifications.

3) Establishment and diffusion of a metrology system

Hosting body: INN

Areas of cooperation:

- (a) Establishment of metrological law, regulations and administrative ordinances and decrees related to the law (establishment of legal framework).
- (b) Provision of the technical prerequisites and technical guidance for metrology verification bodies, type certification bodies, and metrology verification methods etc.

Qualification conditions of experts:

Experts should have special experience directly concerned with metrology administration and knowledge of metrology legislations, with preference given to candidates with a wide knowledge of metrology systems of the various countries. In addition, they should be experts in the metrological technology field with adequate knowledge of metrology administration.

6.3 Expected Role of the Government

For the implementation of this plan, significant roles are placed on the government. The following areas of government involvement are considered of particular importance.

6.3.1 Assistance in Strengthening INN

In industrialized nations with their long history of modern industrial development, standardization activities are also deeply rooted in their history. The standardization efforts have mainly been left to the discretion of private organizations which have functioned very well. However in such a country as Chile where non-traditional industries are emerging the best way to achieve standardization may not necessarily be the style of standardization the western industrialized nations have adopted. The reason is that the non-traditional industries still account for only a small share in the nation's economy and since there are only a few companies in each sector of industry and since, furthermore, the organizations representing each industrial sector have not fully developed, it is clear that the spontaneous standardization activities coming from the private-sector organizations do not offer much hope for standardization.

The importance of industrial standardization is evidenced by the fact that all countries which have shown a commitment to

standardization have achieved rapid economic growth. In Chile, INN is responsible for the nation's industrial standardization as a non-profit private organization. Compared with other countries whose economy is comparable in scale to that of Chile, INN is a rather small organization both in terms of its staffing level and its financial position so that it cannot be described as fulfilling an adequate role in responding to the needs of contemporary society.

In the implementation of this plan, it is expected from the government, that it should provide assistance to INN. In more definite terms, this means that the government should give urgent consideration to the provision of financial assistance to INN so that INN can secure and recruit the staff necessary for the implementation of this plan.

It is hoped that the following staff members will be appointed for the implementation of this plan.

- (1) Establishment of industrial standardization law and related regulations: 2 persons
- (2) Establishment of accreditation system: 4 persons
- (3) Establishment of registration system for auditors: 3 persons
- (4) Diffusion of certification system: 2 persons
- (5) Diffusion of quality control/TQC: 3 persons
- (6) Establishments of metrological law and related regulations:
3 persons
- (7) Assistance for metrological organizations: 3 persons

Total: 20 persons

At present INN has the following staff for the above seven items:

- (1) Establishment of industrial standardization law and regulations: no person
- (2) Establishment of accreditation system:
- (3) Establishment of registration system for auditors: } 3 persons
in Certi-
fication
Section
- (4) Diffusion of certification system: }
- (5) Diffusion of quality control/TQC: 1 person in Education Section
- (6) Establishments of metrological law and regulations: no person
- (7) Assistance for metrological organizations: no person

In view of the present condition at INN, this means that a total of 16 new staff members will be required. Fortunately, INN has plans to increase its staff by recruiting 8 new members in 1991 and 6 in 1992, the total being 14. It is therefore strongly hoped that the government will support INN financially to the extent that these new recruitment plans can be realized.

In addition, there will also be a substantial need for the government to extend financial assistance to promote the activities aimed at intensifying NCh establishment and at diffusing the certification system, to activate the efforts for the popularization of quality control in Chile, and to advance the nation's participation in the international standardization activities.

6.3.2 Assistance at the Initial State of Implementation of the Unified Certification System

In the initial phase of outlining the framework for the certification system, there is a particular large amount of work associated with considerable expense. At this stage, there will be no likely revenue so that these expenses cannot be recovered. And even if

the Unified Certification System has been launched, it will take time until it has penetrated through to the industry at large. During this period it will not be possible to look for revenue from certification fees to break even with the administrative and testing/inspection expenses and overheads. Without assistance from the government to meet the gap in revenue in the initial stage, it will be difficult to promote the diffusion of the certification system. INN's revenue, in particular, will come only from the accreditation of the certification bodies and the registration of auditors. It is likely that INN will not have a sufficient income so that aid plans will be required for make up the gap.

6.3.3 Establishment of Industrial Standardization Law

To ensure that national standardization in Chile as a major national issue will develop both in its organizational and functional aspects, industrial standardization legislation, including the implementation of the certification system, will be essential. It will also be important to establish the detailed provisions based on this. The present regulations largely lack concrete provisions. Nor are they suited for the present situation. To overcome these shortcomings and to lay a national basis for a new certification system, it will be an urgent task to provide the corresponding legal framework.

