Nordicity Group Ltd.
Le Groupe Nordicité ltée

THE IMPACT OF STANDARDS ON THE DIFFUSION OF TECHNOLOGY AND INDUSTRIAL COMPETITIVENESS

VOLUME II
CASE STUDIES

Prepared for:
Industry Canada
and Co-sponsors

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PROCUREMENT, STANDARDS AND COMPETITIVENESS (A COMPARISON OF SELECTED COUNTRIES)

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EXECUTIVE SUMMARY

The purpose of this study was to investigate how the government procurement policies and programs of selected countries and regions are used to support the development of small and medium-sized enterprises (i.e. SMEs) with particular emphasis on the adoption of quality standards such as the ISO 9000 series.

The following regions and countries were selected; the European Community, the United Kingdom, Belgium, France, Japan, Australia, New Zealand and the United States including the States of California, Massachusetts, Michigan, New York and Pennsylvania. Canadian federal government activities as well as those of New Brunswick and Newfoundland and a number of regional initiatives were also included.

All selected countries have either formally introduced ISO 9000 requirements in their procurement process, or have an industrial sector that is responsive to international standards requirements such as ISO 9000. The United Kingdom, where ISO 9000 compliance was initiated in 1979, has the largest number of firms registered to date (i.e. over 20,000).

All selected countries have support programs in place that can be used to help SMEs adopt new quality standards.

In Canada, the ISO 9000 series has been formally adopted by the Department of Defence and by the Government Services Canada for procurement purposes. However, program assistance to encourage the adoption of quality standards have not been fully explored. A model that is ideally suited is the Advanced Manufacturing Applications Program (AMTAP). However, the status of this program remains unclear.

1.0 INTRODUCTION

The purpose of this study was to investigate how the government procurement policies and programs of selected countries and regions are used to support the development of small and medium-sized enterprises (i.e. SMEs) with particular emphasis on the adoption of quality standards such as the ISO 9000 series.

The most recent information published by the Organization for Economic Co-operation and Development (OECD) on defense and general public procurement is summarized in Exhibit 1-1 in both absolute terms and as a percentage of manufacturing GDP. Defense procurement ranges between 1.0% and 10.8% of manufacturing GDP, while general public procurement ranges between 1.1% and 60.7% of manufacturing GDP. In many countries, procurement provides significant leverage as an instrument of industrial policy.

The OECD has established that defense procurement, in sectors such as electronics, road transport, aeronautics and space or shipbuilding can account for as much as 60% of total procurement. The top ten contracting firms would often represent up to 50 or 60% of defense equipment procurement and frequently more than 90% of R&D procurement. A major characteristic of defense procurement is that a limited number of sectors and firms account for the bulk of the expenditure.

As noted in Exhibit 1-1, public procurement, as a percentage of manufacturing GDP, varies widely among OECD countries. However, one consistent indicator is that only a very small proportion of procurements are made abroad (2-3%) which confirms that public procurement markets tend to be protected markets.[1]

The analysis of the costs and benefits of procurement are currently limited by the fact that there is a no agreed-to methodology which can provide a framework for such an investigation.[2]

As will be illustrated in the following sections, procurement is used as a lever to get firms to adopt quality standards. In recent years, the focus has been on the ISO 9000 series of quality standards which are described in Exhibit 1-2. Some 35,000 firms in 53 countries have apparently adopted these standards which are considered to give them a competitive edge over firms which are not certified.

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1 Industrial Support Policies in OECD Countries (1986-1989), OECD, Paris, 1992, p.38. The foreign share of public procurement can increase to 5-10 per cent when the concept is extended to include imported products sold without any change. In Canada, an average 15-18 per cent of the value of federal government prime contracts are sourced with firms outside the country.

2 Ibid.

Exhibit 1-1
Defense Procurement, Public Procurement and Manufacturing Procurement, 1988
(as a percentage of manufacturing GDP)

	Defence Procurement	Public Procurement
Australia	3.9%	35.3%[1]
Austria	2.2%	46.9%[4,5]
Belgium	1.0%	5.4%
Canada	3.0%	6.9%[1]
Denmark	2.3%	60.7%[6]
Finland	2.5%	24.7%
France	9.0%	21.2%[2]
Germany	2.1%	1.2%[1]
Ireland	1.1%	1.1%
Japan	1.3%	1.1%
Netherlands	0.6%	n.a.
Norway	7.5%	58.7%
Spain	n.a.	4.2%
Sweden	5.7%	47.3%[2]
Switzerland	3.6%	11.5%
United Kingdom	10.8%	13.2%[3]
United States	9.7%	24.5%

Notes: The GATT procurement code does not cover services, but applies to non-war goods procured by e.g. Defense agencies.

1 Federal procurement only.
2 Estimates.
3 1987.
4 Includes services covered in intermediate consumption (see Table B).
5 Includes non-federal procurement.
6 Intermediate consumption.

Source: OECD Industrial Support Policies in OECD Countries (1986-89), Paris 1992 -

Exhibit 1-2
ISO 9000 Standards

The International Organization for Standardization (ISO), based in Geneva, issued the ISO 9000 series of standards in 1987. These five standards address quality management and quality assurance in product development, production, installation, and service. The standards apply to the elements and practice – primarily through documentation – of quality management systems, but not to their specific form or means for implementation. The five standards are:

> *ISO 9000. Entitled "Quality Management and Quality Assurance Standards: Guidelines for Selection and Use," this standard sets forth the principal concepts and describes the use of such standards in purchaser-supplier contracts. It also provides guidance on the use of the other four ISO 9000 series standards.*
>
> *ISO 9001. This standard provides a model for quality assurance in the design, development, production, installation, servicing, and supply of products or services. The most comprehensive of all the standards, it includes all of the requirements found in ISO 9002 and ISO 9003.*
>
> *ISO 9002. A model for quality assurance in production and installation.*
>
> *ISO 9003. A mode for quality assurance when only final inspection and testing are required.*
>
> *ISO 9004. Contrast to the other standards, this one offers guidelines for developing and applying internal quality management elements and activities. A company that uses these quality management practices should be able to meet the requirements of ISO 9001 through ISO 9003.*

Although designed to be used in two-party purchaser-supplier contracts, the ISO 9000 series of standards is being applied broadly through third-party certification of a company's quality system operations. In practice, the most important standards are ISO 9001, 9002, and 9003 because they apply directly to company processes, products, and services.

Source: American Society for Quality Control.

2.0 EUROPE

2.1 European Community (EC)

2.1.1 Towards EC-Wide Procurement

The movement towards an integrated market requires the opening up of national public procurement markets to other EC members, which collectively are worth about 10 per cent of the EC's GDP. Directives have been set in place aimed at eliminating discrimination in national public procurement. These directives are consistent with the rules in the GATT Agreement on Government Procurement (GPA).

Every procurement contract, above certain thresholds (see Exhibit 2-1) must be advertised throughout Europe through inclusion in the Official Journal of the European Community. In the utilities sector advertising may take the form of a qualification system.

Common technical specifications are needed to support the move to an EC wide procurement policy. Therefore the harmonization of standards is essential. The EC directives on procurement require reference in specifications to national standards which implement any European standards which are relevant, or the European standards where these alone exist. The latter is increasingly becoming the case. However, the following exceptions apply in situations which involve:

- problems of compatibility with existing equipment; or
- disproportionate costs incurred by departing from previously used standards; or
- innovation.

Where relevant European standards do not yet exist, reference should be made to an alternative in the following order of preference:

- national standards implementing international standards;
- any other national standards; and for utilities; and
- other standards having currency in the EC.

Exceptions and the lack of European standards can act as barriers to the movement towards EC-wide procurement. As noted recently in the Economist:

Exhibit 2-1
Procurement Contract Threshold Levels

Contracting Entity	Contract	Threshold
GATT bodies (central government, health, authorities and certain other public bodies	Supplies	125,576 ecu (1)
	Works	5m ecu
	Services	200,000 ecu
Other central government, and public bodies (+ telecoms until 31.12.92)	Supplies	200,000 ecu
	Works	5m ecu
	Services	200,000 ecu
Utilities (ex. telecoms)	Supplies	400,000 ecu
	Works	5m ecu
Telecoms	Works	200,000 ecu
Utilities	Services	400,000 ecu (provisional)

(1) 1 ecu = approximately $1.3 Cdn

> "Nobody believes that the mere invitation of bids ensures open access to contracts. Both the French and British think they are more open than others. When, say, Italy's public authorities start buying cars and buses made by somebody other than Fiat, scepticism over the openness of public procurement might subside".[1]

2.1.2 Support Programs for SMEs

Regarding the ISO 9000 quality standards, the EC Commission has made the following statement:

> "The Commission upholds ISO 9000 in the form of EN 29000 as a European standard, compliance with which will help companies to supply consistently, and, therefore, to be better placed to meet the requirements of tenders."[2]

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1 The Economist: Survey of the European Community, July 3rd, 1993, p.12.

2 Official Journal of the EC, No. C145/39, May 25, 1993.

To assist SMEs, which in Europe are defined as firms with less than 500 employees, to meet new standards, such as EN 29000, the EC Commission has launched a pilot activity under its Euromanagement Program, aimed at identifying and resolving problems in the areas of standardization, certification, quality assurance and health and safety. Seven hundred firms will be assessed this year by 43 consultants which have been trained (i.e. June 7/8, 1993) by the project's co-ordination, AFNOR, the French national standardization organization, which obtained the contract from the EC Commission for this project. Each consultant will be paid 30,000 ECU (approx. $40,000 Cdn) to spend five days with each of about 15 firms. The pilot program will pay 50 per cent of this fee; the SME and the consultant have to find the other half of the money elsewhere (e.g. another EC or national support program).

Specifically, the activity was launched to help:

- to improve SMEs' awareness of both information sources and requirements regarding standardization and certification of products of particular interest to SMEs, especially with respect to new European standards;

- to assist SMEs to interpret and analyze the new standardization and certification requirements as they apply to their operations;

- to identify particular adjustment problems experienced by SMEs with respect to standardization and certification;

- to assist those SMEs who potentially could benefit from achieving quality assurance certification to identify their management problems and to make them aware of the basic concepts of quality assurance; and

- to improve SMEs' awareness and understanding of the requirements of health and safety in the workplace.

Each firm will receive a full report of the consultant's assessment, enabling management to take whatever action is required. In addition, it is anticipated that this exercise will help to identify solutions, which could potentially be applicable to a wider group of SMEs throughout the Community.

The consultants for Euromanagement - standardization have been selected following a call for tenders on the basis of their proposals, experience in the fields to be covered, and the industrial sectors in which they propose to operate. As a result, a broad range of industrial sectors in Europe is represented.

Once the pilot activity is completed in December 1993, the co-ordinator, AFNOR, will make recommendations regarding the next phase of this program.

Under the EC's regional development policy, disadvantaged regions (e.g. Mediterranean countries, eastern Germany, Ireland, Northern Ireland) can obtain funding under the PRISMA program, which is a broad regional development program, to adjust to European standardization requirements. The program office is in Brussels.

2.1.3 Telecommunications: A Special Case

The telecommunications sector has traditionally been a well protected sector through national regulations. As of January 1, 1993, an EC Directive has come into effect opening up national procurement in this sector on a Community-wide basis. An EC committee of member states chaired by a bureaucrat from DG XXIII, the EC Directorate responsible for telecommunications will oversee the implementation of this directive.

Telecommunications is the area where most new European standards are emerging. These standards are extremely important in establishing a common market in the telecommunications sector. To ensure that there are no undue delays in the development of these standards, standardization considerations are incorporated in the telecommunications research and development (R&D) projects funded under the EC's RACE (Research on Advanced Communications in Europe) Program, which also falls under the direction of DG XXIII.

The RACE Industrial Consortium (RIC) which is charged with the commercialisation of RACE results also provides the interface with European standards bodies such as the European Telecommunications Standards Institute (ETSI).

In fact, RIC is accredited to ETSI and approves the RACE contributions to various ETSI Committees.

In this way research results get into the European standardization process early-on. In turn this assists in the development of European-wide telecommunications market. Also the fact that a major criterion in applying for funds under the RACE (and other EC) R&D program is the requirement that the consortium of firms and research organizations must come from at least two member countries forces the development of European rather than national standards.

2.1.4 Summing Up

The European Community directives on opening-up national procurement have engendered a process of harmonization of national standards and the development of new European standards.

The telecommunications sector is leading in the establishment of new European standards. To accelerate the standardization process, standards concerns are incorporated in relevant EC R&D programs such as RACE.

To assist SMEs to adopt new standards, such as the EN 29000 (i.e. ISO 9000), a pilot activity was recently launched to help some 700 firms.

2.2 United Kingdom

2.2.1 The Catalyst of Defence Procurement

In 1979, the Ministry of Defence (MOD) launched the ISO 9000 movement by requiring the BS 5750 (ISO 9000) quality standards from its prime contractors. The purpose for imposing BS 5750 was to improve the poor quality image of British industry. In turn, prime contractors encouraged their suppliers to adapt the BS 5750 standards. Some prime contractors made this requirement mandatory. Other government departments began to uphold the BS 5750 standard. This cascading effect has apparently resulted in some 20,000 firms currently conforming to the BS 5750 standard.

However, largely because of the current recession, there has been a backlash, especially by SMEs on the appropriateness of moving to this standard. This controversy has forced the British Standards Institute (BSI) to set up a committee to review the issue. The mandate of this committee is to look at ways of simplifying the implementation of the standard for small firms and reducing costs.

The Department of Trade and Industry (DTI) is actively promoting the adoption of BS 5750, which is equivalent to the European EN 29000 standard, so that British firms can be more competitive within the EC. DTI does not want the BSI review to result in a "two-tiered system" in which SMEs are exempt from adopting the BS 5750 standard but large firms are not. This would be a regressive step.

2.2.2 Enterprise Initiative

The principal program aimed at supporting SMEs is the Enterprise Initiative Program which is a comprehensive, self-help package of advice, assistance and guidance from DTI to help businesses improve their cutting edge at home, across the Single European Market and beyond.

Consultancy help is available to most manufacturing and service businesses and groups with fewer than 500 employees. It comes as confidential guidance and advice from independent consultants in key management areas including business planning, design, financial and management information systems, manufacturing and services systems, marketing and quality. DTI will subsidize the most of a consultancy project lasting between five and 15 days. Sixty per cent of the uptake of this aspect of program is for quality management assistance.

This program provides information and advice on the integrated management of design, quality, manufacturing, and purchasing and supply. New topics are under development.

Alongside the consultancy scheme, with the same aim of putting U.K. business in a strong, competitive position, the Enterprise Initiative offers:

- information about technological developments as well as providing help to solve technical problems;
- grant support to develop innovative ideas, participate in collaborative research and bring forward new products and processes;
- practical advice and assistance if you are exporting or planning to export;
- special assistance for firms in Assisted Areas and Urban Program Areas;
- help in forging links between business and local schools, universities and polytechnics.

2.2.3 Summing Up

In the U.K., the mandatory requirement to conform to the BS 5750 (ISO 9000) standard to qualify for defense procurement was the principal catalytic factor which resulted in a large number of firms (e.g. some 20,000) adopting the standard.

In turn, this requirement has led to a large uptake (60%) of the major support program for SMEs, the Enterprise Initiative, for quality management assistance.

2.3 Belgium

2.3.1 A Flow-Through Economy

Belgium exports about 73% of its GDP. The import ratio is similar. Therefore, this country of some 10 million people has what could be called a "flow-through" economy. As such, the focus is very much on accepting European and international standards. In fact, there are now almost no Belgium standards per se.

The Institut belge de la Normalisation (IBN) sees its role more as participating in the development of European standards than in pursuing the development of Belgium standards.

2.3.2 Regionalization

Procurement policy is part of the industrial policy which is now regionalized under the institutional reforms of 1993 within the industrial policies of the three regions;

the Flemish region, the Wallon region and the Brussels-Capital region. Procurement policy responsibilities are passing to the regional level. At the moment, it is not apparent that the regions have well defined procurement policies and industry support programs.

At the regional level there are the Association wallonne pour la gestion de la Qualité (AWGQ) and the Flemish Vlaams Centrum voor Kwaliteitszorg (VCKZ). These two bodies have promotional programs to inform firms on how to adapt European and international standards.

2.3.3 Summing Up

Belgium is a country currently in a state of flux. Because of the regionalization process recently set in place there do not appear to be clear industrial/procurement policies.

Moreover, because of the "flow-through" character of the economy, firms readily adopt European and international standards. It is a cultural trait of Belgium to respond to forces from outside their country.

No estimate of the firms complying to EN 29000 (ISO 9000) was available.

2.4 France

2.4.1 Procurement as an Element of Industrial Strategy

The French feel that they are in a "catch-up" situation vis-à-vis the U.S.A., Germany, the U.K. and Japan in using standards as an instrument of industrial policy. To rectify this situation, a Délégué Interministériel aux Normes was appointed within the Ministère de l'Industrie et du Commerce Extérieur. This person heads a standing interdepartmental committee whose mandate is to determine how standards can be used as an instrument of industrial strategy. A representative of the Commission Centrale des Marchés, which oversees public procurement, sits on this interdepartmental committee.

As well, the Délégué oversees the government's participation in the Association française de normalisation (AFNOR) which represents some 35% of that standardization body's budget. While AFNOR is privately incorporated, it is recognized by the government and represents France in the international standards arena.

AFNOR plays a pro-active role in linking standards development with French industrial strategy. Twenty sectoral groups have been established to elaborate standards strategies in given areas (see Exhibit 2-2). Each sectoral activity is led by a committee made up of government and industry representatives.

Exhibit 2-2
AFNOR: Major Sectoral Groups

1 Agribusiness
2 Information Technologies
3 Electrical and Electronic Technologies
4 Construction and Public Works
5 Medical and Dental Technologies
6 Mechanical Equipment
7 Petroleum Industry
8 Materials
9 Transportation
10 Wood and Furniture
11 Health and Safety in Work Place
12 Business Management and Services to Firms
13 Gas
14 Steel Making
15 Consumer, Sport and Leisure Items
16 Water Treatment
17 Telecommunications
18 Environment
19 Physical Standards
20 Chemistry

2.4.2 Procurement and Standards

The French public procurement market accounts for about 5% of France's GDP.[1] In public procurements it is obligatory to make reference to French and European standards if they exist. A European standard will take precedent over a French standard. If standards do not exist then a specification will be developed. Also certain exception can be made in areas of "strategic importance".

However, the aim is to have a totally transparent non-discriminatory procurement system. A "Mission interministérielle d'enquète sur les marchés" has been put in place to ensure transparency and non-discrimination.

This "mission" is supported by recently passed legislation (1991) which provides for penalties (financial and imprisonment) for those individuals found guilty of discrimination in allocating public contracts.

2.4.3 Support Mechanisms of SMEs

The French government has set in place at least two innovative support mechanisms to assist SMEs (i.e. firms with less than 500 employees) to adopt new standards. This is in addition to more general support programs available to SMEs, aimed at upgrading their manufacturing capabilities.

The "Partenaires pour l'Europe" program is aimed at preparing SMEs for the European market by offering 40% subsidy to projects related to standards, certification and testing. Areas covered include the following:

- information services on standards provided by industry association;
- participation in European Standardization bodies;
- translation of technical specifications into standards;
- certification activities leading to obtaining the NF certification;
- adaptation to the CE certification;
- development, diffusion, and promotion of quality concepts;
- training related to quality;
- specific actions within the firm to upgrade quality.

The definition of the research tax credit has been extended to include expenditures related to standards. The following expenses qualify for a 50% tax credit:

- salaries and overheads of employees for the time that they participate in

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[1] In Canada, Federal Government procurement accounted for about 3 per cent of GDP in 1987 (footnote 1, page 1).

official standards meetings;

- expenses related to the above (tax credit is fixed at 30% of salaries); and
- the expenses of the CEO of a firm who participates in official standards meeting up to 3,000F per day.

2.4.4 Summing Up

France has set in place a structure that links standards to industrial strategy and to public procurement.

It is obligatory in public procurements to refer to French and/or European standards if they exist. Otherwise, a specification has to be formulated.