6.3.4 Assistance for the Diffusion of the Unified Certification System

It is not easy to let the voluntary certification system penetrate and establish itself in private companies, even though great efforts may be made by INN as an accreditation body or by the certification bodies to persuade and convince companies of the effectiveness of this system. In order to obtain certification approval, it is essential to make the necessary investments required to reinforce the control system to supervise companies, to establish documentation on quality systems and upgrade manufacturing equipment, and extend the testing and inspection facilities. In most instances, however, the effects or benefits accruing from certification will not become immediately

manifest, and these investments will not pay-off in the very short term. In the initial phase of introducing the certification system, it will therefore be of paramount importance, in the interest of the diffusion of the Unified Certification System, to have the reassurance of government assistance, as indicated above. A particularly effective propagator of the Unified Certification System will be a "Government or Government Body Procurement System Giving Priority to Products Identified with the Certification Mark of Conformity with the Unified Certification System." The advantage of this system is that it gives companies a tangible notion of the merits of the system, and in this sense it is bound to make a substantial contribution to the propagation of the Unified Certification System and, consequently, to the diffusion of quality control and thus to quality improvement. It is therefore strongly hoped that this "Preferential Procurement System" will come about. Another very effective propagating factor will be the use of persuasion directed at the general consumer to (preferentially) buy products identified with the Certification Mark.

6.3.5 Aid for the Diffusion of TQC

The diffusion of the certification system will entail the diffusion of quality control at the same time, so that the aid schemes referred to in the previous sections would also support the diffusion of quality control at the same time. It is therefore desirable that the above assistance programs should be carried through also in the interest of expanding quality control. Aid schemes other than those described above may include a system offering finance and tax advantages and low-cost consultancy services so that medium and small companies can avail themselves of consultancy services for the introduction of quality control (for example, this may be a system involving the sending out of an expert from a public body to the applicant firm to act as a consultant advising on quality control and giving the necessary guidance on the introduction of quality control).

**CHAPTER 7 EFFECTS LIKELY TO ARISE FROM THE
IMPLEMENTATION OF THIS PLAN**

7.1 Introduction

According to the ISO (International Organization for Standardization), standardization has six objectives:

- (1) Fitness for purpose
- (2) Compatibility and interchangeability
- (3) Variety control
- (4) Safety
- (5) Protection of the environment
- (6) Product protection

It is self-evident what these purposes entail so that no further explanation is required here.

The question, however, is what can be expected to emerge as the result of standardization as an activity pursued for these purposes. The principle of standardization is universal, but the main benefits likely to arise from standardization will differ according to the standpoint of the pursuer of standardization. In the case of manufacturers, however, the main benefits expected from company standardization may include an improvement in product quality, an upgrading of production efficiency, a reduction in production costs, technical development, and an upgrading of the level of technology. In contrast, standardization from the standpoint of the national standardization organization serves the development of the nation's industry, the strengthening of the nation's technical potential, and the improvement of the level of technology through the promotion that comes from standardization of the manufacturers as the main agents in the implementation of standardization. In addition to these purposes, it also serves the wider purposes of enhancing public health, protecting life and wealth, preserving the environment, simplifying and facilitating fair transactions, and rationalizing consumption of goods. Ultimately therefore, standardization by the national standardization organization may be expected to increase the welfare and well-being of the nation.

Various studies have so far been conducted on the methods of evaluating the level of success of standardization, and the results have been published. For example, ISO has engaged in the most fervent studies with the participation of many specialists. It created the Committee on Benefits of Standardization, concentrating attention mainly on methods for evaluating the economic benefits of standardization. The conclusion it eventually reached was that it is in fact difficult to calculate the economic effect of international and national standardization. The ISO concluded its findings on the subject with the publication of a report under the title Benefits of Standardization. This report gives the concept and method for the qualitative and quantitative evaluation of the benefits of standardization. However, the qualitative estimation method uses parameters based on major assumptions. It is clear therefore that the accurate evaluation of specific problem areas in company standardization presents difficulties, leave alone the overall evaluation of public standardization. The IFAN (International Federation for the Application of Standards) published a guide on "Methods for Determining the Advantages of Company Standardization" and NAS (U.S. Aviation and Space Industry Association) announced its document entitled "Standardization Savings Identification and Calculation: NAS-1524". Various other evaluation methods have been proposed or are being studied in addition to the above. The result of these efforts show that no appropriate method has yet been established for evaluating the economic effect of standardization with practical accuracy. Attention should be drawn to the fact that the effects of standardization elude quantitative analysis and that they are amenable to qualitative assessment. It should be noted that qualitative effect by standardization is often substantial.

7.2 Effects That Can Be Expected at the Company Level

7.2.1 Effects of the Introduction of a Unified Certification System and the Diffusion of Quality Control

One of the major objectives of introducing and disseminating a unified certification system is that it ensures the diffusion of the

national standards of the country concerned to all companies throughout the particular country.