As well as having the usual programs that support SMEs, there are two programs aimed directly at assisting SMEs with standardization. One program is the "Partenaires pour l'Europe", the other is the extension of the definition of the research tax credit to include standards related expenditures.

In France, some 1,100 firms are currently certified to ISO 9000 (EN 29000).

3.0 UNITED STATES OF AMERICA

The U.S. government is considered to be the world's largest purchaser of goods and services. Purchases by military and civilian government installations averaged about $US 185 billion annually in recent years (with over $US 190 billion in each of 1990 and 1991). The government buys just about every category of commodities and services available. The Department of Defense (DoD) is the largest of the government purchasers, accounting for over 70 percent of total contract dollar awards.[1]

3.1 Procurement Policy

3.1.1 New Directions

The U.S. federal government has made it a priority to thoroughly reform its procurement policy, particularly (but not exclusively) defense procurement policy. President Clinton's February 22 report on new technology initiatives aims to simplify procurement procedures so that commercial manufacturers can benefit from government investment. The report says that in recent years "the military and commercial worlds have grown increasingly segregated from one another."[2] This is not due to differing technical requirements, but rather the problem is "a growing morass of procurement laws and regulations."

The following reforms were proposed in the Clinton/Gore report:

- Government purchases or government-contracted development should give priority to commercial specifications and products.

- Agencies should invest in and procure advanced technologies, where it is economically feasible, in order to facilitate their commercialization.

- Agencies should experiment with a portion of their procurement budget to allow them to procure innovative products and services incorporating leading edge technologies.

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1 The State of Small Business: A Report of the President, Small Business Administration, transmitted to the Congress, 1992, Appendix C.

2 "Technology for America's Economic Growth, A New Direction to Build Economic Strength", President William J. Clinton and Vice President Albert Gore, Jr., February 22, 1993, p.22.

- Agencies should evaluate bids based on their ability to minimize life-cycle cost rather than acquisition cost, including environmental, health and safety costs borne by the public.

- Agencies should obtain rights in technologies developed under government contracts only to the extent necessary to meet the agencies' needs, leaving contractors with the rights necessary to encourage private sector investment in the development of commercial applications.

- Agencies should use performance-based contracting strategies that give contractors the design freedom and financial incentive to be innovative and efficient.[1]

Several initiatives are underway within the federal government that reflect the above proposed reforms. One major initiative known as "defense conversion" is proceeding to convert R&D activities from the military framework that dominated federal technology efforts for half a century to a greater emphasis on civilian purposes. Several related defense conversion programs have arisen as a result of this new direction within the U.S. government.[2] One of the elements of DoD's defense conversion exercise that will affect all firms hoping to sell to DoD is procurement reform. The Department is attempting to reduce the number of unique defense specifications and to introduce commercial contracting procedures into the acquisition process. A current DoD proposal would allow commercial acquisition procedures to be used for all projects under $100,000.[3]

The National Defense Authorization Act for Fiscal Year 1993 mandates the modification of DoD acquisition policy to encourage integration of the civilian and military industrial base:

> It is the policy of Congress that the United States attain the national technology and industrial base objectives set forth in [10 U.S.C. 2501(a)] through acquisition policy reforms that have the following objectives: ...
>
> (2) Reducing the reliance of the Department of Defense on technology and industrial base sectors that are economically

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[1] Ibid.

[2] For descriptions of the various programs (of DoD, Dept. of Commerce, Dept. of Energy and NASA) that support the defense conversion initiative, see: "Program Information Package for Defense Technology Conversion, Reinvestment, and Transition Assistance", March 10, 1993, ARPA publication.

[3] "Defence Conversion and Canadian Industry", draft report by Matthew Johnston, Defence Programs, Embassy of Canada, Washington, D.C., July 12, 1993.

dependent on Department of Defense business.

(3) Reducing Federal Government barriers to the use of commercial products, processes and standards.[1]

The general direction of DoD's conversion and acquisition policies is to make greater use of components, systems and services available "off-the-shelf". Contracting out for new or custom-made items would only be in the cases when it has been established that those readily available are clearly inadequate to meet military requirements.

3.1.2 Support for Small and Mid-Sized Businesses

The U.S. Small Business Administration (SBA) has the responsibility of making certain that small business obtains a fair share of government contracts and subcontracts.[2] This mission is spelled out in the Small Business Act of 1953 which established SBA: "The policy of Congress is that ... the government should aid, counsel, assist and protect, insofar as possible, the interests of small business in order to ... insure that a fair proportion and services for the government ... be placed with small business." Amendments to this act and other legislation in the intervening years have reinforced and expanded this vital mission.

Small businesses were awarded $62.9 billion of a total of $191.2 billion in goods and services purchased by the federal government in Fiscal Year 1990, the latest year for which published data are available.[3] Of the total, $35.7 billion (18.6 percent) was awarded directly to small firms and at least $27.2 billion (14.3 percent) was awarded to small businesses as subcontractors. The overall share of federal procurement that went to small firms increased from 31.9 percent in FY 1989 to 32.9 percent in FY 1990. The Department of Defense is the largest single source of contract awards, accounting for over 70 percent of small business award dollars in FY 1990.[4]

Many laws applying to federal procurement have some special provisions about

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[1] Public Law No. 102-484 (1992).

[2] SBA is responsible for making determinations as to whether a particular business qualifies as a small business under the existing size standards set forth in the Code of Federal Regulations. In general, these standards vary from industry to industry (as defined by U.S. SIC codes) and could be determined by the firm's number of employees (not to exceed 500) or by its annual receipts, depending on the type of industry to which the firm belongs. In industries dominated by large firms, a company of 500 employees would be considered "small". A small business concern should also be independently owned and operated. By Canadian standards, "small business" in the U.S. encompasses our SMEs. The small business standards are listed in the U.S. Federal Acquisition Register (FAR) Part 19.102.

[3] The State of Small Business: A Report of the President, transmitted to Congress, Small Business Administration, 1992.

[4] Ibid. p.xv.

small business and disadvantaged or minority small business contracting. However, no law has had a more profound effect than Public Law 95-507.[1] This law (enacted in October 1978) made major revisions to the Small Business Act. In summary, the law requires:

- A strong and specific commitment to subcontracting with small and small disadvantaged businesses by large business prime contractors.

- Detailed subcontracting plans for larger contracts. These plans may be accepted or rejected by the government contracting officer in a negotiated procurement and must be carried out forcefully in either a negotiated or sealed bid procurement by the successful large business.

- Monitoring of performance against the plan by Small Business Administration (SBA) and by the procuring activity's contracting officer.

- Federal buying agencies to establish an Office of Small and Disadvantaged Business Utilization to assist small businesses by expanding their contracting opportunities and by helping solve problems.

- Annual goals for contracting with small and small disadvantaged businesses to be set by federal agencies.

The SBA, working closely with federal agencies and the nation's leading contractors, carries out its procurement assistance responsibilities through a number of programs including:

- Prime Contracting
- Subcontracting
- Procurement Automated Source System (PASS)
- Certificates of Competency
- Natural Resources Sales Assistance

Prime Contracting Assistance: Federal agencies collectively award about 20 percent of their prime contracts to small businesses. Much of this small business prime contracting occurs without intervention by SBA. SBA, however, continually tries to increase both the dollar value and percentage of total awards to small business, principally through the work of its procurement center representatives (PCRs) stationed at selected military and civilian locations where there are major buying

[1] Procurement Assistance: A Practical Guide for Businesses Seeking Federal Contracts, U.S. Small Business Administration, October, 1992, p.2.

programs.

Subcontracting Assistance: The federal government's role in subcontracting assistance to small business was changed significantly by Public Law 95-507, which amended Section 8(d) of the Small Business Act. The emphasis was changed from voluntary to mandatory and from best efforts to maximum practicable opportunity. The Act directs that federal government contracts over $10,000 shall contain a clause entitled Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals. For larger contracts, i.e., those over $500,000, the law also requires a subcontracting plan setting forth percentage goals for utilizing small business concerns.

SBA has commercial market representatives (CMRs) located throughout the country. Their basic responsibilities include:

- Assisting small business in discovering and expanding subcontracting opportunities.

- Working with large prime contractors to identify competent small business contractors, and assist them in interpreting Section 8(d) and its implementing regulations, including the formulation of subcontracting plans.

Procurement Automated Source System (PASS): Over the years, many source lists and bidders' lists of small businesses were developed by agencies and companies. Some were manual, others were partially automated.

PASS was designed to establish a centralized, computer-based inventory and referral system of small businesses interested in being prime or subcontractors for federal requirements. Using computers and remote video terminals, PASS furnishes sources by matching key words which small firms have used to describe their capabilities.

Since 1978, the PASS system has grown to an "inventory" of more than 230,000 small firms and is growing every day.

Certificates of Competency (COC): SBA's procurement assistance effort is greatly strengthened by the COC Program. SBA is authorized by the Congress to certify as to a small company's "capability, competency, credit, integrity, perseverance and tenacity" to perform a specific government contract. If granted, the COC would require award of the contract to the firm in accordance with the Small Business Act.

SBA conducts a completely independent survey, which evaluates the characteristics of the applicant in terms of the needs of the specific acquisition in question. Credit ratings, past performance, management capabilities, management schedules and the prospects for obtaining needed financial help or equipment are considered.

A COC is valid only for the particular contract for which it was issued.

Natural Resources Sales Assistance: The federal government sells large quantities of many kinds of real and personal property -- property surplus to federal needs. SBA's Natural Resources Sales Assistance Program is intended to (a) ensure small business concerns obtain a fair share of government property sales/leases to include, where necessary, small business "set-asides", and (b) provide aid, counsel and other available assistance to small business concerns on all matters pertaining to government sales/leases.

Another form of assistance to small businesses, for federal government procurement purposes, are the so-called "set-asides". A small business "set-aside" is a method of acquiring goods or services for use by the federal government whereby participation in the acquisition is restricted exclusively to small business concerns. Large businesses cannot participate; thus small businesses are assured of receiving a contract. The criterion for a small business set-aside is, essentially, reasonable expectation that sufficient (two or more companies) small business competition exists to meet the requirement to obtain the goods or services at fair and reasonable prices.

In addition, each executive department has an office of Small and Disadvantaged Business Utilization (SDBU). Its officials try to maximize opportunities identified for small business, and to assist these businesses in connecting with suitable prime contractors.

3.1.3 Procurement and Quality Standards

Traditionally the U.S. Government contracts operate on the principle of "supplier responsibility." Quality is one of the three important elements of successful government contracts: i.e., quality, price and timely delivery. Suppliers must provide an acceptable quality program described in writing and must be available to the government representative. It must include:

- an organization chart which clearly depicts the place of quality control functions;

- persons performing quality control functions, their responsibilities and authority in dealing with the government on contracts;

- a flow chart of production;

- inspection stations, inspection procedures, test methods, statistical techniques, etc.;

- calibration of equipment, frequency, procedures, traceability to standards and records; and

- samples of quality control forms, tags, charts, labels and any other written matter used to control quality.[1]

In keeping with the "supplier responsibility" principle, the DoD also, "to the maximum extent practical", has in the past permitted contractors providing commercial items to use their existing quality assurance systems and quality programs. For critical goods and services, however, the DoD conducts its own audits of suppliers to ensure that appropriate quality standards are in place which conform to military specifications.

Notwithstanding the above, several agencies of government (including DoD) are in the process of examining and/or adopting the ISO 9000 quality standards to utilize them in their contracting requirements (see section 3.2 for descriptions of ISO 9000 activities by department, and section 3.3 for developments within DoD).

In addition, the Office of Management and Budget (OMB) has issued a revised version of its OMB Circular A-119, "Federal Participation in the Development and Use of Voluntary Standards", to the Heads of Executive Departments and Agencies on June 25, 1993. Section 7a(2) of this revised Circular states that : "International standards should be considered in procurement and regulatory applications in the interests of promoting trade and implementing the provisions of the Agreement on Technical Barriers to Trade and the Agreement on Government Procurement (commonly referred to as the "Standards Code" and the "Procurement Code," respectively)." Implementing these requirements falls equally on small and mid-sized businesses as on larger enterprises."

The closing date for final review and comments regarding the above revised Circular was July 30, 1993.

3.2 Shifts to ISO 9000 Standards Series

The National Institute of Standards and Technology (NIST) is heading an Interagency Committee on Standards Policy (ICSP). This Committee has set up an ISO 9000 working group which acts as a clearinghouse for the dissemination of agency

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[1] "What is an acceptable quality program?" in 25 Most-Asked Questions About Federal Procurement, U.S. Small Business Administration, 1992, p.17.

activities related to the ISO 9000 Standards. Several of the ICSP members have reported their specific activities related to ISO 9000. The information provided below is current to mid-July 1993.

3.2.1 National Institute of Standards and Technology (NIST), Department of Commerce

NIST managers have been holding discussions related to quality and the need for an internal quality policy in specific program areas, particularly with respect to the ISO 9000 standards. There is considerable support among both managers and staff for articulation of such a policy. NIST is currently exploring its available options.

The NIST National Voluntary Laboratory Accreditation Program (NVLAP) operated by the Office of Standards Services is: (1) working towards internal compliance with ISO 9000 requirements; and (2) planning to offer its accredited laboratories (as an option) quality system registration to ISO 9002. The assessment processes would be combined to provide NIST-accredited laboratories with a cost effective option for obtaining laboratory accreditation and quality system registration at the same time. Staff members are completing training in ISO 9000 requirements and how to conduct assessments.

The Office of Standards Services' Weights and Measures Program is upgrading the State Laboratory Accreditation Program in cooperation with the NVLAP. Technical criteria are being developed based on ISO/IEC Guide 25, which notes in its introduction: "Laboratories meeting the requirements of this Guide comply, for calibration and testing activities, with the relevant requirements of the ISO 9000 series of standards, including those of the model described in ISO 9002 when they are acting as suppliers producing calibration and test results."

3.2.2 Small Business Administration (SBA)

The SBA does not have any specific requirements related to ISO 9000 standards, but it is studying the implications of these standards on small businesses. The SBA acknowledges that ISO 9000 requirements will increasingly become critical to a large segment of American businesses. In addition, it is possible that ISO 9000 could have an impact on the Certificates of Competency (COC) Program (see above).

Specific offices within the SBA organization that are affected and are involved in researching the implications of ISO 9000 implementation are: Office of Procurement Assistance, Office of Financial Assistance, Office of Small Business Development Centers, Office of International Trade, and Office of Business Initiatives, Education and Training.

3.2.3 Food and Drug Administration (FDA), Department of Health and Human Services

The FDA is revising its medical device Good Manufacturing Practice (GMP) regulations to include requirements related to design control. The regulations will then be consistent with ISO 9001. GMP requirements for maintenance of complaint files, failure investigation and documentation will be more stringent than ISO 9001 requirements. The anticipated Federal Register publication date for the proposed regulation is Fall 1993.

3.2.4 National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services

NIOSH is part of the Department of Health and Human Services. NIOSH is considering ISO 9000 quality standards for implementation in its certification programs.

3.2.5 Department of Energy (DOE)

DOE is also considering use of the ISO 9000 series in the publication of its safety guide series which provides supplemental information for contractors on DOE's orders and rules.

3.2.6 Office of Acquisition and Property Management, Department of Interior

The Office of Acquisition and Property Management has been assigned responsibility for studying the issue of implementation of ISO 9000 standards requirements. No specific activities other than information collection are underway at present.

3.2.7 National Oceanic and Atmospheric Administration (NOAA), Department of Commerce

NOAA is converting its analog charts to digital databases for use in several different systems, including the Electronic Charting Display Information System (ECDIS), which will be used in shipboard displays to assist in navigation in harbours along the coasts. The activity is being conducted in cooperation with an international consortium composed of U.S. and foreign government agencies and industry representatives. The responsible unit of NOAA is planning to become internally compliant with applicable ISO 9000 standards requirements

3.2.8 MSHA's Approval and Certification Center (A&CC)

The A&CC of the Mines Safety and Health Administration (MSHA), Department of Labor, has ISO 9000 related activities in four areas:

Research. A committee has been formed to study and compare the ISO 9000 standards with other popular quality assurance standards.

Education. A training seminar was held at the A&CC in June for 24 employees by an accredited ISO 9000 registrar. The seminar covered a wide variety of ISO 9000 topics including: history; a discussion of each element in ISO 9001; registration processes and auditing.

Evaluation. A regular part of the Quality Assurance Division (QAD) activities is the evaluation of quality assurance manuals. More companies are submitting QA manuals which follow the elements of the ISO 9001 and 9002 standards and QAD employees are becoming familiar with these elements. The QAD standard operating procedures for processing quality manuals is also under evaluation for possible changes which cover the review of ISO 9000 based QA manuals.

Accreditation. The A&CC is considering seeking accreditation by a third party to demonstrate compliance with the requirements of ISO/IEC Guide 25. As part of this process, the A&CC is currently focusing on two areas: documented procedures, and calibration. A committee was formed to thoroughly review all A&CC policies and procedures.

3.2.9 General Services Administration (GSA)

The Office of Business, Industry and Governmental Affairs is coordinating GSA's ongoing study of the ISO 9000 standards in collaboration with members of the GSA Working Group on Quality Management System Registration. Included in the GSA action plan for the summer months are discussions with trade associations, corporations registered to ISO 9000, the Small Business Administration (SBA) and colleagues in other federal agencies.

3.2.10 Other Related Federal Government Activities

U.S. Postal Service: The Postal Service has initiated an effort to determine how ISO 9000 will/could impact on U.S. postal activities.

U.S. International Trade Commission (USITC): While the USITC does not participate in any standards developing groups or become involved in procurements requiring the use of such standards, USITC is interested in the impact of the development and application of international standards, such as the ISO 9000 standards, on international trade and competitiveness.

Nuclear Regulatory Commission (NRC): The NRC has not initiated any program/activities to formally review the ISO 9000 standards documents. However, NRC staff is monitoring the development and implementation of the quality system standards contained in the ISO 9000 standards.

Department of Education (DOEd): While DOEd has no plans at present for using the ISO 9000 standards within its programs, DOEd is collecting information on the possible applications of the ISO 9000 standards within the education and training fields.

Office of European Community Affairs (OECA), Department of Commerce: The OECA is tracking references to the use of the ISO 9000 standards (or their equivalent - the EN 29000) in EC directives and assesses the potential impact on U.S.-EC trade.

Occupational Safety and Health Administration (OSHA), Dept. of Labor: On a limited basis, the relationship between the ISO 9000 standards and process safety is being addressed in outreach presentations on the OSHA Process Safety Management Standard.

Federal Trade Commission (FTC): The FTC is collecting information on the requirements/applications of the ISO 9000 standards and the use of ISO 9000 registration claims in advertising and labeling.

3.3 Department of Defense

The Department of Defense, as discussed in section 3.1.1, is undergoing major changes in its procurement practices -- moving more towards commercial practices and simplification of defense acquisition transactions.

Within this broader context, DoD has begun to phase-in ISO 9000 standards into its procurement practices. Currently, an interagency working group, led by DoD is examining the implications of ISO 9000 in the context of defense acquisition streamlining initiatives. This working group includes NASA, the Coast Guard, the Department of Energy, and the Federal Aviation Administration. The team is developing a "statement-of-work" which will focus on quality standards for procurement needs in the 1990's.

DoD formally accepted American National Standards Institute - American Society for Quality Control (ANSI-ASQC) Q90 quality system series in an adoption notice dated February 6, 1991. Since the Q90 series is technically identical to the ISO 9000 series, this action in effect constituted adoption of the ISO 9000 series.

The department subsequently adopted the ISO 9000 series in a separate notice and both the Q90 series and the ISO 9000 series are listed in the DoD *Index of Specifications and Standards*. The intent of the separate notices was to reserve the Q90 series for domestic contracts and the ISO 9000 series for overseas contracts.

To date, DoD has issued a "Quality System Standards - Action Memorandum" (March 8, 1993), which has authorized purchasing agents, as an interim measure, "to use the International Organization for Standardization, ISO-9000 series and the equivalent [Q90 series] ...."

The Pentagon subsequently issued (on April 2, 1993) further interim guidance which clarifies the March 3 memorandum. Again in the form of a memorandum to military acquisition officials, David J. Berteau, Principal Deputy Assistant Secretary of Defense, issued more specific instructions, to help preclude misapplication and non-uniform application of the ISO-9000 standards.

Berteau's memorandum limits potential application of the ISO 9000 series standards to purchases where MIL-Q-9858 would be applied. Berteau's memorandum also stated that more time is needed for officials to review and approve the DoD position. "We want to move ahead with plans to upgrade our quality standards; however, we want this to be done in a coordinated and well-planned-out manner."[1]

The use of the ISO 9000 standards has not yet been included with the Federal Acquisition Regulation (FAR) or the DOD Federal Acquisition Regulation Supplement (DFARS).

3.4 Support Mechanisms for Small and Mid-Sized Businesses

For many small firms with limited resources, becoming ISO 9000 registered is a major obstacle. Most firms need help with developing the best way to work through the registration process.

3.4.1 NIST Programs

The United States' long-dominant position in the world's marketplace is declining due to increasingly sophisticated foreign competition and the swiftness of changing

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[1] Memorandum from David J. Berteau, Principal Deputy Assistant Secretary of Defense (Production and Logistics) to: Assistant Secretary of the Army for Research, Development, and Acquisition; Assistant Secretary of the Navy for Research, Development, and Acquisition; and Assistant Secretary of the Air Force (Acquisition) -- on Use of ISO 9000 Series Quality Assurance Standards, April 2, 1993.

technologies. There are more than 350,000 manufacturing firms in the U.S. with less than 500 employees. These firms employ about 12 million workers and account for over 50 percent of the total of that country's value added to goods and services.[1]

Many of these firms have not been able to keep pace with the rapidly changing, computer-driven, global marketplace of the past decade. To address this problem, the Omnibus Trade and Competitiveness Act established the Manufacturing Technology Centers (MTC) program as a NIST initiative. The goal of the program is to contribute toward improved U.S. industrial productivity and competitiveness in the growing international marketplace.

The first manufacturing technology centers were established in January 1989. There are now seven manufacturing technology centers funded through this program. These centers serve as a bridge between industry and sources of modern manufacturing technology (e.g., federal labs and departments, universities, professional organizations and vendors). Due to the success of this program the Dept. of Commerce has proposed an extension of the number of centers.

The seven existing technology centers serve as resource facilities to help manufacturers improve their competitive position through the application of manufacturing technology. Several of these centers have sponsored workshops on ISO 9000, and now provide counseling in the pre-assessment process for ISO qualification.

In an effort to assist small to medium sized manufacturing firms with their efforts to become ISO 9000 registered, NIST's Northeast Manufacturing Center (NEMTC) has established a "Quality Systems Resource Facility (QSRF)" at its headquarters on the campus of Rensselaer Polytechnic Institute in Troy, New York. This pilot program for assisting small to medium sized businesses through the ISO 9000 registration process has been highly successful and it is anticipated that the program at NEMTC will be used as a benchmark that will be extended to the other Manufacturing Technology Centers throughout the country.

The program consists of a complete series of seminars, workshops and training modules that are intended to give the small to medium manufacturer a logical and coherent step-be-step plan toward registration of a quality system to the ISO 9000 series of standards. The program consists of ten sessions spread out over 12 months duration that will assist small manufacturers as they go through the process of preparing for the third-party registration audit.

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[1] "The Manufacturing Technology Centers Program, A Sampling of Individual Case Histories", NIST Special Publication 830, February 1992.

3.4.2 Small Business Administration Programs

Discussion with a senior SBA official indicated that the SBA is looking into the impact of ISO 9000 series on U.S. small business enterprises (see section 3.2.2 above). This official also stated that it would not be likely that, over the next year or so, the SBA would introduce a new, or utilize any existing, grant/award program for assisting small businesses to adapt to ISO 9000 standards. Support through business development centers and loans would be more likely, but the SBA is still in the "thinking" stage in this matter. In addition, this official did not consider that the popular Small Business Innovation Research Program (SBIR) would be a vehicle for assisting companies to conform with ISO 9000 standards series.

A potential program which could be used in the U.S. to help small business adjust to ISO 9000 standards is the Small Business Development Center (SBDC) program. The SBDC is a partnership between Federal, state, and local governments and institutions of higher learning to provide business management and technical assistance to the country's small businesses. Funding is cost-shared with non-Federal funds of at least 50 percent (usually from state and local governments and institutions).

There are now 57 small business development centers -- one or more in 50 states, the District of Columbia, Puerto Rico and the Virgin Islands -- with a network of more than 700 service locations. These offices -- located at universities, local government economic development offices or chambers of commerce -- provide management and technical assistance through training, business counseling, market research, business planning, and procurement process assistance.

Specific Small Business Administration programs such as the Procurement Assistance to Small Business may be accessed through SBDC offices.

The SBA runs various loan programs which potentially could be tapped by a small business for the purpose of financing the implementation of a quality system. These programs include: the Small Loan Program (loans of up to $US 50,000), the Microloan Program (loans of up to $US 25,000), and the 7(a) General Loan Program (which represents 90 percent of the agency's total loan effort, and involves guarantees of up to 90 percent of loan amounts provided by commercial lenders).

3.4.3 ARPA and DoD Programs

ARPA is a separately organized agency within DoD, and by DoD standards it is a small agency. It received just $1.6 billion of the military's $38 billion in research, development, test, and evaluation funding in 1992. Yet its charter is broad, allowing it to contribute to many fields with potential military application. [1]

Though receiving only a small percentage of DoD's R&D budget, ARPA has funded many technologies throughout its 35-year history that have both satisfied defense requirements and enjoyed great commercial success.[2]

Other DoD programs include financing for Nuclear Weapons Laboratories, Dept. of Energy Laboratories, Dept. of Defense Laboratories, Defense Technical Information Centers, Defense Advanced Manufacturing Technology Partnerships, Defense Manufacturing Extension Program, Defense Manufacturing Engineering Education Program, Small Business Innovation Research (Dept. of Defense) Program, etc.

According to a senior procurement officer at DoD, none of the ARPA or other DoD programs are designed or likely to be used for assistance to suppliers so that they could develop their quality systems. DoD has operated in the past on the basis of "supplier responsibility" for quality assurance, including compliance with product standards and quality systems standards. DoD carries out its own (second-party) audits of suppliers, and according to the DoD official, will continue to do so for critical products and services, even when (and if) ISO 9000 standards become more widely used for military procurement.

3.4.4 EDA Funded Trade Adjustment Assistance Centers (TAACs)

The Economic Development Administration (EDA) of the Department of Commerce operates twelve regional Trade Adjustment Assistance Centers located across the United States. These centers help companies that have experienced declines in sales and employment, due at least in part to increasing imports of competitive products. These centers can provide financial assistance to companies, including assisting companies with costs associated with ISO 9000 registration.

3.5 State Support Programs

According to a NIST official, heading the ISO 9000 working group of the Interagency Committee on Standards Policy, some state trade assistance and economic development authorities, alone or in conjunction with local colleges and universities have apparently begun providing training or offer other assistance, to support firms to achieve compliance with standards such as Q90 and ISO 9000. Some of the relevant programs, in selected states, that provide assistance to small businesses, to

[1] Defense Conversion: Redirecting R&D, Office of Technology Assessment, Congress of the United States, May 1993.

[2] Ibid.

help them expand their procurement opportunities and to help them handle requirements such as federal, state and international specifications and standards, are described below.

3.5.1 California:

Within the California Department of Commerce, the **Office of Small Business** (OSB) provides the following services to small businesses: advocacy, seminars, general information, management and technical counseling and loan programs. The OSB helps small businesses deal with regulatory agencies, provides guidance on licence requirements, and acts as a link to the resources needed to solve business problems.

The **Small Business Section** of the **Office of Small and Minority Business** assists state agencies in identifying resources, establishing goals and policies, disseminating information and providing liaison services with small businesses. Among its activities it engages in outreach programs such as small business conferences and seminars.

The **Business and Industrial Development Corporations** (BIDCOs) in California provide financial assistance (in the form of loans) to California firms in cooperation with the U.S. Small Business Administration, pursuant to section 7(a) of the federal Small Business Act.

Small Business Development Centers (SBDCs) provide in-depth counseling and technical assistance in the areas of business planning and management, financing, and marketing to existing and prospective small business owners. Other services include workshops and conferences for existing and new businesses as well as information dissemination. There are 20 SBDCs located throughout the state.

Other support to small businesses operating in California is provided by the Department of Commerce through the **Office of Local Development**, the **Office of Business Development** and the **Office of Economic Research.** Each of these offices promote economic development as an ongoing function. As part of their activities, they prepare seminars, disseminate information and distribute handbooks and educational materials on a variety of pertinent topics.

3.5.2 Massachusetts:

The office of the **Small Business Purchasing Program** compiles and maintains a bidder's list of small businesses, makes recommendations for simplification of procurement specifications and terms, and encourages certified firms to participate in other state economic development programs. To be eligible to participate in this program, companies must be independently owned and operated, have

Massachusetts as their principal place of business, and meet certain industry size standards.

The **Office of International Trade and Investment**, located in the Executive Office of Economic Affairs, oversees the state's international trade activities. The office provides corporate counseling and maintains an organized trade commission.

The **Massachusetts Small Business Development Centers** (MSBDCs) provide a high quality program of one-to-one management and technical assistance counseling and educational programs by effectively combining the resources of government, education and the private sector. The centers provide free counseling on topics such as business plan development, international trade, marketing, human resources issues, and financial management.

The MSBDC's **Manufacturers Assistance Program** provides small manufacturers with technical assistance in production, quality control, new technology, plan layout, and cost control. The program also conducts training programs for manufacturers.

3.5.3 Michigan:

The **Michigan Department of Commerce** provides a variety of services to small firms through its Business Ombudsman Office, Technical Business Services Bureau, and various other programs.

The **Michigan Small Business Development Center** (MI-SBDC) is a network of counseling and service centers that provides practical management and technical assistance to small business owners and prospective entrepreneurs. Counseling is provided for free and a variety of educational packages are offered for a nominal fee. The program is a partnership between the U.S. Small Business Administration and Wayne State University. Several of the SBDC centers are jointly funded by the Michigan Department of Commerce and the Small Business Development Center Program. There are 50 of these centers scattered around the state.

The **Michigan Energy and Resource Research Association Small Business Development Center** provides executive business counseling services to Michigan's small technology-based R&D firms, sponsors conferences and workshops, and serves as an official secondary distribution and matching center in Michigan for the federal **Small Business Innovation Research** program.

Among the responsibilities of the **Michigan International Office** (MIO) are promoting the export of the goods and services of small and medium-sized Michigan enterprises in world markets; encouraging investment by foreign firms in Michigan and assisting Michigan firms as they seek joint venture opportunities abroad; and performing as an international liaison for the state.

3.5.4 <u>New York:</u>

The **Division for Small Business** of the **New York Department of Economic Development** is responsible for developing programs, providing services, and undertaking other initiatives that are responsive to the special needs of the state's small businesses.

The **Procurement Assistance Program** helps businesses obtain contracts and subcontracts from federal and state agencies, departments, and authorities, and from prime contractors in the private sector. The program assists the state's small businesses in obtaining a larger share of the billions of dollars that government agencies spend annually on goods and services.

The Procurement Assistance Program offers training seminars, workshops, and trade shows to help companies get on bidders' lists, receive bid packages, understand qualifications, and complete bid documents. Through the program specialists also help New York's small businesses locate subcontracting opportunities with large firms that provide goods and services to government.

The purpose of the **Training and Technical Assistance Program** of the Division of Small Business is to provide small businesses with training on a variety of topics of interest and value to them. Workshops and training sessions cover such topics as federal and state procurement opportunities, export and investment opportunities, state tax policy and investment incentives.

3.5.5 <u>Pennsylvania:</u>

The **Bureau of International Development** offers specific assistance to Pennsylvania companies seeking the latest information on potential foreign markets for their products. The office also provides regional economic development organizations and companies with general assistance regarding all facets of international trade.

Small Business Development Centers (SBDCs) provide practical management and technical assistance to present and prospective small business owners. They offer courses, seminars, and one-on-one counseling as well as access to information on marketing, managing, and financing a small business. SBDCs are partially funded by the U.S. Small Business Administration, and are usually affiliated with a state college or university. There are 14 subcenters located throughout the state. A lead SBDC is located in Philadelphia, at the Wharton School of the University of Pennsylvania.

The **Ben Franklin Partnership (BFP)** programs promote advanced technology in an effort to make traditional industry more competitive in the international marketplace and to spin off new small businesses on the leading edge of technological innovation.

The BFP's four **Advanced Technology Centers** represent consortia of private sector, labour, research universities and other higher education institutions, and economic development groups. Each center provides: joint applied research and development work with the private sector; education and training in technical and other areas to assist firm start-ups and expansion; and entrepreneurial assistance services.

3.6 Summing Up

There is some activity in Washington D.C. focused on studying the options for implementing ISO 9000 for procurement requirements. The DoD, although having formally adopted the standard, is moving cautiously through a transition period to allow contractors to adjust smoothly from existing military standards to the use of the ISO 9000 series. The standards are being encouraged but registration to ISO 9000 series is not being required.

The U.S. federal government, unlike other countries (mainly within the European Community), has many players acting independently to implement policy on ISO 9000 standards (with no consolidated government strategy), and many are looking into the usefulness of the ISO 9000 standards within the context of their regulatory and procurement programs.

At this point, in the U.S., there are no active financial assistance programs (awards/grants) which directly aid small businesses to adjust to ISO 9000 standards requirements. There are, however, various actual (and potential) support programs which provide (or could provide) counseling, information and training for this purpose. For example, one of the Manufacturing Technology Centers (of NIST's MTC program) has developed a package (workshops, seminars, training modules) and established a Quality Systems Resource Facility to assist small manufacturing firms with becoming registered to ISO 9000 standards. It is anticipated that this package will be used as a benchmark that will be extended to the other MTC's throughout the country.

In the U.S. an increasing number of companies are seeking quality system registration to one of the ISO 9000 or Q90 standards. The number of ISO 9000 registered company sites in the Summer 1992 *Register Company Directory* published by CEEM were over 400, and by December 21, 1992 this figure had risen to 621 (unofficial records of CEEM).

Officials at SBA and DoD have informed us that an award or grant program to assist small businesses towards ISO 9000 registration is not likely at either of these departments, respectively. Loan programs could potentially be tapped for this purpose, and training, consulting, and information dissemination activities and services could be part of a support mechanism for small enterprises. There is also the possibility of including quality system upgrading as a negotiable part of contracts, as an expense component.

In addition to federal government initiatives, some state trade assistance/ development authorities, alone or in conjunction with local colleges and universities have apparently begun providing training or offer other assistance, to support firms to achieve compliance with standards such as Q90 and ISO 9000.

4.0 PACIFIC RIM

4.1 Japan

The Standardization Division of the Ministry for Industrial Science and Technology, Ministry of International Trade and Industry (AIST/MITI), has advised[1] that Japanese government procurement represents only a "small portion" of the overall economic activities in Japan, and, as such, its influence on standards setting is minimal. There are no specific government policies for encouraging adoption of quality systems standards such as ISO 9000 series.

The setting of standards is done through a consensus building process, coordinated by the Japanese Industrial Standards Committee (JISC). It is not the practice in Japan for government to unilaterally impose a standard on industry. On industry's side, the view is that once a standard has been set, and by definition agreed to by industry, there is no need for government to stimulate acceptance or application of the standard through its procurement activities.

JISC is working to make the Japanese Industrial Standards, where appropriate, compatible with ISO standards. About 300 Japanese firms have received ISO 9000 designation. Essentially all of these 300 companies are exporting to Europe, therefore obtaining the ISO 9000 designation is essential for them.

However, the Japanese government, in its procurement activities, uses Japanese industrial standards, and apparently will continue to do so -- since they believe them to be higher than the ISO 9000 series.

Regarding support programs to encourage SMEs to meet Japan's own quality standards, there does not appear to be any programs specifically intended for this purpose.

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[1] This information was supplied by Canada's S&T counselor in Tokyo.

The Japanese do, however, operate "networks" of research and technology centers across Japan (approximately 180), which assist SMEs to develop and adopt new technology. These centers, called "kohsetsushi", provide product testing services, product development research and training programs. These activities, by their nature, assist companies to improve their quality and help them adjust to meet required standards, whether these be national or international standards.

4.2 Australia and New Zealand

4.2.1 Procurement Policy and Standards

The Australian and New Zealand governments are currently involved in a Closer Economic Relationship (CER) arrangement (which is somewhat akin to FTA between Canada and the United States). Under CER, various mutual recognition agreements and product standard harmonizations are being negotiated.

In the area of standards, the two countries have already established, by treaty, the Joint Accreditation System of Australia and New Zealand (JAS-ANZ). JAS-ANZ accredits second and third party certification bodies which provide conformity certification systems based on internationally recognized standards. JAS-ANZ has initially been concentrating on conformity certification of quality systems by accrediting organizations conducting certification and attendant auditor training and registration. JAS-ANZ will be expanded to include product certification, personnel certification and testing/laboratory accreditation systems.

The accredited certification bodies assess suppliers' quality systems against the requirements of ISO 9000 series, known as AS 3900-1987 (Australia) and NZS 9000-1990 (New Zealand). European standards bodies are working to establish a single system based on mutual recognition of accreditation bodies. JAS-ANZ is working to achieve mutual recognition with these and other national/regional bodies around the world.

The Australian federal government's policy on quality assurance (including assessment of conformance to quality system standards) is based on the Australian Standard AS 3900 standards series. These are identical to the New Zealand NZS 9000 series and the ISO 9000 series.

Both Australia and New Zealand have adopted these standards in their procurement policies for quality assurance, both for regular supplies and services and for military purchasing.

In its policy statement regarding quality, the Australian government notes that government purchasers will seek quality assurance, in general, when:

- performance or outcome is important; and
- there will be a net benefit to the Commonwealth.[1]

Government buyers will decide which goods and services should conform with ISO 9000 series by considering:

- the consequences of failure and/or non-compliance with specifications or expected performance;

- the risk to health and safety and/or property due to failure and/or non-compliance;

- the performance history of particular categories of goods and services; and

- the objectives of other Commonwealth policies.

Individual departments and agencies of government may decide not to require quality conformance for their purchases. However, even if suppliers are not required to conform, the government encourages companies to obtain certification to maintain or improve their competitiveness. If they are to seek quality assurance, they are encouraged to seek assessment and certification of: their product and the quality system. Even if they have their product(s) assessed against an existing product standard, the auditor will also assess the company's quality system in whole or in part.

Whenever government buyers have identified the need for quality assurance requirements, it is specified in each request for offers. These requirements apply equally to Australian, New Zealand and foreign suppliers. Buyers can ascertain who is quality assured by consulting registers provided by the Joint Accreditation System of Australia and New Zealand..

Generally, the Australian government policy requires that:

- Commonwealth agencies identify goods and services for which they require Quality Assurance, and

- suppliers of those selected goods and services to be able to demonstrate that

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1 "Quality Assurance for suppliers, a quick quide to the Commonwealth's Quality Assurance Policy", Australian government publication, 1993.

they have been assessed as meeting the relevant product or quality system standard.

These requirements apply from July 1, 1993 for goods and related services, and from January 1, 1994 for services in general.

4.2.2 Quality Support Programs

The Australian federal government provides support to firms in adopting quality requirements through the National Industry Extension Service program. The NIES is a joint Australian Commonwealth/State venture offering advisory and referral services and subsidy assistance to small and medium sized firms in the manufacturing industry to improve business efficiency and international competitiveness. About $A 5 million was spent by the Commonwealth under the NIES in 1990-91 and a further $A 10.5 million was paid to the States and Territories as their component of the NIES. The NIES was extended in 1991, as a government industry service, to June 30, 1995.

The NIES has developed packages of quality enhancement programs which, through the use of licensed quality consultants and workshops, NIES products can help businesses to understand the steps necessary to adopt quality management principles and maintain international competitiveness.

The Australian Vendor Qualification Scheme (VQS) assists firms in the information industry to gain international standards accreditation necessary to become globally competitive. Assistance for developing conformance to ISO standards (such as ISO 9000 series) appears to be within the mandate of this program. The VQS is administered through the existing NIES program infrastructure. Expenditures on this program were about $A 1.3 million in 1990-91.