In other words, the companies in the country will treat the national standards as their own, in-house standards and create a quality control systems to manufacture in a stable and reliable manner products of a quality complying with the standards concerned. The implementation of this system is this one of the primary objectives of the certification system. A certification system is the most effective means of ensuring the dissemination of quality control to the companies. It can be asserted, however, that a certification system will not and cannot easily spread unless serious efforts are made by the public bodies concerned to spread and propagate quality control to the companies.

The results generated by company standardization and quality control have been a topic to which much research has been dedicated and extensive studies conducted in Japan in an effort to make a contribution to the research carried out at the ISO as described earlier. These investigations have produced to following results:

- (1) Broken down by individual industry sector, in-house standardization has been found to produce significant results in industries such as the electrical, mechanical engineering, metals and metallurgy industry, and the chemical sectors. The effects are particularly significant in the assembly type industries.
- (2) By scale of enterprise, it can be seen that within the assembly type industries such as electrical and mechanical engineering companies, the larger firms with a workforce of over 300 employees stand to gain much more from in-house standardizations than the smaller firms with a workforce less than that. Moreover, there are substantial differences of economical effect between larger firms and smaller firms. In contrast to this, the companies in the chemical and textile industries do not show this kind of dependence of the result on their scale or size.

- (3) On the basis of a division between the standardization of things and the standardization of (human) actions, it has been found that in companies belonging to plant type industry such as chemical industry and firms in the transport and communication sectors as well as public utility corporations generally register a greater benefit arising from the standardization of human actions rather than the standardization of things. In other types of companies, however, there is no significant difference between the results obtained from these two types of standardization.
- (4) Broken down by the types of activities of the various departments within companies, it can be seen that there is a general tendency for the benefits of standardization decrease in the following order: design, procurement, inspection, manufacture, equipment maintenance, control, and management areas, in other words, the benefit is the greatest for the design department. By type of industry, the benefit obtained from standardization in the design department is particularly substantial for the assembly type industries such as the electrical industry and the mechanical engineering sector. In these industries, the benefit second biggest for the inspection department, third biggest for the manufacturing department, and fourth biggest for the procurement department. In the plant type industry sectors, the benefits of standardization are most strongly felt in the following order: procurement, inspection, equipment maintenance, and design.
- (5) A breakdown of the areas in which the benefits of standardization are high shows that the following industries stand to gain particularly from standardization bringing the following merits:
- 1) In the primary industries: reduced variety of products or materials to be purchased
 - 2) In the mining industry: fewer disasters, reduced waiting time for materials as a result of stock depletion
 - 3) In the construction industry: reduced variety of products and parts in the design, reduced variety of products or materials

to be purchased

- 4) In the metal and metallurgy industry (including ferrous and non-ferrous metals): fewer rejects/down-grade products, enhance safety of operation, fewer accidents
- 5) In the machinery sector (general machinery and equipment, transport machines and implements, precision machines and equipment): increased efficiency of design work, reduced variety of products and parts in the design, and improved inspection performance of inspectors
- 6) In the electrical industry: increased efficiency of design work, reduced variety of products and parts in the design, and improved inspection performance of inspectors
- 7) In the chemical industry (chemical products and petrochemical products): fewer inspection errors, enhanced level of production control, and reduced waiting time for materials
- 8) In the textile industry (fiber, textile fiber products): reduced variety of products or materials to be purchased, enhanced level of production control, and reduced waiting time for materials
- 9) Other areas in the secondary sector (metal products, printing and publishing, leather, leather goods, wood, wood/timber products, furniture, food products, etc.): reduced number of rejects/down-grade products, fewer inspection errors, and improved efficiency of design work
- 10) In the transport, communication, utility corporations (railways, road truck transport, water transport, air transportation, warehousing, communications, electricity, gas, water): reduced variety of products or materials to be purchased, fewer liaison tasks

- 11) Other areas in the third sector (commerce, finance & insurance, real estate, service industry): reduced variety of products or materials to be purchased, fewer liaison tasks

(For fuller details refer to Annex 7-1 "Benefits of Standardization in the Various Departments of Companies")

According to the innumerable reports published each year by the various companies, it is clear that the introduction of TQC and its thorough implementation produced immense benefits. Many companies have achieved improvements equal to 50 - 60% better productivity in 3 - 4 years of introducing TQC, 10 - 20% fewer production costs, 70 - 80% fewer complaints, and work disasters down by more than 95%.

According to the results obtained by the Study Team in Chile, it became clear from the questionnaire survey responses that some of the respondents (firms) had achieved very favorable results from their in-house standardization efforts in terms of:

- 1) better product quality
- 2) more uniform product quality
- 3) greater savings of materials and raw materials/feedstock
- 4) reduced reject rate for finished production
- 5) reduced delivery time
- 6) fewer complaints
- 7) increased sales.