Three years ago an Australian Quality Council was established as a prime focus for the encouragement and development of quality within Australian companies. Those companies which achieve excellence in the area of quality receive recognition for their achievements and an opportunity to be a role model for other companies aspiring to excellence. Through the Australian Quality Council, a range of awards recognize quality achievements by Australian companies.

In New Zealand the government's business development policy is generally aimed at assisting regions to identify and capitalize on their own opportunities for development. As part of this policy the Government provides targeted assistance through its Business Development Program, Ministry of Commerce. The objective of the Business Development Program is to encourage New Zealand businesses to become more innovative and internationally competitive. Currently the program comprises a network of 21 Business Development Boards, three grant schemes, and the ExcelleNZ quality products program.

One of the major responsibilities of the Business Development Boards is to administer the Business Development Program Grant schemes. The Expert Assistance Grant Scheme provides up to $NZ 8,000 for firms to engage consultants in key management areas where better performance will lead to sustainable improvements in efficiency and competitiveness. For the year ended June 1992, 238 grants worth $NZ 1.2 million were approved. This scheme is potentially a source for support to SMEs for assistance to implement quality systems.

The Enterprise Growth Development Scheme provides up to $NZ 20,000 in a variety of areas to help firms improve their level of competitiveness by becoming more efficient and effective. During the year ended June 1992, 598 grants worth $NZ 2.4 million were approved. This scheme is also potentially a source for support to SMEs for assistance to implement quality systems.

Both the above schemes require participants to meet half the eligible costs themselves.

The Ministry of Commerce, under the brand name "ExcelleNZ", delivers a package of quality enhancement programs licensed from the Australian National Industry Extension Service. ExcelleNZ incorporates Total Quality Management and world competitive manufacturing practices. Through the use of licensed quality consultants and workshops ExcelleNZ products helps businesses adopt quality management principles.

4.3 Summing Up

Both Australia and New Zealand have adopted ISO 9000 series as their national quality standards for business and for government procurement purposes (including military purchasing). The two countries have established, by treaty, a Joint Accreditation System.

Government departments decide which purchases will require ISO 9000 compliance. Whenever a government buyer has identified the need for compliance this is specified in the request for proposals.

A number of support mechanisms are in place both in Australia and New Zealand, for aiding SMEs to adjust to the national adoption of international standards such as ISO 9000 series. Both countries, respectively, appear to have adopted a strategic approach towards standards and recognize their significant role and impact on international competitiveness of their national industries.

5.0 CANADA

With respect to implementing ISO 9000 standards, Canada is currently in a development and transition phase. The federal government departments most actively involved in pursuing ISO 9000 series implementation are: Government Services Canada (GSC), formerly Supply and Services Canada; Industry and Science Canada (ISC), formerly Industry, Science and Technology; and the Department of National Defence (DND).

5.1 Federal Government Initiatives

5.1.1 Procurement Policies

In conjunction with the Department of National Defence and Industry and Science Canada, the Government Services is phasing in ISO 9000 standards over the next few years. Business sectors such as microcomputers that already have experience with ISO 9000 standards have been targeted first. Including ISO 9000 quality standards as a requirement in microcomputer procurement is already in place within GSC.[1] Before the end of the year, GSC is expected to implement ISO 9000 standards as part of its procurement requirements for other products and services -- compliance to the standards may begin for business furniture, aerospace, clothing and textiles procurement, with selected other sectors to follow.

Last year, GSC and ISC were involved in a pilot project that required specific supplier groups to comply with the ISO 9000 standards. This pilot project was conducted in conjunction with the Canadian Manufacturers Association. Over the course of the project, 105 companies were assessed to the ISO 9000 standard, and 12 of these companies were assisted to complete implementation of the ISO 9001 or 9002.[2]

DND has already started to phase in ISO 9000 series for procurement purposes. The seventy or so major military suppliers of DND already meet many of the ISO 9000 standards requirements under the Allied Quality Assurance Publications (AQAP) series. These companies are now being encouraged to start adopting ISO 9000 standards as a basis for quality assurance.

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[1] A recent review of the impact of imposing ISO 9000 standards on microcomputer procurement concluded that the federal government's policy is "a significant and useful step in encouraging and stimulating technological development and overall capability in the relevant Canadian industry." See Federal Microcomputer Procurement, NGL Nordicity Group Ltd.,; prepared for ISTC, March 31, 1993.

[2] "Notes for an Address by Mr. John Banigan, Capital Goods and Service Industries, ISTC" to ISO 9000 Seminar sponsored by the Aerospace Industries Association of Canada and Canadian General Standards Board, Ottawa, April 21, 1993.

5.1.2 Department of Defence

On February 12, 1993, the Director General of Quality Assurance (DGQA), DND, announced that the Department will adopt ISO 9000 series standards for procurement purposes.[1] One of the underlying reasons for this transition is that NATO has moved to rewrite its AQAPs standards, to harmonize them with the commercially accepted ISO standards. NATO has now developed the new "Century series" of AQAPs numbered 110 (requirements for design, development and production); 120 (requirements for production); 130 (requirements for inspection); 131 (requirements for final inspection); and 150 (requirements for software development). These standards essentially embody the complete set of ISO 9000 standards. AQAP 110 contains all the requirements of ISO 9001; AQAP 120 contains all the requirements of ISO 9002; and AQAP 130 contains all the requirements of ISO 9003.

DND has opted to adopt the ISO 9000 series as their main quality requirements, to provide a single standard for both contract quality requirements and registration of quality systems. The focus on a single standard, plus the international acceptance of ISO as the recognized commercial standard, is expected to enhance Canadian contractors' quality programs and their competitiveness in the world market.

Implementation of ISO 9000 started at DND as of May 1, 1993. The Department, at this point in time, however, is not requiring its suppliers to be registered for ISO 9000. To ensure a positive transition, the Department is undergoing an extensive awareness and training campaign. Training of personnel, in field offices and at headquarters, has been taking place over the past several months. Information briefings to industry, other DND staff and other government departments is ongoing.

A senior official at DGQA informed us that, unlike GSC, DND is not phasing in ISO 9000 series on a sector by sector basis. Contracts with DND have always had quality system requirements. Thus the transition to ISO 9000 standards basically means, for DND, a conversion from the previous standards that were in place to the new. This involves training of staff and briefing suppliers as to the changes and the requirements for conformance.

Third-party registration has not as yet been introduced as a requirement for DND procurement purposes. The Department has been conducting its own quality assurance audits for many years, and it will continue to do so for the foreseeable

1 "New Quality Assurance Standards for DND Procurement", memorandum from G.J. Hunter, Director General Quality Assurance, National Defence Headquarters, February 12, 1993.

future. DND auditors have been trained to carry out assessments based on the ISO 9000 standards. The practice of carrying out second-party audits will continue during the implementation of ISO 9000.[1] As appropriate, contract reviews will also be carried out as part of the audit process.

For a number of years DND has managed a "Recognition Program" of contractors quality systems based on AQAPs standards. The program was voluntary for contractors but the aim was to encourage industry to develop their own formal quality systems. Over 70 contractors were registered to AQAP standards. This program was phased out when ISO 9000 standards were adopted by DND, and when the Standards Council of Canada introduced its accreditation program for quality system registration to ISO 9000 series.

From DND's point of view, registration is still considered voluntary, but they will continue to assess if compliance is being achieved on a contract-by-contract basis. The level and scope of these assessments will depend on the assessed risk.

However, according to W. Doering, Director Quality Assurance Operations, DND,

> "It should be emphasized that although the program is voluntary we will be encouraging contractors to register their quality systems with an SCC accredited firm. We will also be advising [firms] to encourage [their] sub-contractors to get their quality systems registered. To remember is that registration of [firms'] quality systems is a confidence indicator for us. When conducting our risk assessment on contractors we would obviously have more confidence in a contractor with a registered system than one that does not."[2]

5.1.3 Supplier Quality Initiative (GSC and ISC)

GSC and ISC are promoting ISO 9000 because it will allow Canadian firms to be competitive in world markets, including the European Community and the Pacific Rim -- regions where compliance with ISO 9000 standards is fast becoming an advantage for doing business. Accordingly, these two departments have launched the **Supplier Quality Initiative** (SQI) that is working with suppliers and federal government departments to make ISO 9000 standards a part of Canadian business.

This initiative seeks to make the federal government itself a demanding customer.

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[1] According to a senior official at DGQA, the requirement of registration and third-party auditing for DND procurement is being discussed, but is not likely to be introduced during the transition period.

[2] "ISO 9000 -- The Defence Perspective", presented by Mr. W.E. Doering to ISO 9000 Seminar sponsored by Aerospace Industries Association of Canada and Canadian General Standards Board, Ottawa, April 21, 1993.

An industry consultation group with representatives from ISC, GSC, and other major buying departments, industry organizations, and quality practitioners are helping shape the terms of the new procurement initiative.

The SQI also involves the preparation of supplier and consultant training packages, to help the adjustment process towards conformance with ISO 9000 standards. Some packages have already been developed in this context.[1]

Detailed consultations with key stakeholders is ongoing. This includes: industry representatives and associations, sector branches, regional offices, other government departments (such as DND and Treasury Board), and accredited registering bodies (e.g., QMI and CGSB).

GSC and ISC are working with suppliers and federal government departments to reach the new quality goals through a "partnership" arrangement. Advisory committees for each industry sector will help phase in the new requirements. The advisory committees include interested suppliers, GSC buyers, ISC representatives, other federal department representatives and industry associations.

These advisory committees will "decide which of the three ISO 9000 models apply to their sectors. They'll look at what tools industry needs to upgrade to the standards and set the timeframes for registration."[2]

The advisory committees will continue to advise GSC and ISC on industry needs after the standards are in place.

The Supplier Quality Initiative is being managed by the Centre for Supplier Promotion of GSC and the Services to Business Branch of ISC.

5.2 Support Mechanisms

There are several Canadian federal and provincial support programs in place, that lend themselves to the support of SMEs to adjust to quality systems standards. The following is an illustrative description of some of these programs. In some cases, the programs have actually been used to help SMEs with quality systems and management practices, and the other programs could be tapped for this purpose.

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[1] See, for example, ISO 9000: Making Quality Happen, by Devon Hunter Consulting, May 1993, Issue 2.

[2] "Your ticket to world-class quality", outline on Supplier Quality Initiative, Supply and Services Canada and Industry, Science and Technology Canada, Ottawa, June 1993.

Technology Outreach Program (TOP): This program provides start-up and sustaining support for technology centres to improve the productivity and competitiveness of Canadian industry. Through this program funds have been made available to support the formation of a **National Quality Institute** (NQI). The NQI is a national reference resource for quality issues and services. Its objective is to develop and implement a strategy for "total quality" commitment in Canada and to coordinate the delivery of services through the creation of a network of organizations.

The activities of the NQI are integrated with the activities of the **Canadian Network for Total Quality** (CNTQ), whose membership share the same mission. The NQI/CNTQ mission is to contribute to the economic and social well-being of Canada by promoting and facilitating the use of total quality principles and practices throughout Canada.[1]

There is a joint NQI/CNTQ intent that organizations with similar goals, who provide complementary services, will be encouraged to join the network and the NQI. The founding members of the CNTQ are: Canadian Manufacturers Association; Canadian Trucking Association; Collège Edouard-Montpetit; Conference Board of Canada; Bureau for Excellence in Durham Region; Institute of Quality Assessment; The Manufacturing Technology Centre Inc. of New Brunswick; Quality Council of Alberta; and Winnipeg Quality Network. The Association Québécoise de la Qualité, British Columbia Institute of Technology and Institute of Market Driven Quality are also members.

Activities of the NQI/CNTQ include: providing training services, courses for industry, workshops on specific quality topics, as well as training for quality practitioners. The NQI is to develop a national policy on quality, liaise with international organizations on quality issues, and manage the national awards program: Canada Awards for Business Excellence Program (CABE).[2]

Advanced Manufacturing Technology Application Program (AMTAP): AMTAP, an Industry and Science Canada program, has undergone some restructuring recently. The components of this program related to technology diffusion are being transferred to the National Research Council. The status of the remaining components of AMTAP is unclear at this point, but commitments of funding to existing projects will be maintained.

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[1] Funding for NQI/CNTQ is $19.3 million from the Technology Outreach Program and $14.7 million from the private sector.

[2] See announcement by Michael Wilson, Minister of Industry, Science and Technology and Minister for International Trade: "Wilson Announces Federal Government Support for Private Sector Initiative to Establish National Quality Network"; News Release, October 28, 1992, Ottawa.

The AMTAP program enhances the international competitiveness of Canadian industry by stimulating more effective use of new technologies and related management practices. AMTAP provides funding for qualified firms to engage outside consultants: to assess their overall production operations with respect to a long term strategy, identify areas for improvement, analyze costs and benefits of alternatives, and prepare an implementation plan; and to assist in the management of the implementation plan. AMTAP contributes up to 60 percent of the cost of consultants, not to exceed $15,000 for single applications. The maximum contribution for group applications is $200,000, not to exceed $15,000 per company.

Western Economic Diversification Canada (WD): In 1987, the government of Canada introduced the $1.2 billion WD program. It is an investment fund designed to broaden and strengthen the economic base of Western Canada. The essential requirements which determine the acceptability of proposal under the Program are the contribution that a project would make to the diversification of the economy. The key element of the program is flexibility.

One of the components of the WD program is the Quality Assurance Assistance Program. This program provides direct financial assistance for quality assurance implementation. WD originally provided assistance of up to 50 percent of direct costs for quality assurance initiatives which result in a recognized quality standard. As of May 1993, under new guidelines due to Federal government budgetary cuts, the program provides funding on a one to three ratio basis.

Examples of quality standards related assistance by this program are as follows:

- Assistance of $80,095 to a Saskatchewan heavy equipment manufacturer for a $204,046 project to implement a quality assurance program to meet military and international commercial standards in order to expand market opportunities in defense procurement and commercial export markets.

- Assistance of $49,000 to an Alberta office furniture manufacturer for a $98,000 project to achieve the standards established by Supply and Services Canada for supplying computer office furniture to the federal government.

- Assistance of $99,740 to a B.C. electronics and communications equipment manufacturer for a $198,940 quality assurance program to meet military and commercial standards in Britain, the United States, and Europe. This project will enable the firm to access new export and military markets, as well as upgrade their existing operations to the changing requirements of existing customers.

Atlantic Canada Opportunities Agency (ACOA): Under the Atlantic Action Program component, ACOA provides financial support for projects that involve new products expansion and the establishment, modernization and expansion of businesses throughout the Atlantic provinces.

Financial support can include direct contributions, loan insurance, and interest buy-downs. Certain sectors have been targeted: aquaculture, business service industries, commercial research and development, manufacturing and process, mining and tourism. Assistance is available for seven main areas of activity: innovation; business studies; capital investment; procurement; marketing development; human resource development; and business related support requirements. The procurement segment of this program provides financial assistance to help Atlantic Canadian suppliers successfully compete for, or acquire, public procurement contracts or sub-contracts. Assistance to meet expenditures related to conformance with procurement standards such as ISO 9000 would be eligible under this program.

FedNor Business Incentive Program: The Federal Economic Development Initiative in Northern Ontario (FedNor) is aimed at encouraging economic growth and diversification, job creation and income generation by supporting initiatives of the private sector. One of the components of FedNor is directly related to improving quality management practices of firms.

Under the quality management assistance component, FedNor will contribute up to 50 percent (to a maximum of $100,000) towards the cost of a qualified consultant to analyze a firm's current production process and product quality and determine deficiencies, to help draft a quality assurance manual and to design a quality assurance training program for staff. Assistance is also available towards new quality control related equipment and the costs of registration of a firm or product certification. This component of the program was introduced because "international markets, as well as large industrial and institutional buyers generally require that their suppliers be certified or registered under a recognized quality management program."[1]

Federal Office of Regional Development -- Quebec (FORD-Q): The objective of this program is to promote economic development in Quebec while concentrating efforts on small and medium-sized enterprises and on the development and enhancement of entrepreneurial talent.

One of the components of this program is the Federal Procurement Assistance Program (FPAP). With a budget of $10 million, this program has been authorized for province-wide implementation. The purpose of this program is to assist Quebec businesses in meeting standards and requirements set down by the federal government and its agencies for potential contractors, so that they can participate

[1] See program promotional literature, "Quality, Technology and Management Development" section.

more fully in federal government contracts and take advantage of business opportunities provided by the federal government or its agencies, or by prime contractors retained by them.

The program is intended for existing businesses with annual sales of under $10 million. Eligible projects include consultant services (training, quality control manuals, production standards, laboratory tests, preparation of quality assurance plans, and licensing); adaptation of a product service; and purchase of specialized equipment necessary for quality control.

New Brunswick Quality Assurance Program: The New Brunswick Department of Commerce and Technology (Industrial Services Branch) has in place, a Quality Assurance Program set up to assist New Brunswick manufacturers, processors, and selected other firms, on the road to total quality.

Financial assistance under this initiative is available through the Quality Incentives Program (QIP), which will offset some of the direct costs associated with developing and implementing quality assurance. Costs associated with upgrading a firm's quality system, to comply with ISO 9000 requirements, are eligible.

Enterprise Newfoundland and Labrador Corporation: Several programs under this organization are available to SMEs. Under the Company Development Program, companies that export their goods or services are the main focus. As part of an appraisal and advice service, a company's strengths and weaknesses are analyzed, and advice on management, strategy, business planning, etc., is offered. In addition, up to 50 percent of the salary (or $30,000) costs of financial, management, marketing, and business planning personnel (or consulting services) may be paid, on a one- to two-year basis. Money may also be available for implementing information systems.

5.3 Summing Up

Canada has formally adopted the ISO 9000 series of quality standards for defense and other non-military government procurement. The Department of Government Services is committed to phasing in the standards over the next few years. ISO 9000 requirements for microcomputer purchases are already mandatory and application of the standards to business furniture and aerospace products are being targeted. Other products and services are also being considered for ISO 9000 conformance, for the purpose of procurement. The Supplier Quality Initiative (a joint GSC and ISC initiative) is promoting the proliferation of conformance to the standards, so that Canadian industry can have a competitive edge in markets around the world.

Canada has a selection of regional development programs which are appropriate for assistance to SMEs, to adapt to ISO 9000 standards. Other federal and provincial programs could be tapped for aid related to implementation of quality standards.

Exhibit 5-1 shows the number of Canadian firms registered to ISO 9000 standards. In addition to these firms, many more are now preparing themselves for registration and/or currently conform to all or to elements of these standards, but are not yet registered, or have not yet applied for registration.

As Exhibit 5-1 shows, several key manufacturing industries are involved in registration activities. Most of the firms are registered for ISO 9002 or ISO 9003. The more comprehensive standard, ISO 9001, accounts for 46 (12 percent) of the total 381 firms that are registered. Most of these are in the electronic and other electrical equipment (including computer and non-computer related) components.

Exhibit 5-1: Tabulation of ISO 9000 Companies in Canada

June 18, 1993

CODE	DESCRIPTION	ISO 9001	ISO 9002	ISO 9003	TOTAL
1000	Metal Mining	0	2	0	2
1200	Coal Mining	0	0	1	1
1300	Oil & Gas Extraction	0	0	4	4
1700	Construction - Special Trade Contractors	1	0	1	2
2000	Food & Kindred Products	0	0	1	1
2200	Textile Mill Products	0	2	0	2
2300	Apparel & Other Finished Products Made from Fabrics & Similar Material	1	0	3	4
2400	Lumber & Wood Products, Except Furniture	0	0	1	1
2600	Paper & Allied Products	3	4	17	24
2700	Printing, Publishing & Allied Products	0	0	1	1
2800	Chemicals & Allied Products	1	23	12	36
2900	Petroleum Refining and Related Industries	0	2	1	3
3000	Rubber & Miscellaneous Plastic Products	2	6	11	19
3200	Stone, Clay, Glass & Concrete Products	0	2	2	4
3300	Primary Metal Industries	1	7	18	26
3400	Fabricated Metal Products, Except Machinery & Transportation Equipment	1	14	43	58
3500	Industrial & Commercial Equipment & Computer Equipment	8	5	27	40
3600	Electronic & Other Electrical Equipment & Components, Except Computer Equipment	16	23	22	61
3700	Transportation Equipment	1	2	2	5
3800	Measuring, Analyzing, & Controlling Instruments, Photographic, Medical & Optical Goods; Watches & Clocks	3	2	3	8
3900	Miscellaneous Manufacturing Industries	2	3	4	9
4000	Railroad Transportation	0	0	6	6
4800	Communications	3	1	0	4
5000	Wholesale Trade - Durable Goods	2	2	35	39
5100	Wholesale Trade - Nondurable Goods	0	5	1	6
7300	Business Services	1	2	4	7
7600	Miscellaneous Repair Services	0	2	3	5
8700	Engineering, Accounting, Research, Management & Related Services	0	0	1	1
8900	Miscellaneous Services	0	0	2	2
	TOTALS	46	109	226	381

Source: Quality Systems Update, May 1993

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6.0 COMPARATIVE ANALYSIS

Exhibit 6-1 summarizes the ISO 9000 standards related activity that is underway in selected countries around the world. The United Kingdom has been the most active over the recent past in terms of registration of firms. However, all other countries shown, either have formally introduced ISO 9000 requirements in their procurement process, or have an industrial sector that is responsive to international standards requirements (e.g., ISO 9000). The tally of registered firms is likely to change significantly over the next few months, since the number of firms preparing for application are estimated to be numerous.

In addition, there are thousands of additional firms who already comply with existing national quality standards around the world. Many of these standards include significant conformance to (or exceed) ISO 9000 specifications.

All countries shown in Exhibit 6-1 have some form of program assistance in place (e.g., financing, training, counseling, or promotional activities). As the popularity and diffusion of the ISO 9000 series expands, we can expect to see governments being significantly more active in supporting their industrial base, particularly SMEs, to adjust to the realities of the new quality requirements.

Exhibit 6-1: Comparative Analysis of Countries: Policies and Programs

	PROCUREMENT POLICY RELATED TO QUALITY	SME SUPPORT PROGRAMS RELATED TO QUALITY (e.g., ISO 9000 series)	NUMBER OF FIRMS WITH ISO 9000 REGISTRATION (1)
EUROPE			
European Community	EC directives encourage use of ISO 9000 for procurement purposes.	Support for standards activities incorporated in R&D programs (e.g., RACE). Pilot program to aid 700 firms conform to ISO 9000.	25,000
United Kingdom	Mandatory requirements to conform to BS 5750 (ISO 9000) -- to qualify for defense procurement. Other departments also uphold BS 5750.	Major support program, Enterprise Initiative, for quality management assistance.	20,000
France	Standards linked to industrial strategy and to public procurement -- European standards take precedent.	Direct assistance program to assist SMEs with standards (Partenaires pour l'Europe) and research tax credits include standards related expenses.	1,100
Belgium	No clear policies, but firms are responsive to European standards requirements and EC directives.	Promotional programs to inform firms on adapting to European and international standards.	?
PACIFIC RIM			
Japan	Japanese industrial standards only used for government procurement. Companies conform to international standards primarily for trade purposes.	No specific programs, but "kohsetsushi" (networks/ centers for research and technology) aid SMEs adapt to new technology and standards.	300
Australia	Formally adopted ISO 9000 (AS-3900) in contract procurement (for military and civilian applications).	National Industry Extension Service provides advice and training packages/ workshops for quality enhancement of firms.	?
New Zealand	Formally adopted ISO 9000 (NZS-9000) in contract procurement (for military and civilian applications).	ExcelleNZ program provides quality enhancement packages (workshops/consulting), and Enterprise Growth Development Scheme provides assistance for SMEs to improve quality systems.	?
NORTH AMERICA			
Unites States	Formally adopted ISO 9000 for defense procurement -- subject to phasing in. Some activities underway for studying other procurement applications.	Many Federal and State programs could be tapped to assist SMEs adopt international standards. Manufacturing Technology Centers program is active in assisting companies with ISO 9000 standards.	621
Canada	Formally adopted ISO 9000 for defense and other non-military procurement -- subject to phasing in.	Federal regional development programs are suitable for assistance to SMEs to adapt to ISO 9000 series. TOP program funding for NQI. Other federal and provincial programs could be tapped for quality standards.	381

Note: (1) Respective country figures are approximations based on unofficial accounts, and reported at different points in time over the past 6 months. Many additional firms are in the process of applying for registration all over the world.

7.0 CONCLUSION

This study has demonstrated that ISO 9000 quality standards are now being adopted worldwide, by governments for procurement purposes and within the private sector. All countries described in this study recognize the significance of these standards for developing and maintaining the competitive position of their industrial sectors. Several government programs have been introduced in some countries which directly assist SMEs to adjust to the requirements of ISO 9000 series.

In Canada, the ISO 9000 series has been formally adopted by the Department of Defence and by Government Services Canada, for procurement purposes. However, opportunities for program assistance to encourage the actual adoption of quality standards, particularly by SMEs, with all the industrial competitiveness benefits that accrue as a result, have not been fully explored.

One program ideally suited for this purpose was the Advanced Manufacturing Technology Applications Program (AMTAP), of Industry and Science Canada. Parts of this program (involving technology diffusion activities) have been transferred to the National Research Council. A program such as AMTAP, or a similar initiative, could be used to complement the Supplier Quality Initiative of Industry and Science Canada and Government Services Canada.

2

Nordicity Group Ltd.
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AN EVALUATION OF THE MARKET/TECHNOLOGY INTELLIGENCE POTENTIAL OF JTC1

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TABLE OF CONTENTS

1.0 INTRODUCTION

A technical standard represents a consensus on the state of a technology at any given time. The "give-and-take" in the consensual development process can provide valuable market and technology intelligence. In technology-intensive fields, market and technology concerns tend to merge.

With globalization of the world economy there is a shift towards the development of international technical standards and the acceptance of these standards at the national level.[1] The International Organization for Standardization (ISO), the principal agency involved in supporting the development of consensual international standards, has experienced an increased work load in recent years. In the period from 1946, when the organization was founded, to 1982, ISO had published 4,917 standards, averaging 137/year. By 1992, 8,651 standards had been published, averaging 373/year in the 1982-1992 period.

International information technology standards have contributed significantly to the growth of international standards in recent years. ISO and its sister body the International Electrotechnical Commission (IEC) have established a Joint Technical Committee on information technology called JTC1. It is one of the 180 or so Technical Committees of ISO.

The purpose of this study was to provide an initial evaluation of the market/technology potential of the activities of JTC1. The focus is primarily on how standards-setting activities could provide intelligence on technology development in existing markets.

[1] The policy of the Standards Council of Canada is that international standards should be adopted in Canada when they are available.

2.0 THE DYNAMICS OF JTC1

2.1 The ISO Standards-Setting Process

The ISO standards-setting process is illustrated in Exhibit 2-1. Each of the 92 member countries in ISO are represented by an appropriate national body. For Canada, that body is the Standards Council of Canada (SCC) which accredits delegates to the various ISO activities.

New work items (NWI) are presented by "champions" to any of 180 Technical Committees (TCs) or 2500 Sub-Committees (SCs) or Working Groups (WGs). These are voted on by member countries and, if accepted, become part of the work program of an appropriate TC, possibly leading eventually to an international standard.

The work of the various TCs, SCs and WGs is one of continual adjustment of national positions on a Working Document (WD) until a consensus emerges around a Committee Draft (CD) document leading to a Draft International Standard (DIS) which is then sent to member countries for voting. If 75 per cent of the votes are in favour of the DIS, it is accepted for publication as an International Standard. This process of adjustment can provide valuable market/technology intelligence. Participants in ISO meetings are supported by national level committees which mirror the ISO committees.

Those who participate in this process find their involvement to be of value. For example, Joel Shaw of Advanced Information Technologies Corp. (AIT) of Ottawa, who chairs a WG on "Identification Cards - Machine readable documents", has stated publicly that his participation in this WG has given him intimate knowledge of technological developments and an early signal when a country was looking to make its passports machine readable.[2] A question which arises is, can this type of market/technology intelligence be made available to those who <u>do not</u> participate directly in the ISO process, such as the small and medium-sized enterprises (SMEs) that do not have the necessary resources?

In our study of technology diffusion and standards the limited involvement of SMEs in the standardization process was identified as an issue and the following recommendation was made:

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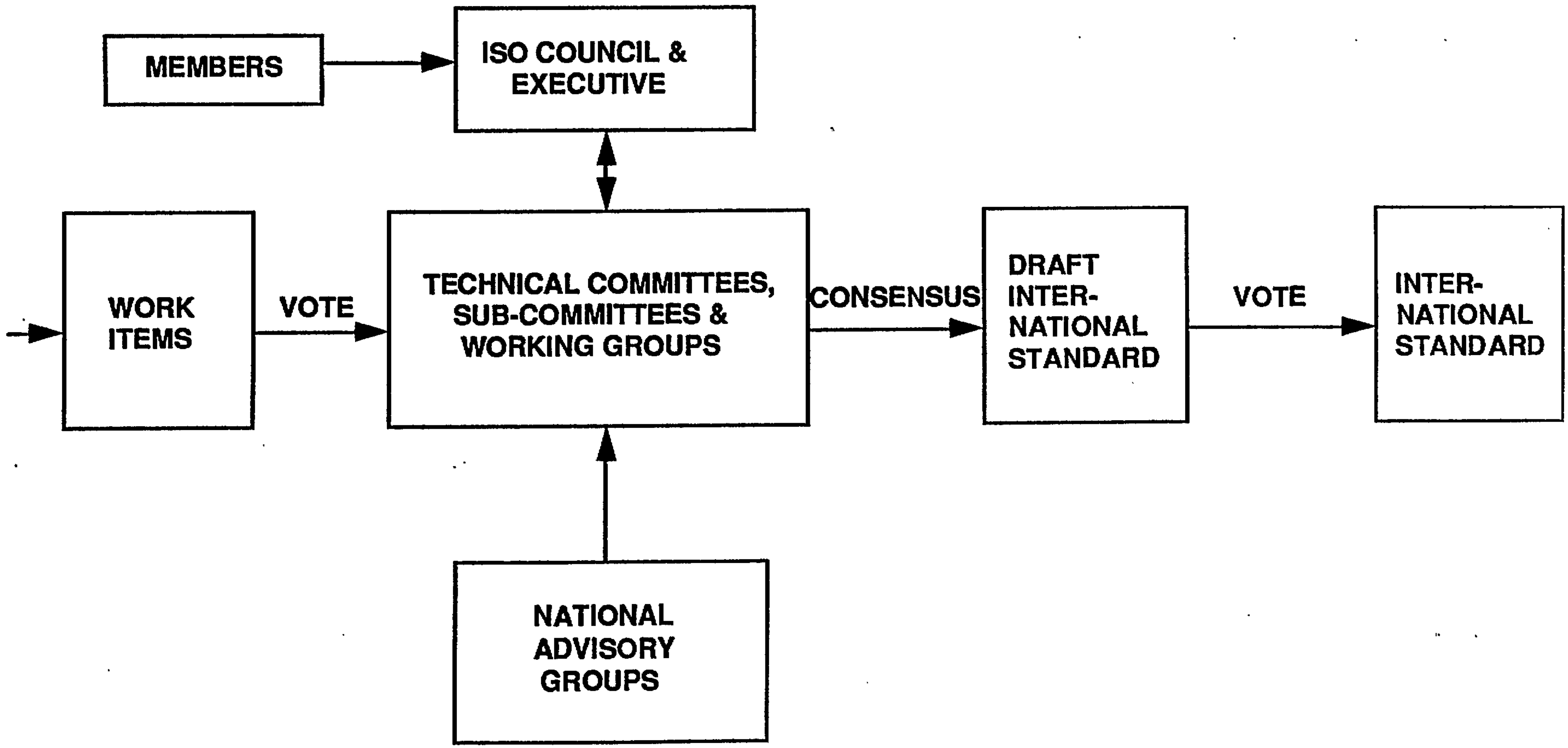
[2] Globe and Mail: Report on Business; May 17, 1993.

EXHIBIT 2-1; MARKET/TECHNOLOGY INTELLIGENCE AND STANDARDISATION

THE CONSENSUAL PROCESS OF STANDARDS DEVELOPMENT PROVIDES A VALUABLE SOURCE OF MARKET AND TECHNOLOGY INTELLIGENCE.

THE INTERNATIONAL ORGANIZATION FOR STANDARDISATION(ISO) PROCESS



> "Mechanisms to acquire, evaluate and disseminate sectoral and firm level standards intelligence (should) be identified and established in collaboration with various government departments and agencies".[3]

This issue was also identified in other federal government studies.[4] [5]

2.2 The JTC1 Structure

JTC1, which is mandated to develop international standards in information technology is made up of 18 SCs and 78 WGs. In Canada, some 437 people[6] participate in the activities of the Canadian Advisory Committee (CAC) to JTC1. The structure of JTC1 activities and the CAC are shown in Appendix 1.

Given the large number of SCs and WGs and the limited resources allocated for this study, two SCs were selected in concert with the client, Industry and Science Canada, for in-depth analysis:

- SC7 - Software Engineering; and
- SC29 - Coded Representation of Picture, Audio and Multimedia/Hypermedia.

Current documentation related to the activities of these two SCs was obtained from the SCC which is the repository for ISO documentation. Participants involved in the activities of these SCs and the work of JTC1 in general were also contacted. The names of the people contacted are listed in Appendix 2. Given the large volume of documentation related to the activities of these two SCs, one WG from each SC was selected for more detailed analysis. In the case of SC7, WG4 was selected. For SC29, WG11 was retained.

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3 NGL Nordicity Group Ltd., The Effects of Standards on Technology Diffusion: Deliverable No. 5, Final Report, September 1993.

4 Ho B. and J.D. Kelley; "Report of the Five Regional IT&T Seminars Organized by Communications Canada SPO and Regional Offices - June 1992; Department of Communications, August 4, 1992.

5 TECH TEAM Management Inc.; A Study of the Issues in Canadian Information Technology and Telecommunications Standards, prepared for Department of Communications, December 1992.

6 The breakdown by sector is 68% industry, 17% federal government, 12% university, 3% provincial governments and less than 1% municipal government.

3.0 ANALYSIS

3.1 Documentation

A content analysis was undertaken of documentation related to the activities of SC7 and SC29, especially WG4 and WG11 respectively.

3.1.1 New Work Items

New Work Items (NWIs) provide an "early warning" of technology trends and related issues as well as possible market implications. The introduction to these documents present the reasons why such a work item is important. As noted by one interviewee for this study, NWIs have strategic value because firms do not want to be "blind sided" by new technological developments. It becomes important to review the issues raised in a NWI and know who the proponents are. An NWI that is proposed for the development of a new standard has more market intelligence value than one that is aimed at the amendment of an existing standard.

Hundreds of NWIs are submitted every year to JTC1 committees. Even if they are voted on and accepted as part of the work program, about half are not developed into working documents for one reason or another, and come to be declared "null and void". But NWIs do, however, provide a sense of the relative importance that some "champions" attach to specific issues. The voting pattern of countries on NWIs provides a source of market intelligence, since voting reflects the intentions of a country vis-à-vis a specific technology.

Two examples of NWIs can be found in Appendices 3 and 4. The first is a U.S. proposal to WG4 of SC7 on the adoption and integration of CASE tools. As noted in the introduction to the document there is "discordance between expectations and reality" in the use of Computer-Aided Software Engineering (CASE) tools. The NWI recommends a practice that "will maximize the possibility of successful adoption" of CASE tools. Such a proposal should certainly be of interest to firms selling or purchasing CASE products in a worldwide market that was $4.8 billion (U.S.) in 1990 and expected to grow by 20% annually through 1995.

The other example (Appendix 4) is the NWI to WG11 of SC29 on Very-Low Bit rate Audio-Visual Coding. As noted in the document a large number of communication applications become possible if a solution is found to provide acceptable audio-visual-quality at very-low bit rates. Firms in these application areas (e.g. - remote sensing, interactive multimedia databases, video games, etc.) would surely be interested in following the development of this activity.

In sum, NWIs provide an "early warning" system of possible standardization activities that would affect technology development in specific market areas. This information can be of strategic importance to firms involved in product development in these areas.

3.1.2 Technical Documentation

As a work item becomes integrated into the work program, various Working Documents (WD), Committee Drafts (CD) and eventually related draft international standards (DIS) emerge. These are highly technical documents which unlike NWIs, are not easily understandable by the non-expert. To illustrate, the Table of Contents of such a document is presented in Appendix 5.

There was consensus among individuals interviewed for this study that, at this stage, interested parties have to participate in the activities of the Canadian Advisory Committee (CAC) and of ISO, to fully appreciate the market/technology implications of the changes made in various working document drafts and the positions of other countries that lead to a WD, CD or DIS. As one interviewee put in, these documents reveal the "nitty-gritty" of what is going on and what the market wants. Ways have to be found to interest firms, especially SMEs, that could be affected by standards development in their market area. Some of these means are discussed in later sections of this report.

One innovative approach used by P. Voldner, the Convener of WG4 of SC7 was to send his own newsletter on the activities of WG4 to about 1,000 people he felt should be informed. Raising awareness is the first step in getting people interested in issues that could affect them.

3.1.3 Minutes of Meetings and Trip Reports

Minutes of the meetings of the various SCs and WGs as well as the related Trip Reports from attendees at these meetings are of limited value because they centre more on the process of the meetings (e.g. - decisions, documents tabled, up-coming work items, etc.) than on the content of the meetings.

However, a careful scanning of Minutes and Trip Reports can reveal some bits of information having market intelligence value. For example in a Trip Report of SC7 WG10 (Dublin Jan 18-22, 1993) regarding the work item "Software Process Assessment - Improvement and Capability Evaluation" stated that "France indicated that the inclusion of capability evaluation in the standard to be a sensitive area and possibly damaging to the S/W business in France". This apparent weakness of French S/W firms could be of interest to firms interested in selling in that market. This statement could lead an aggressive S/W firm to pursue with the Canadian delegate to that meeting the implication of the statement made by the French delegate.

Another example, was the request made at the January, 1993, Meeting of WG11, as recorded in the resolutions of that meeting, that members comply with JTC1 policy by giving their companies' patent positions related to a standard under development by the following meeting. The firms complied and as can be seen from Appendix 6 there appears to be multiple patent claims which could affect the ability of firms to operate freely in the market area in question (i.e. - Moving Pictures and Associated Audio).

As can be seen, bits of market intelligence can be gleaned from the perusal of Minutes and Trip Reports.

3.1.4 Summing-Up

The market/technology intelligence value of JTC1 documentation is mixed and depends on whether or not an individual is outside or inside the standards setting community.

Outsiders could find value in scanning NWIs that have been approved to obtain a strategic perspective on technology trends and emerging issues. NWIs of specific interest could then be tracked to see how they are dealt with within the JTC1 system. Tracking can be done by scanning Minutes and Trip Reports related to SC and WG meetings. As noted above, these Minutes and Trip Reports are focussed principally on the process side of JTC1 activities and therefore lend themselves to tracking work items. From time to time they also contain some substantive information that is of market/technology intelligence value.

However, to get a more in-depth appreciation of the issues addressed as a work item is translated into a standard, direct participation in the activities of the Canadian Advisory Committee (CAC) and/or JTC1 SCs and WGs becomes necessary. The documentation and the various amendments at this stage, are too voluminous and, at times opaque, to be fully appreciated and understood by outsiders. A "fall-back" position for outsiders is to have access to the participants in JTC1 activities for briefings on subjects of interest.

4.0 MAKING JTC1 ACTIVITIES MORE TRANSPARENT

4.1 Dealing with Existing Information

The repository for JTC1 documents is the Standards Council of Canada (SCC), Canada's interface with the International Organization for Standardization (ISO). There are structural problems with the information; the documents are filed, as received, not chronologically and not all documents, Minutes, etc. are on file. After six months, the material is archived.

There are two projects currently in play proposing to develop electronic data bases for standards information. One originated under the auspices of the Telecommunications Standards Advisory Council of Canada (TSACC) and proposes to have International Telecommunications Union (ITU) and JTC1 information in the data base. The other originated under the auspices of the SCC and would contain information on all ISO Committees, possibly also including JTC1 information. The content of these databases is currently being determined. Discussions related to the former database, which is planned to be launched as a pilot activity in the spring of 1994, are more advanced.