The number of companies stating that they had gained from standardization was overwhelmingly greater than the number of companies saying they had not.

In Chile's industrial sector, the present state of in-house standardization and the implementation of quality control cannot necessarily be described as satisfactory. The findings of the present Study Team have revealed that there is only a very small number of companies implementing quality control at all stages of the plant, from the design through to the packaging and dispatch

of the finished products. Most companies have quality control only in the production/manufacturing process stage or in the inspection of the finished products. Except for a small minority of companies, the general picture is that companies have a small number of in-house standards and keep a few records on quality control. This demonstrates that the level of quality control is still rather low in Chile's industry. Yet they have already sufficient potential for introducing high level of quality control theory and techniques. There is therefore likelihood of quality control spreading, given some opportunity.

It is hoped that through the implementation of the plan, the large firms (workforce of 300 employees or more) and the medium firms (workforce of 200 - 300 employees) will establish the kind of quality system presented in ISO 9002 and carry out quality control activities in accordance with ISO 9004. The consistent implementation of in-house standardization and quality control will enable them to supply and deliver products or render services in good time (timely delivery) at an effective costs, with the products and services being of a quality satisfying the user and consumer thereof. Once this level has been reached, the companies concerned will be in a position to intensify their corporate activities even further by being more effective in collecting market information, reinforcing product plans, upgrading their level of technology, innovating their plant, improving the quality of their products, lowering their costs and developing a bigger or new market for their products. Since ISO 9002 is an international standard, if the company can establish a quality system meeting this standard, it will mean that the company has, and is seen to have, reached an international level of quality control for its products. As a result, it will achieve a major leap forward in improving its competitiveness and is bound to improve its export performance. Product of a high quality can be sold at a high price, while, at the same time, production costs will not go up in proportion to the increase in quality because of the consistent implementation of quality control. The result will therefore be an increase in profitability and prosperity for the company.

As stated earlier, in-house standardization and quality control in Chile is comparatively at low level at present and there is still much room for improvement. However, if we look at the results Japan has achieved, it will be clear that the economic benefits are immense if only Chile's industry will be able to achieve the level of ISO 9002.

Small and medium firms (with a workforce of less than 200 employees) which have ties with medium and large companies will introduce company standardization and quality control under the influence of the latter, and their firm activities will be enhanced.

7.2.2 Benefits of Introducing a Metrology System

In the manufacturing industries, metrological control is an absolutely essential factor in all processes, including product development, design, material purchasing, production control, quality control, production process technology, delivery and sales. There is at present no method for calculating and quantifying the benefits arising from the metrological control to the national economy, and it is also unavoidably true to say that it is strictly impossible to calculate the benefits by concentrating only on one particular model for the calculation of the very diversified commercial activities.

However, the following example on ball bearings will demonstrate how big the economic effect of accurate calibration for ball bearing production is.

The economic loss (L) due to measurement errors is given as being proportional to the square of the size (magnitude) of the error, according to the theory of quality control. Generally, however, it is found that the economic loss (L) can be expressed by the equation $L = K\sigma^2$, because the average "error distribution σ^2 " of the square of the error is used, when a measurement is repeated several times, rather than the square of the magnitude of the error. Here, K is a proportionality constant. It is expressed by the values obtained by

dividing the loss (harm) in price terms A associated with the repair of the down-graded product or the scrapping thereof by the square of the permissible error tolerance $[\Delta]$, that is, the magnitude of the permissible error (i.e., $K = A/\Delta^2$). From this definition of the proportionality constant K , we can now express the economic harm or loss (L) due to measurement error as:

$$L = A^2 / \Delta^2$$

Let's use an example to make this clear:

Suppose the dimensional errors that must be strictly adhered to in the production of ball bearings are:

- inner diameter error (tolerance) $[\Delta]$ $30\text{mm} \pm 5 \mu\text{m}$
- each instance of deviation from this tolerance causes a loss of due to scrapping (Loss A) 400 yen/each
- error distribution for measuring equipment $[\sigma^2]$ $1 \mu\text{m}$
- with an annual production output $1 \text{ million bearings}$

The loss due to inner diameters deviations associated with measurement errors is:

$$L = 400/5^2 \times 1^2 \times 100 \text{ million} = 16 \text{ million yen}$$

Let us next consider the loss L' which arises when the measuring instrument has a poorer accuracy because it has not been calibrated and is used in this condition because no information has been given saying that the error distribution has doubled. This loss L' is four times the value of the loss L , that is, 64 million yen.

This demonstrates that the loss taken as the loss L is 4% if the value of annual output is 400 million yen but the loss L' is 16%.