The aim of both databases is to have, as a first step, basic information on JTC1 activities, that is synopses of working documents, Minutes, Agendas, etc. that could easily be queried electronically. Synopses of approved NWIs should also be included. A chronological ordering of documents would be a basic level of value-added service. Other value-added services could be added at some future time.

4.2 Value-added Services

The pressure to provide value-added services comes from firms, especially SMEs, that do not participate directly in standards-setting activities, but wish to obtain intelligence on standardization activities that could affect their products in specific markets. Meeting standards, a posteri, in the marketplace can adversely affect product development strategies and be very costly if products have to be modified.

As well as providing basic information through a user-friendly electronic system, a higher level of value-added service could include Trip Reports by Canadian delegates to various JTC1 committees that contain more discussion of substantive issues. Delegates could also be asked to debrief interested parties.

Canadian delegates to JTC1 committees participate on a voluntary basis so the question arises as to how much should be expected from these delegates. Through their participation, delegates do obtain market/technology intelligence that is of value to their firms. Since delegates are accredited to ISO by the SCC, the Council is in a position to extract some quid pro quo for this accreditation which is very beneficial to participants. For example, the SCC could request a more substantive Trip Report. Such a report could follow a prescribed format that would facilitate report writing and inputting into an electronic database.

Delegates could also be required, as a condition of accreditation, to be available for a debriefing session with interested parties. This could be done through a nation-wide conference call, for example.

An alternative, used by the Swedish and Norwegian national standards bodies for example, is to hire consultants to attend committee meetings and to prepare the reports.

4.3 Summing-Up

The challenge in providing meaningful market/technology intelligence to firms which do not participate directly in standards-setting activities is to put an information system in place which has value-added services as well as basic information that describe, chronologically, the progress of a NWI through the standardization process with an indication of issues encountered as a consensus on a standard is developed.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This pilot study has indicated that JTC1 activities have market/technology intelligence value. However, the extent to which value can be extracted is dependent on the ability to track specific JTC1 activities and documents and on active participation in JTC1 SCs and WGs or having access directly, or indirectly through trip reports, to individuals who do participate.

A first, relatively easy level of entry into the world of JTC1 is to track the evolution of approved New Work Items (NWIs) in the JTC1 system as they are translated into draft standards.

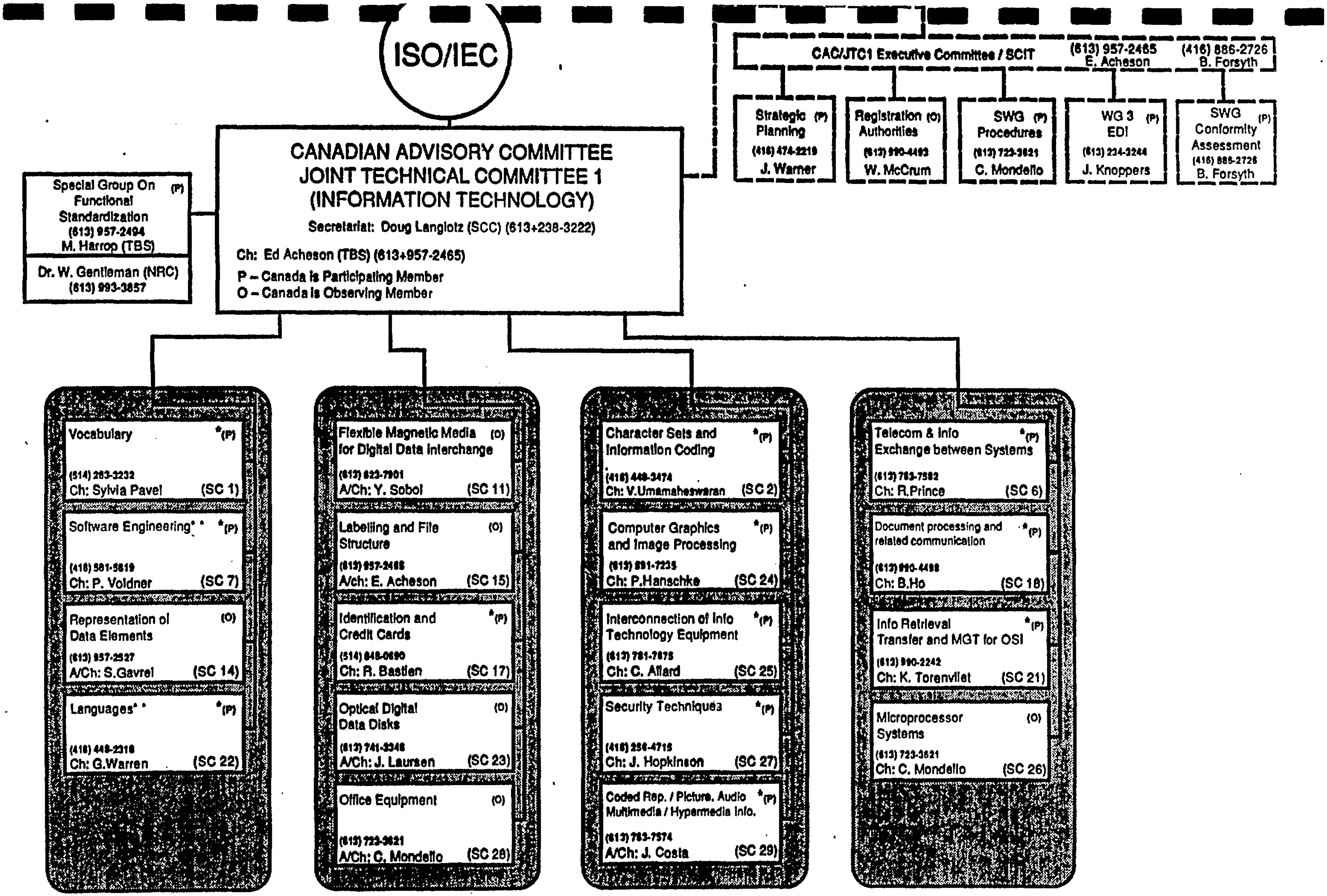
A second, and relatively more difficult, level of entry is to understand the issues related to the evolution of Working Documents (WDs), Committee Drafts (CDs) and Draft International Standards (DISs). The documents themselves provide very technical information which needs to be cast in a broader context if maximum market/technology intelligence is to be extracted. The participants involved in developing a consensus on these documents are the best venue to obtaining this intelligence.

It is recommended that a comprehensive market study be undertaken to determine the scope of the opportunity. Such a study would help to shape the content of the proposed electronic data bases and the pricing of services. It would also support the development of a business plan.

It is also recommended that SCC investigate the extent of the leverage that its accreditation of participants to JTC1 SCs and WGs has in extracting more substantive trip reports from these participants.

This approach to extracting market/technology intelligence from ISO activities should also be explored for other priority sectors.

APPENDIX 1
CANADIAN ADVISORY STRUCTURE TO JTC1



* – Canadians chair these international SCs or their Working Groups SCI – Hélène Cormier (613) 994-3508
SC7 – Joseph Côté (613) 957-2496

** – Canada Provides International Secretariat SC7 – François Coallier (514) 486-5523
SC22 – Dave Johnstone (613) 726-1006

February 18, 1993
097 1261(430)

1993-04-28

ORGANIZATIONAL STRUCTURE OF ISO/IEC JTC 1 SUB-COMMITTEES AND WORKING GROUPS

CAC = Canadian Advisory Committee
CH = Chairmen
A/CH = Acting Chairmen
SEC = Secretary
N = Not Participating
O = Observer
P = Participating

JTC1: - Information Technology - P
CAC CH - E.R. Acheson Ph: 613-957-2465 Fax: 613-957-8700
Secretariat: ANSI

Terms of Reference - Standardization in the field of information technology.

JTC1/WG 3: - Open Electronic Data Interchange
Secretariat: AFNOR

JTC1/SWG-P: - Procedures
Secretariat: ANSI

JTC1/SWG-SP: - Strategic Planning
Secretariat: SCC

JTC1/SWG-RA: - Registration Authorities
Secretariat: SNV

<u>JTC1/SC1:</u> - Vocabulary - P
CAC CH - Ms H. Cormier **Ph: 819-994-3508** **Fax: 819-953-9353**
SEC - Mr. F. Mouzard
Secretariat: AFNOR

Area of Work - Standardization of terminology for information technology and related fields in order to develop a user-oriented vocabulary in co-ordination with the sub-committees of JTC 1 and other appropriate committees.

<u>JTC1/SC1/WG 1:</u> - Advisory Group of SC 1
Secretariat: SCC

<u>JTC1/SC1/WG 4:</u> - Fundamental Terms and Office Systems
Secretariat: ANSI

<u>JTC1/SC1/WG 5:</u> - Software
Secretariat: ANSI

<u>JTC1/SC1/WG 6:</u> - Hardware, Operations and Services
Secretariat: SCC

<u>JTC1/SC1/WG 7:</u> - Communication
Secretariat: ANSI

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JTC1/SC2: - Coded Character Sets - P
CAC CH - Dr.V. Umamaheswaran Ph: 416-448-2359 Fax: 416-448-6057

Secretariat: SNV

Area of Work - Standardization of graphic character sets and their characteristics, associated control functions, and their coded representation for information interchange; excluding audio and picture coding.

JTC1/SC2/WG 2: - Multiple-octet Codes
Secretariat: ANSI

Terms of Reference - To standardize multiple-octet codes.

JTC1/SC2/WG 3: - 7-bit and 8-bit Codes and Their Extension
Secretariat: SNV

Terms of Reference - To develop and maintain 7-bit and 8-bit code standards, to define the coded graphic character sets for such codes, to specify coded control character sets for such codes in liaison with WG 6, to define character sets (or repertoires) in general, to specify names for all characters of the character sets defined. Picture coding is excluded from this scope.

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JTC1/SC6 - Telecommunication and Information Exchange Between Systems - P
CAC CH - R.I.G. Prince Ph: 613-763-7582 Fax: 613-763-2697
Secretariat: ANSI

Area of Work - Standardization, in the field of telecommunications and Open Systems Interconnection, of system functions, procedures and parameters, as well as the conditions for their use, for the four OSI layers that support the Transport Service. A vital aspect of this work is done in effective cooperation with CCITT.

JTC1/SC6/WG 1: - Data Link Layer
Secretariat: SCC

Terms of Reference: Services and protocols in the OSI Data Link Layer

JTC1/SC6/WG 2: - Network Layer
Secretariat: BSI

Terms of Reference: Services and protocols in the OSI Network Layer

JTC1/SC6/WG 3: - Physical Layer
Secretariat: DIN

Terms of Reference: To develop International Standards in the area of the physical layer of the OSI model. This includes services and protocols in the layer in addition to the electrical mechanical and functional characteristics of interfaces. In addition, to provide a focal point for coordination with other standards bodies relative to the above.

JTC1/SC6/WG 4: - Transport Layer
Secretariat: AFNOR

Terms of Reference: Services and protocols in the OSI Transport Layer

JTC1/SC6/WG 6: - Private Integrated Services Networking
Secretariat: SAA

Terms of Reference: To develop service and protocol standards for private telecommunications networks and their interworking with public networks. This includes, but is not limited to, Private Integrated Services Networking (PISN) and methods for cooperation between telecommunications and data processing environments. To ensure alignment between ISO/IEC and CCITT.

JTC1/SC7 - Software Engineering - P
(Title as presented in ISO/IEC JTC 1 N 910)
CAC CH - P. Voldner Ph: 416-581-5619 Fax: 416-979-7669
SEC - W. Braden Ph: 613-235-5040
Secretariat: SCC

Area of Work - Development of guidelines for management techniques, and standardization of supporting methods and tools necessary for the development and testing of software.

JTC1/SC7/WG 1: - Symbols, Charts and diagrams
Secretariat: ANSI
Terms of Reference -

a) to investigate requirements and develop standards for their representation by symbols, charts or diagrams of all appropriate stages of the software life cycle.

b) to develop standards in the area of screen-based tools for specification, development and documentation of software, insofar as they concern the use of symbols charts and diagrams.

c) to participate at an appropriate level in the work of other ISO committees and external organizations in projects related in symbols, charts and diagrams for computing and information technology applications.

JTC1/SC7/WG 2: - System Software Documentation
Secretariat: BSI
Terms of Reference - To co-ordinate and develop standards for the documentation of software.

JTC1/SC7/WG 4: - Tools and Environment
Secretariat: SCC
Terms of Reference - Preparation of standards and technical reports for tools and CASE environment

JTC1/SC7/WG 6: - Evaluation and Metrics
Secretariat: JISC

Terms of Reference - Preparation of standards and technical reports related to valuation and metrics

JTC1/SC7/WG 7: - Life Cycle Management
Secretariat: ANSI

Terms of Reference - Preparation of standards and technical reports on life cycle management

JTC1/SC7/WG 8: - Integral Life Cycle Processes
Secretariat: ANSI

Terms of Reference - Preparation of standards and technical reports on integral life cycle processes

JTC1/SC7/WG 9: - Classification and Mapping
Secretariat: ANSI

Terms of Reference - Preparation of standards and technical reports and guidance documents on classification, mapping and standards placement.

JTC1/SC7/WG 10: - Process Assessment
Secretariat: BSI

Terms of Reference - Preparation of a standard covering the method and application of software process assessment in software procurement, development, delivery, operation, evolution and related service support.

JTC1/SC7 WG 11: - Data Definition
Secretariat: ANSI

Terms of Reference - Preparation of a standard to provide means for users of software engineering tools to consistently access and interpret their descriptive data used for software engineering, to integrate that data and to reliably exchange that data.

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<u>JTC1/SC11</u> - Flexible Magnetic Media for Digital Data Interchange - O
A/CH - Mr. Y. Sobol Ph: 613-623-7901 Fax: 613-623-2886
Secretariat: ANSI

Area of Work - Standardization for the purpose of digital data interchange of:

- flexible magnetic media, such as tapes, tape cassettes, tape cartridges and flexible disk cartridges
- the recording of data on these media
- algorithms for the lossless compression of data

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<u>JTC1/SC14:</u> - Data Element Principles - O
A/CH - Ms K. Gavrel **Ph: 613-957-2527** Fax: 613-957-8700
Secretariat: SIS

Area of Work - Standardization of data elements (including general rules and guidelines for their definition, description, classification, representation and registration) that are interchanged among information processing systems, and the syntax by which these data elements are associated.

<u>JTC1/SC14/WG 4:</u> - Co-ordination of Data Element Standardization
Secretariat: ANSI

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<u>JTC1/SC15</u> - Volume and File Structure - O
(Title as presented in ISO/IEC JTC 1 N2465)
A/CH - Mr. E. Acheson **Ph: 613-957-2465** **Fax: 613-957-8700**
Secretariat: JISC

Area of Work - Standardization of logical structures and formats of Labels, Volumes and Files recorded on media for information interchange.

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JTC1/SC17: - Identification Cards and Related Devices - P
CAC CH - R. Bastien Ph: 514-848-0690 Fax: 514 849-3531
SEC - Ms.C.Arjoonlal Ph: 416-362-6092 Fax: 416-362-0563
Secretariat: BSI

Area of Work - Standardization in the area of identification cards and related devices for use in inter-industry applications and international interchange.

JTC1/SC17/WG 1: - Physical Characteristics and Test Methods for Identification Cards
Secretariat: DIN

JTC1/SC17/WG 3: - Machine Readable Passports Travel Documents
Secretariat: SCC

JTC1/SC17/WG 4: - Integrated Circuit Cards
Secretariat: AFNOR

JTC1/SC17/WG 5: - Registration Management Group (RMG)
Secretariat: ANSI

JTC1/SC17/WG 8: - Contactless Integrated circuit(s) Cards
Secretariat: DIN

JTC1/SC17/WG 9: - Optical Memory Cards and Devices
Secretariat: JISC

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JTC1/SC18 - Document Processing and Related Communication - P
CAC CH - B. Ho Ph: 613-990-4496 Fax: 613-957-8845
Secretariat: ANSI

Area of Work - Standardization of document processing, related communication and the user-system interface as applied to the fields of publishing and office systems, such as:

- open document architecture and interchange formats which allow the definition of the constituents of a document, their interrelations and their representations as a data structure, including the required content architectures and content notations.

- generic (neutral) content notations and models that could be bound to a content architecture and used with any standardized or non-standardized document architecture.

- model and framework for the totality of multimedia and Hypermedia work.

- specialized languages and resources (including fonts) for the description, processing, presentation and typographical rendering of compound and Hypermedia documents.

- services, procedures and protocols that enable communication in distributed office applications.

- keyboards; input and presentation techniques and dialogue; character based, graphical and voice user interfaces; and graphical symbols.

The term "document" used above describes any representation of information intended for human perception. A document can consist of component objects of different types, textual and non-textual, linked in a linear or non-linear fashion.

Excluded:
- SC2 and SC29 work on coded representation of contents within content architectures.

- SC6 and SC21 work on communication in both OSI and non-OSI environments.

- SC24 work on presentation of multimedia and Hypermedia documents.

- SC29 work on real time interchange of final form multimedia and Hypermedia information.

JTC1/SC18/WG 1: - Standards Development Strategy and User Requirements
Secretariat: ANSI

Terms of Reference -
- To identify user requirements for SC18 standards
- To assess the extent to which standards under development meet user needs
- To assess the coherence and completeness of SC18 standards including conformance requirements.
- To provide management support and coordination among the SC18 working groups to ensure the proper progression of standards
- To develop a model/framework document for the projects of SC18
- To establish guidelines and procedures for projects that involve multiple SC18 working groups.

JTC1/SC18/WG 3: - Open Document Architecture (ODA) and ODA Content Notations
Secretariat: BSI

Terms of Reference - To develop standards for office document architecture (ODA) and interchange formats which allow the definition of the constituents of a document their interrelations and their representations as a data structure < including the content architectures and content notations required for the Open Document Architecture. (Note: A content architecture may be a binding to ODA of a content notation defined by SC18/WG5 or other standardization bodies.)

To develop standards for the formal specification, document application profile proforma and testing methodology for conformance to standards developed by WG3.

JTC1/SC18/WG 4: - Distributed Systems Communications
Secretariat: JISC

Terms of Reference - To develop standards for services, procedures and protocols that enable communication between applications on distributed systems.

JTC1/SC18/WG 5: - Generic Content Notations and Transforms
Secretariat: ANSI

Terms of Reference - To define generic content notations and underlying models, generic colour architecture and specifications that control content transforms to and from generic notations and architectures (such as those creating a business chart from numeric data, or converting from one colour model to another as controlled by generic architecture). Such generic content notations and transforms may be employed by document architectures and languages (such as SPDL, ODA and DSSSL) by designing suitable interfaces.

<u>JTC1/SC18/WG 8:</u> - Document Description and Processing Languages
Secretariat: ANSI

Terms of Reference - To produce standards for languages and resources for the description and processing of compound and hypermedia documents, including:

- Reference and operational models for WG8 projects
- Standard Generalized Markup Language and support facilities
- Document processing architecture and formatting for documents represented in SGML
- Final form document architecture and Standard Page Description Language
- Font architecture, interchange format and services
- Glyph architecture and registration procedures
- Hypermedia document structuring language and application resources
- Content architectures and content notations for document architectures defined or supported by "Document Description and Processing Languages" standards. (Note: A content architecture may be a binding of a content notation defined by SC18/WG5 or other standardization bodies.)

<u>JTC1/SC18/WG 9:</u> - User-Systems Interfaces and Symbols
Secretariat: DIN

Terms of Reference - To develop standards for the physical and logical interfaces between the human user and the hardware and software commonly used in hypermedia, multimedia, publishing and office systems. This includes input devices; input and presentation techniques and dialogues; character based, graphical and voice user interfaces; and graphical symbols.

JTC1/SC21 - Open Systems Interconnection, Data Management and Open distributed Processing - P
CAC CH - K. Torenvliet Ph: 416-990-2242 Fax: 416-990-4120
Secretariat: ANSI

Area of Work: - Standardization of protocols, services, interfaces and information objects, and of related reference models covering the areas of:

- Open Systems Interconnection,

- Management of data and information resources in both a local and distributed processing environment,

- Open Distributed Processing,

- security and management aspects related to the above and the relationships among these areas.

Standardization of related conformance testing methodologies, description languages and techniques, and registration procedures.

Excluded are:

- SC 6 areas of work on OSI lower layer standards,
SC 18 areas of work on document processing, message handling, and related communication
SC 22 areas of work on language, environments and System Software Interfaces
SC 27 areas of work on security techniques.

JTC1/SC21/WG 1: - OSI Architecture
Secretariat: AFNOR

Terms of Reference -
- Development and maintenance of the OSI Reference Model (See Note)

NOTE: Development of some refinements or extensions to the OSI Reference Model (e.g. internal structure of a layer) may be assigned to other working groups within SC 21 or even within another SC. In this case, SC 21/WG 1 will ensure control and co-ordination of these developments and have responsibility for their integration in the OSI Reference Model Standard.

- Development of tools and methods of general interest for OSI in particular in the area of:

- Vocabulary
- Formal Description Techniques
- Conformance Testing Methodology and Framework

- Liaison with CCITT on the above topics

JTC1/SC21/WG 3: - Database
Secretariat: SCC
Terms of Reference -
- Development and maintenance of a reference model for database standardization.
- Development of standards for Database Management Systems (DMS), including Information Resource Dictionary Systems (IRDS).
- Data and schema definition and manipulation languages.
- Data storage definition languages.
- User interfaces, including query languages and programming language bindings.
- Distributed database and information resource dictionary systems.

JTC1/SC21/ WG 4: - OSI Management
Secretariat: JISC

Terms of Reference -
- Development of framework for identification and coordination of OSI management standard.
- Standardization of OSI directory services and protocols.
- Standardization of OSI management information services and protocols.
- Formal specification of OSI management services and protocols.
- Test suites for conformance testing and validation of OSI management services and protocols.
- Liaison with CCITT on the above topics.

JTC1/SC21/WG 7: - Basic Reference Model of Open Distributed Processing
Secretariat: SAA

Terms of Reference -
- To develop and maintain the Basic Reference Model of Open Distributed Processing which includes the description of the infrastructure upon which Open Distributed Processing systems may be constructed
- To identify or develop, where necessary, at a high level of abstraction, general concepts and methods of general interest to Open Distributed Processing
- To provide a general understanding of the concepts and nature of Open Distributed Processing in order for essential liaisons and areas of coordination to be identified
- To carry out tasks related to Open Distributed Processing, as directed by SC21, in particular coordination activities

JTC1/SC21/WG 8: - OSI Upper Layers
Secretariat: ANSI

Terms of Reference -
- development of the detailed structure of the Session, Presentation and Application Layers of OSI
- standardization and maintenance of services, protocols, and PICS Proforma for the Session Layer, Presentation Layer, general Application Service Elements (including Association Control; Commitment, Concurrency, and Recovery; File Transfer, Access, and Management; Job Transfer and Manipulation; Remote Procedure Call; Terminal Management: Transaction Processing; and Virtual Terminal), security services and definition of managed objects for the upper layers of OSI.
- standardization of ASN.1 and associated encoding rules
- test suites for conformance testing of the above upper layers standards
- formal specification of the above services and protocols
- registration authority procedures for OSI

- maintenance of all standards on the above topics
- liaison with JTC1/SC6 on the OSI Transport Service
- liaison with other relevant organizations (such as other JTC1 and ISO Committees, CCITT Study Groups, and regional OSI workshops) on the above topics

JTC1/SC22 - Programming Languages, Their Environments and System Software Interfaces - P

CAC CH - G. Warren	Ph: 416-448-2318	Fax: 416-448-4810
SEC - B. Martineau	Ph: 613-952-3023	Fax: 613-952-0701

Secretariat: SCC

Area of Work -
Standardization of programming languages, their environments and systems software interfaces such as:
- specification techniques; and
- common facilities and interfaces.

Excluded: specialized languages or environments assigned to the program of work of another Subcommittee or Technical Committee.

JTC1/SC22/WG 2: - Pascal
Secretariat: BSI

JTC1/SC22/WG 3: - APL
Secretariat: SCC

JTC1/SC22/WG 4: - COBOL
Secretariat: ANSI

JTC1/SC22/WG 5: - FORTRAN
Secretariat: ANSI

JTC1/SC22/WG 8: - BASIC
Secretariat: ANSI

JTC1/SC22/WG 9: - Ada
Secretariat: ANSI

JTC1/SC22/WG 11: - Binding Techniques
Secretariat: NNI

JTC1/SC22/WG 13: - Modula 2
Secretariat: BSI

JTC1/SC22/WG 14: - C
Secretariat: ANSI

JTC1/SC22/WG 15: - POSIX
Secretariat: ANSI

JTC1/SC22/WG 16: - LISP
Secretariat: AFNOR

JTC1/SC22/WG 17: - Prolog
Secretariat: BSI

JTC1/SC22/WG 18: - Forms Interface Management System (FIMS)
Secretariat: ANSI

JTC1/SC22/WG 19: - Vienna Development Method - Syntactic Language
Secretariat: BSI

JTC1/SC22/WG 20: - Internationalization
Secretariat: ANSI

JTC1/SC22/WG 21: - C++
Secretariat: ANSI

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JTC1/SC23 - Optical Disk Cartridges for Information Interchange - O
A/CH - J. Laursen Ph: 613-741-3346
Secretariat: JISC

Area of Work - Standardization of optical disk cartridges for media and information interchange between information processing systems

JTC1/SC23/WG 1: - Permanent Editing Committee
Secretariat: SNV

Terms of Reference -
- **To review all drafts before submission to DIS votes**
- **To finalize all DISs before they are sent to the Central Secretariat**
- **To liaise with WGs producing drafts under consideration**

JTC1/SC23/WG 2: - Rewritable 130 mm and 90 mm ODCs
Secretariat: ANSI

Terms of Reference -
- To develop standards for rewritable 130mm and 90mm ODCs
- To consider aspects related ROM area(s) on such ODCs

JTC1/SC23/WG 3: - 300mmWORMODCs
Secretariat: AFNOR

Terms of Reference -
- To develop international standards for 300 mm WORM ODCs

JTC1/SC23/WG 5: - 356mmWORMODCs
Secretariat: ANSI

Terms of Reference -
- To develop international standards for 356 mm WORM ODCs

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JTC1/SC24 - Computer Graphics and Image Processing - P
CAC CH - P. Hanschke Ph: 613-591-7235 Fax: 613-591-0343
Secretariat: DIN

Area of Work -
Standardization of interfaces, in windowed and non-windowed environments, for:

- computer graphics
- image processing
- interaction with and visual presentation of information

Included are the following related areas: reference models; application portability; functional specifications; interchange formats; device interfaces; testing methods; registration procedures; presentation and support for creation of multimedia and hypermedia documents.

Excluded: Character and image coding; coding of multimedia and hypermedia document interchange formats; SC 18 work on user system interfaces and document presentation.

JTC1/SC24/WG 1: - Architecture
Secretariat: ANSI

Terms of Reference -
- **Development and maintenance of the Computer Graphics Reference Model**
- **Management of liaison with organizations outside SC 24 on all topics of concern to SC 24**
- **Solicitation of user requirements in the area of computer graphics and imaging**
- **Guidance of proposed new areas of work prior to NP acceptance by JTC 1**
- **Specification techniques for computer graphics standards and imaging standards**

JTC1/SC24/WG 4: - Language Bindings and Registration
Secretariat: DIN

Terms of Reference -
- **Develop programming language binding standards of SC 24 semantic standards to existing programming language standards**
- **Review language bindings aspects of items proposed for registration**
- **Review bindings to non-standard programming languages**
- **Provide interpretations of existing bindings as required**
- **Develop methods and procedures for the registration of graphical items**
- **Review and resolve SC24 ballot comments on items proposed for registration**

JTC1/SC24/WG 6: - Multimedia Presentation and Interchange
Secretariat: NNI

Terms of Reference:
- **Standardization of computer graphics functional specifications for application program interfaces**
- **Standardization of techniques for presentation of multimedia information, including its creation, and support for user interaction**
- **Standardization of interfaces for storage, retrieval and interchange of multimedia objects**
- **Standardization for graphical information exchange, including computer graphics metafiles and computer graphics device interfaces**
- **Standardization of encodings for SC24 standards**

<u>JTC1/SC24/WG 7:</u> - Image Processing and Interchange
Secretariat: DIN

Terms of Reference -
- **Development of Imaging Architecture**
- **Processing of digital images**
- **Interchange and storage of digital images**
- **Imaging techniques (components) in IT frameworks like multimedia, electronic mail, windowing, hypermedia and documents**
- **Profiling of generic specifications for use in specific application domains**

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JTC1/SC25: - Interconnection of Information Technology Equipment - P
CAC CH - C. Allard Ph: 613 781-7675 Fax: 613-781-6454
Secretariat: DIN

Area of Work - Standardization of interfaces, protocols and associated interconnecting media for information technology equipment, generally for commercial and residential environments.

Development of standards for telecommunication networks and interfaces to telecommunications networks is excluded.

JTC1/SC25/WG 1: - Home electronic systems
Secretariat: ANSI

Terms of Reference - Standardization in the field of electronic systems for the interaction and control of electrical and electronic devices in home and small business environments

JTC1/SC25/WG 3: - Customer Premises Cabling
Secretariat: DIN

Terms of Reference - Standardization of characteristics of cabling systems for customer premises including test procedures and planning and installation guides.

JTC1/SC25/WG 4: - Interconnection of Computer Systems and Attached Equipment
Secretariat: DIN

Terms of Reference - Standardization of interfaces and protocols for the interconnection of computer systems and computer peripheral equipment.

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<u>JTC1/SC26:</u> - Microprocessor systems - O
CAC CH - C. Mondello PH: 613-723-3621 FAX: 613-723-3937
Secretariat: JISC

Area of Work - To prepare international standards for microprocessor systems, where the term "microprocessor systems" includes but is not limited to microprocessor assemblies, and the related hardware and software for controlling the flow of signals at the terminals of microprocessor assemblies.

<u>JTC1/SC26/WG 1</u>: - Definitions of microprocessor instructions and their mnemonic representation
Secretariat: BSI

Task - To prepare a Secretariat document on definitions and mnemonics for microprocessor assembly language taking account of Document 47B (Secretariat)12, the work of the ad hoc WG at the SC 47B meeting in Tokyo, and the work on the IEEE P694.

The document shall cover 8, 16, and 32 bit microprocessors.

<u>JTC1/SC26/WG 6:</u> - Revision of Publication 821
Secretariat: ANSI

Task - To prepare a draft for a future revision of IEC Publication which will be in conformance with IEEE 1014.

NOTE: The numbering of Rules, Permissions, Observations, Suggestions and Recommendations in the existing Publication 821 should be adhered to as much as possible.

<u>JTC1/SC26/WG 8:</u> - VICbus
Secretariat: SNV

Task - To prepare the VICbus specification as an extension of the OSI VMEbus family.

<u>JTC1/SC26/WG 10:</u> - Open Microprocessor Architecture
Secretariat: ANSI

Tast - To define a non-proprietary Instruction Set architecture derived form a Reduced Instruction set Computer Lineage

JTC1/SC26/WG 11: - Terminology Related to Microprocessors
Secretariat: ANSI

Task - To examine IEC 824 (Terminology Related to Microprocessors) to determine whether this standards should be retained, and if retained, how it should be revised.

JTC1/SC26/SWG - Strategic Planning
Secretariat: ANSI

Task - To map out Areas and Programme of SC 26 work

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JTC1/SC27: - IT Security Techniques - P
(Title as presented in ISO/IEC JTC1/SC27N490)
CAC CH - J. Hopkinson Ph: 613-256-4715 Fax: 613-232-6352
SEC - D.S. Crawford Ph: 613-945-7255 Fax: 613-995-4038
Secretariat: DIN

Area of Work - Standardization of generic methods and techniques for IT security.

This includes:
- identification of generic requirements (including requirements methodology) for IT system security services;
- development of security techniques and mechanisms (including registration procedures and relationships of security components);
- development of security guidelines (e.g., interpretative documents, risk analysis); and
- development of management support documentation and standards (e.g. terminology and security evaluation criteria).

Excluded are:
- the embedding of mechanisms in applications;
- the standardization of cryptographic algorithms.

JTC1/SC27/WG 1: - Requirements, Security Services and Guidelines
Secretariat: BSI

Terms of Reference -
- identify application and system component requirements;
- develop standards for security services (e.g., authentication, access control, integrity, confidentiality, management and audit) using the techniques and mechanisms developed in WG 2;
- develop supporting interpretative documents (e.g., security guidelines, glossaries, risk analysis).

JTC1/SC27/WG 2: - Security Techniques and Mechanisms
Secretariat: AFNOR

Terms of Reference - This group will consist of ad hoc groups as necessary for the development of techniques and mechanisms which are needed by the services identified by WG 1.

- WG 2 provides a centre of expertise for the standardization of IT Security techniques and mechanisms within JTC 1.
- Areas of work include, for example, mechanisms relating to authentication, access control, confidentiality, non repudiation and data integrity. Techniques may be cryptographic or non cryptographic.
- Work areas are established with the approval of SC 27, based on requests from WG 1 or other appropriate standards bodies.

JTC1/SC27/WG 3: - Security Evaluation Criteria
Secretariat:

Terms of Reference -
- Standards for IT security evaluation and certification of IT systems, components, and products. This will include consideration of computer networks, distributed systems, associated application services, etc.
- Three aspects may be distinguished:
    - (a) evaluation criteria
    - (b) methodology for application of the criteria
    - (c) administrative procedures for evaluation, certification, and accreditation schemes
- This work will reflect the needs of relevant market sectors in society, as represented through ISO/IEC National Bodies and other organizations in liaison, expressed in standards for security functionality and assurance.
- Account will be taken of related ISO/IEC and ISO standards for quality management and testing so as not to duplicate these efforts.

JTC1/SC28 - Office Equipment - N
CAC CH - C. Mondello PH: 613-723-3621 FAX: 613-723-3937
(Title as presented in ISO/IEC JTC 1 N912)
Secretariat: SNV

Area of Work - Standardization of basic characteristics, test methods and other related items, excluding such interfaces as user system interfaces, communication interfaces and protocols, of office equipment and products such as:

Printers
Copying equipment
Electronic typewriters
Facsimile equipment
Supplies (Stationery, spools, etc.)

<u>JTC1/SC29</u> - Coded Representation of Picture, Audio and Multimedia/Hypermedia Information - P
CAC CH - Dr. J.M. Costa Ph: 613-763-7574 Fax: 613-763-2697
Secretariat: JISC

Area of Work - Standardization of coded representation of audio, picture, multimedia and hypermedia information - and of sets of compression and control functions for use with such information as:

- Audio Information
- Bi-level and Limited Bits-per-pixel Still Pictures
- Digital Continuous-tone Still Pictures
- Computer Graphic Images
- Moving Pictures and Associated Audio
- Multimedia and Hypermedia information for Real-time Final Form Interchange
- Audio Visual Interactive Scriptware.

Excluded: Character Coding.

<u>JTC1/SC29/WG 9:</u> - Coded Representation of Bi-Level and Limited Bits-per-pixel Still Pictures (JBIG)
Secretariat: DIN

Terms of Reference - To recommend standards for ISO/IEC JTC12/SC2 on the topics of progressive and/or sequential data compression/decompression for bi-level images. In the course of this work, new compression/decompression methods will be developed with special consideration on progressive build-up performance, so the scope of work includes evaluation of resolution methods used for the progressive image build-up in progressive compression/decompression.

<u>JTC1/SC29/WG 10:</u> - Coded Representation of Digital Continuous-tone Still Pictures (JPEG)
Secretariat: ANSI

Term of Reference - Formulation of a standard method for the compression and decompression of still-frame, continuous-tone, "photo-graphic" (gray scale of colour and monochrome), digitized images capable of satisfying the essential needs of a wide variety of computer communications applications for photographic-type digital images, for subsequent recommendations by WG 8 to ISO/IEC JTC1/SC2 and CCITT SG VIII.

JTC1/SC29/WG 11: - Coded Representation of Moving Pictures and Associated Audio (MPEG)
Secretariat: UNI

Terms of Reference - The development of international standards for the coded representation of moving picture images, associated audio, and their combination (moving pictures) when used for storage and retrieval on digital storage media (DSM).

JTC1/SC29/WG 12: - Coded Representation of Multimedia and Hyprermedia Information (MHEG)
Secretariat: AFNOR

Terms of Reference - Development of standards which specify the coded representation of multimedia synchronization and hypermedia navigation information.

TITLE: INFORMATION TECHNOLOGY - SPECIAL GROUP ON FUNCTIONAL STANDARDIZATION (SGFS, no hyphen please)
Secretariat: NNI

Area of Work - Functional Standardization in the field of Information Technology through the development, maintenance and application of procedures and management tools, including:

1. definition of functional standardization and functional standard;
2. development of a catalogue of functional standards with appropriate classification (known as the "Taxonomy");
3. Definition of a methodology for achieving functional standardization, and the publication of International Standardized Profiles (IOSPs) in accordance with user requirements. (An ISP is defined as: 'An internationally harmonized document which identifies a group of standards, together with options and parameters, necessary to accomplish a function or set of functions');
4. development of a set of operating procedures and assessment of resources;
5. execution of the review of proposed draft functional standards;
6. consideration of the requirements of functional standards on conformance and maintenance;
7. development of expeditious publication procedure.

Note: Excluded from the scope of the SGFS are:
a) standardization of base standards referenced in functional standards
b) standardization of test suites for base standards in a) above

The area of functional standardization includes that of Open Systems Interconnection (OSI) and its extension to the development of Application Environment Profiles (AEPs), and the Open System Environment (OSE).

APPENDIX 2
LIST OF INTERVIEWEES

Appendix 2
List of Interviewees

B. Ho	Manager, Systems Interconnection Spectrum, Info Tech and Telecom Industry and Science Canada
D. Langlotz	Senior Program Officer, Information Technology, Standards Council of Canada
R. Bastien	Nova Services Conseil, 400 rue St. Jacques, Montréal, P.Q.
P. Hanschke	GKS Product Manager, Prior Data Sciences Ltd., 240 Michael Coupland Dr., Kanata, Ontario
R. Prince (retired)	(formerly) Manager, Data Standards Coordination, Bell-Northern Research Ltd., 3500 Carling Ave., Nepean, Ontario
V. Umamaheswaran	Senior Analyst, IBM Canada Ltd., 844 Don Mills Rd., North York, Ontario
K. Torenvliet	Senior Advisor, CGA Spectrum, Info Tech, Telecom, Industry and Science Canada
R. Rand	Senior Commerce Officer, Software Products and Informatic Services Branch, Industry and Science Canada
P. Voldner	Information Systems Advisor, Bell Sygma Inc., 483 Bay St., Toronto, Ontario
G. Warren	Manager, Compiler Development, IBM Canada, 844 Don Mills Rd., North York, Ontario
C. Allard	Associate Director, Planning Standards Research, Stentor Resource Center Inc., 160 Elgin St., 4th Floor, Ottawa, Ontario
J. Costa	Manager, Standards Coordination, Bell-Northern Research Ltd., 3500 Carling Ave., Nepean, Ontario

APPENDIX 3
NEW WORK ITEM FOR SC7/WG4

ISO/IEC JTC1/SC7/WG4

4/ N - 130

AUG 9 19..

Software Engineering
- Tools and Environment

Convener : Canada (SCC)
P. Voldner, **Bell Sygma**
483 Bay street, Floor 12N,
TORONTO, Ontario,
Canada M5G 2E1
Tel: +1 416 215 2312
Fax: +1 416 979 7669

Title: New Proposal for WG4 - **Adoption of CASE Tools.**

Source: USA
Date: 1993 -07

Reference 7/ N 1112; 4-Tokyo-5
SC7 Resolution, assigning as Co-editors Dr. D. Smith (USA) , and Dr. D. Lee (Korea).

ACTION: For information only, pending JTC1 ballot approval.
If approval prior to Prague then:
Members are asked to review the proposal and the base document (4-Tokyo-5) enclosed; this base document is a personal contribution by D. Smith of USA.

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ISO/IEC JTC1/SC7
Software Engineering
Secretariat: CANADA (SCC)

ISO/IEC JTC1/SC7 N1112

June 29th 1993

TITLE: **NWI Proposal: Adoption and Integration of CASE Tools**

SOURCE: **USA National Body**

WORK ITEM:

STATUS:

REFERENCE:

ACTION: **For consideration at the May/June 1993 Plenary meeting of JTC1/SC7**

Address reply to: ISO/IEC JTC1/SC7 Secretariat
F. Coallier
Bell Canada - Acquisitions Technical Services
2265 Roland Therrien, Room 226, Longueuil (Quebec) Canada J4N 1C5
Tel.: (514) 468-5523 Fax: (514) 448-2090

N1112

Title: Proposal for a New Work Item: Adoption and Integration of CASE Tools

Source: USA National Body

Status: for consideration at the May/June 1993 Plenary meeting of SC 7 in Japan

Proposal for a New Work Item (NWI)

Title: Adoption and Integration of CASE Tools

Scope and Field of Application

This NWI will result in a Technical Report identifying the steps necessary to integrate CASE tools successfully into an organization's operating structure; i.e. how best to ensure that CASE tools are properly used, and do not become "shelfware." Its scope is limited to CASE tools and related software engineering environment (SEE) issues. The integration referred to is organizational and psychological rather than technical in nature.

Examples of the types of activities which <u>might</u> be addressed include: the involvement of future tool users in the tool requirements analysis, evaluation and selection processes, the availability and scope of training and the timing of its presentation, and initial use of the tool(s) in pilot projects, to name but a few.

There may be some minimal set of activities which can be identified as mandatory, enabling the document to be adopted as a standard. However, this seems problematic, so that an initial publication as a Technical Report is proposed. It is expected that the document will identify and address a variety of optional activities and groups of activities, and that alternative approaches to implementation may be identified and discussed.

Purpose and Justification

Activities have been on-going since 1989 to develop a standard process for evaluating and selecting CASE tools. These activities have resulted in a draft IEEE Standard (final balloting successfully completed 11/92) and a Working Draft for an International Standard. During the course of these activities it has become clear that many cases of CASE tool procurement have been followed by less than satisfactory tool use. Perhaps even a majority of cases! In some instances the fault can be traced to the tool selection process resulting in a tool which is not appropriate for the intended use. The evaluation and selection effort is intended to address exactly that problem.

In other cases, however, it appears that organizations have felt that if they purchased a tool and provided some (often minimal) initial training, their software developers would automatically take to the tool, use it to its best advantage, and quickly become more productive. The more typical result is that the software developers resist using the tool - perhaps for a variety of reasons - which results in the tool becoming shelfware and the investment in advancced software technology viewed as a waste.

In fact, software engineers are not totally resistent to change.

Low level (lower CASE) tools (e.g. compilers, screen generators, icon development and manipulation tools, etc.) are becoming very popular and do not seem to share the difficulties that higher level (upper CASE) tools seem to encounter. The reasons for this are probably varied: the narrowness of scope of many lower CASE tools, their ease of understanding and use by the engineer, and their immediate payback in terms of increased productivity. One of the main goals of this effort will be to learn lessons from the success of adoption of lower CASE tools and apply them more generally to the broader CASE arena.

Program of Work

a.	Approval of NWI and assignment to WG	June 1993
b.	Tabling of documents and development of initial Working Draft	October 1993
c.	Distribution of initial CD	October 1994
d.	Publish TR	June 1995

The aggressive and optimistic schedule above is based upon the assumption that a Technical Report vs. an International Standard is to be the result.

Reference Documents

a. 7.25 Evaluation and Selection of CASE Tools

b. IEEE Standard Practice for the Evaluation and Selection of CASE Tools

c. ISO/IEC JTC1 SC7 WG6 documents:

   1. The General Guide
   2. The Buyer's Guide
   3. Metrics

d. Software Engineering Institute documents:

   1. Guide to CASE Adoption, CMU/SEI-92-TR-15
   2. Integration and Adoption of CASE Tools and Environments, tutorial, September 1992

Cooperation and Liaison

Assuming that this effort is assigned to WG4, continued liaison with WG6 will be required. WG6 liaison is necessary to ensure that quality evaluation and metrics are correctly factored into the implementation process.

Draft
Recommended Practice For the Adoption of CASE Tools

Draft
Recommended Practice For the Adoption of CASE Tools

1.0 Introduction

Computer Aided Software Engineering (CASE) technology is considered by many to be one of the important technologies for improving the manner in which we build software. The rapid growth in the CASE market directly reflects this growing interest; the worldwide market for CASE products and related services had reached $4.8 billion by 1990, and was expected to grow at 20% annually through 1995.

In spite of the perceived potential of CASE technology, many organizations which purchase CASE tools do not achieve the expected improvements in quality and productivity. It is possible (and in fact likely) that a large proportion of CASE tools purchased fall into disuse within a few years.

A significant part of the discordance between expectations and reality to be the result of the differing practices exercised by organizations adopting CASE technology. An organization's adoption practices is a critical determinant of the degree of long term success with CASE tools.

1.1 Purpose.

The purpose of this document is to provide guidance which if followed will maximize the possibility of successful adoption. The detailed practices address the questions of why, when and how to bring CASE technology into an organization. Technical, managerial, organizational, and cultural issues are discussed.

These practices are intended to assist project managers in making informed decisions about CASE technology, and to support them in decisions concerning when and how to introduce CASE into an organization.

1.2 Acronyms and Abbreviations

CASE: Computer Aided Software Engineering

MIS: Management Information System

STS: Scientific and Technical Systems

1.3 Definitions.

CASE: the use of computer-based support in the activities of a software project. This includes support for managerial, administrative, and technical aspects of development and maintenance.

CASE Tool: An automated software engineering development tool that can assist software engineers in analyzing, designing, coding, testing, and documenting a software system and managing a software project.

Note: A CASE tool may provide support in only selected functional areas or in a wide variety of functional areas.

Integrated CASE Tools: The combination of two or more components (in this context tools) to form a unified whole. We note that this definition normally implies two requirements for integration: a conceptual understanding of the relationship between the services or functions provided by the components; and a physical means by which to combine the components and thus permit them to operate as a unified whole.

Software Engineering Environment or SEE: An integrated collection of CASE tools brought together in support of the methods, policies, guidelines, and standards that support the activities within a software engineering process. The integrating mechanism may be a physical artifact, such as a database or a message broadcast system, or a conceptual artifact, such as an agreed transfer protocol or a common schema.

1.4 Scope.

A CASE adoption process is the manner in which an organization identifies appropriate software tools and transitions those tools into general use. Successful CASE adoption includes more than the casual selection of tools. The activities for successful CASE adoption should include:

- Evaluating the maturity of available CASE technology,
- Selection of CASE tools based on organizational needs in terms of the business environment.
- Acquiring and installing the tools,
- Pilot use of the tool.
- Institutionalizing the use of the tools in order to achieve and maintain expected organizational improvements.
- Analyzing the impact of the tools.

A successful process of CASE adoption is not limited solely to tool use; rather it embraces the planning and implementation of the entire set of technical, organizational, cultural and management processes necessary to achieve the required organizational improvements.

There is no simple route to selecting and adopting the best set of CASE tools for a particular software project. In light of the ongoing problems experienced by organizations adopting CASE tools, then, it is hoped that use of a well-founded CASE adoption process, which includes careful analysis of the organization and the tools prior to actual tool purchase, will help maximize the return on investment for CASE tools. With CASE tool adoption, the less that is known about the adoption effort prior to the selection and during implementation, the more the adoption process is likely to cost in time, money, and satisfaction once problems are discovered.

Since CASE adoption is an instance of the broader technology transition problem, this document addresses the adoption practices appropriate for a wide range of computing organizations. Organizations that may benefit from the suggested adoption practices include both those that develop Management Information Systems (MIS) and those that develop scientific and technical systems (STS). In addition, the recommended practicesis of benefit to both government and commercial computing environments.

In addition, while the IEEE recognizes (and encourages) a strong software process and culture, this document specifically does not address the defining of such a process and the assessment of the process and method capabilities of organizations. Similarly, it takes no position on the appropriateness of a specific type of tool for an organization at a specific level of process maturity. Rather, it attempts to identify good CASE adoption practices for an organization at any level of process maturity.

Finally, this document neither dictates nor advocates particular development standards, software processes, design methods, methodologies, techniques, programming languages, or life cycle paradigms.

1.5 CASE Features and Expectations

The range of capabilities considered to be CASE has grown significantly since the early application of the term to tools providing support for structured analysis and design. Currently the vision for CASE is that of an interrelated set of tools which support all aspects of the software development process. Some CASE tools, termed vertical tools, provide support for specific phases of the life cycle, such as analysis and design tools, code generators, and testing tools. Other CASE tools, termed horizontal tools provide functionality across the life cycle, including project management tools, configuration management tools, and documentation tools. Recently, a third category of CASE tools has emerged. These tools, termed integration frameworks, provide a set of mechanisms that facilitate the interaction of other CASE tools.

Regardless of the category and features of the tool, most CASE vendors and *some* CASE users claim significant gains from using CASE tools, including: 1) increased developer productivity, 2) improvements in the quality of the software, 3) consistency and uniformity of development approach. There is also a general belief that automated tools can help alleviate such symptoms as: 1) frequent changes due to volatile requirements, 2) unreliable delivered software, 3) deliveries late and over budget, 4) insufficient capability to detect inadequate designs, 5) inefficient solutions, 6) poor fit to application, 7) poor documentation leading to difficult post-deployment maintainability, and 8) problems of inefficiency, such as a chaotic software process and cost overruns.

Because of the diverse nature of CASE tools, it is imprecise to make blanket statements about what CASE actually offers relative to these expectations. Some tools, such as configuration management tools and documentation tools, are generally accepted mechanisms for improving the manner in which software is developed. Less well understood and accepted is the impact of other tools which provide analysis and design tools, reverse engineering, and code generation support.

Even less well understood is the potential of the various integration frameworks. Among the major problems with careful determination of the impact of any type of CASE tool are:

- The wide variation in quality and value within a single type of tool.
- The relatively short time that many types of CASE tools have been in use in organizations.
- The wide difference in the adoption practices of various organizations.
- The general lack of detailed metric data for previous and current projects.
- The wide range of project domains.
- The confounding impact of changes to methods and processes that are often associated with the adoption of CASE tools.

As expected based on difficulty of determining the impact of CASE tools, the extremely limited data available (primarily from case studies of organizations adopting CASE tools) varies widely. Organizations have experienced variances in the impact of CASE tools depending on the type of tool, the project size, the degree of customer involvement, and sophistication of the user. In addition, some CASE analysts expect that true gain is only realized after 1-2 years of experience, while others suggest that the impact may only become evident during the maintenance phase of the software lifecycle, where improved software design reportedly attributable to CASE technology leads to lower maintenance costs.

1.6 Caveats to CASE

The decision to invest in CASE technology is not easy to make. An organization is forced to make informed assessments about the value of a wide variety of individual tools based on inconclusive data. In attempting to reach consensus on the purchase of CASE tools, an organization must address a large number of issues in spite of the poor quality of the data. Unfortunately, the positions adopted by an organization in addressing these issues can determine whether a CASE tool will be ultimately successful. Among the more vexing issues are:

- **Investment of Resources.** The cost of adopting CASE technology is higher than many organizations anticipate.
- **Current Processes and Methods.** The frequently inexact match between the processes and methods supported by CASE tools and those utilized within the organization can be troublesome.
- **Changing the People in the Organization.** This often neglected part of CASE adoption is one of the crucial components of a successful adoption effort.
- **Support Mechanisms.** CASE tools often require extensive support mechanisms both to maintain the tool and the skill level of users.
- **Tool Scalability.** Many CASE tools have limited capabilities in dealing with very large systems.
- **Assessment of Real Value.** The actual value of CASE tools is difficult to determine in light of the sometimes inflated claims of vendors.

Any decision to bring a CASE tool into an organization should be made with an awareness of both the potential benefits and the potential negative implications of tool adoption. Among the negative implications commonly cited are a short term decrease in productivity, dissatisfaction on the part of employees adopting the new technology, difficult changes to process and methods, extensive training, and significant expense. Over the longer term, CASE users must address long term maintenance costs of CASE tools, frequent releases of new technology, the potential that framework technologies will lead to major restructuring of tools, and the continual costs for training new staff and upgrading the skills of existing staff.

The success or failure of a CASE adoption effort depends largely on the ability of an organization to manage the short- and long-term costs. Organizations which have addressed these problems in a well conceived adoption process stand the best chance of success. This approach contrasts with other approaches which focus primarily on the mechanics of choosing a particular tool.

2.0 References

The standards listed below of the exact date of issue are part of this standard to the extent specified elsewhere in this document.

ANSI/IEEE Std 610.12-1990, IEEE Standard Glossary of Software Engineering Technology.

ISO/IEC 9126: 1991, Information Technology - Software Product Evaluation - quality characteristics and guidelines for their use.

ANSI/IEEE 1209, Evaluating and Selecting CASE Tools.

3.0 Overview of CASE Adoption.

3.1 Definition of Successful CASE Adoption

CASE adoption needs to address the entire adoption life cycle which is described in this document. While failure to address these perspectives does not guarantee an unsuccessful tool adoption, it does likely contribute to the volume of CASE software that quickly becomes CASE "shelfware".

Successful CASE adoption includes more than the casual selection of tools. A successful process of CASE adoption is not limited solely to tool use; rather it embraces the planning and implementation of the entire set of technical, organizational, cultural and management processes necessary to achieve the required organizational improvements.

3.2 Relationship of CASE Adoption to General Process Improvement.

An overall process improvement program alone cannot define the set of requirements for a CASE tool strategy. While an overall tool strategy should consider the process in place, other characteristics of the organization are also important. These characteristics include the methods used, the organization's life cycle needs, the existing and necessary environmental infrastructure, the general skills and the abilities of the organization's staff and the needs of individual projects.

While this document does not address the issue of general process improvement, it does address the relationship of CASE tools with the organization's process, as well as with methods, life-cycles, environment infrastructure, staff skills, and project needs.

3.3 CASE Adoption Overview

The proposed CASE adoption strategy identifies an interrelated set of practices, many of which will require tailoring to the individual organization.

The CASE adoption recommended practices are as follows:

- Define CASE needs -
  - Review CASE Practice. In order to define CASE needs, suggested practices include becoming familiar with the capabilities of CASE technology and the current state-of-the-practice.
  - Assess the organization.The organization needs to perform a self-assessment of its current processes, activities, methods, tools, and personnel. Of particular importance is a careful assessment of user needs, expectations, and amenability to change.
  - Define user needs. The results of understanding the technology and the definition of the organization's needs lead to an identification of areas where CASE can improve an organization's practice.
- Evaluate and select tools- IEEE recommended practice 1209 identifies is a guide for the evaluation and selection of CASE tools. These recommended practices include preparation of an evaluation task definition statement which includes a definition of the purpose of the evaluation, identification of the evaluation criteria based on the task definition statement, identification of candidate tools, evaluation of candidate tools in comparison with each of the chosen criteria and reporting the results. The selection process interacts closely with the evaluation process. Recommended practices include preparation of a selection task definition statement based on a statement of users need, performing selection activities, and reporting the final selection.
- Conduct pilot study- Recommended practices for initial use of CASE tools include acquisition and installation of tools, identification of key players and appropriate projects, initial training, the development of preliminary standards for use, initiation and tracking of a pilot project or projects, evaluation of the pilot use of the tool, and the creation of an institutionalization approach.
- Evaluate pilot results. Make decisions on institutionalization.
- Institutionalize use of tools - Recommended practices for institutionalizing CASE tools include establishing and disseminating standards for tool use, introducing tool use to the organization, establishing continual training, maintenance, and support, and activating on-going evaluation and review of metric and other data.

The recommended practices are diagramed in Figure 3-4. It is expected that the evaluation of existing tool support and the search for new support will be an ongoing activity. Thus, the institutionalization of tool use will often be closely followed by renewed evaluation of the organization's tool needs.

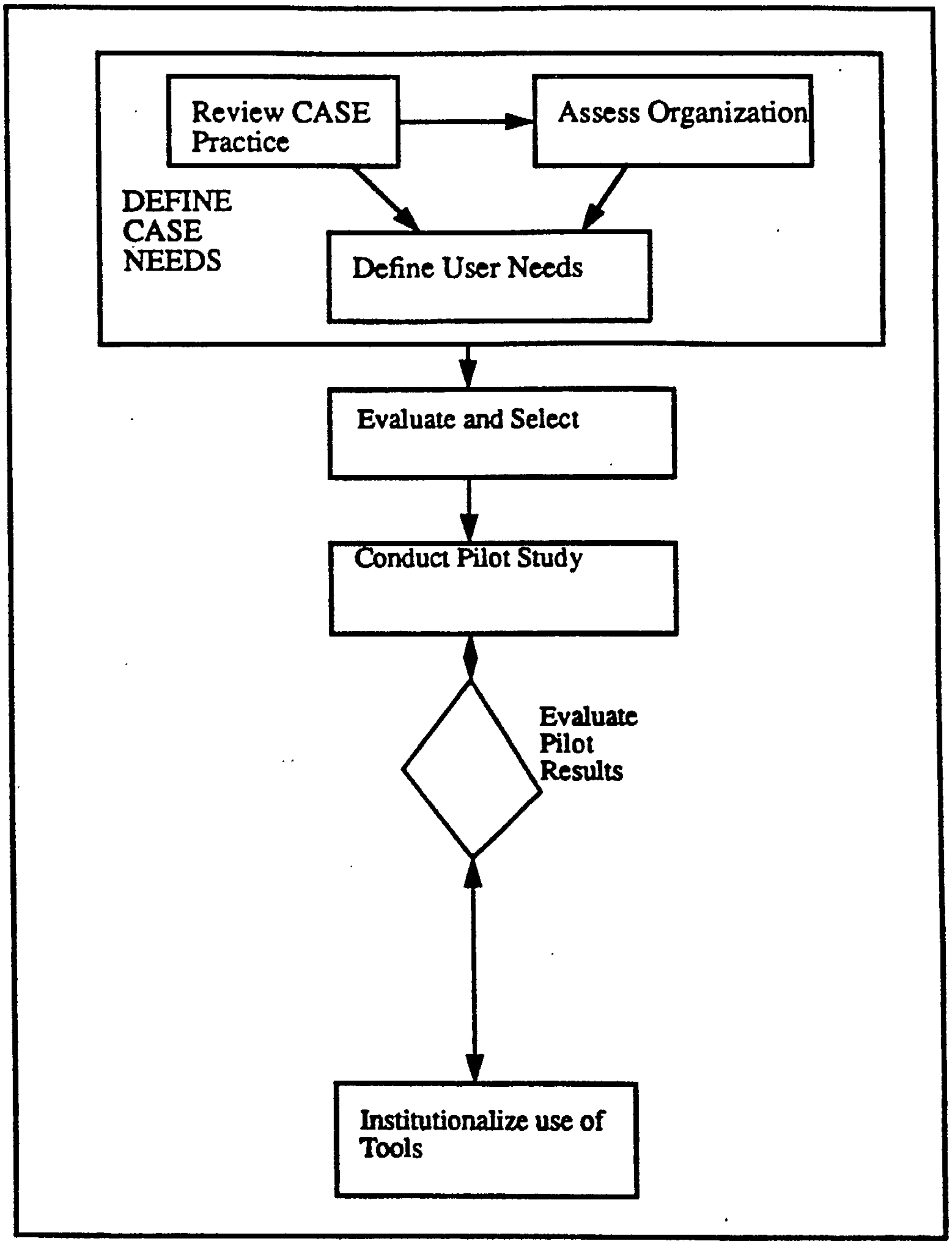

Figure 3-4 : CASE Adoption Strategy

Careful adherence to any set of CASE adoption practices will not automatically guarantee positive results. In addition to a formalized process of tool adoption, a successful organization must provide a mechanism for shared exploration of management and engineer goals, a vehicle for dissemination of organizational and tool capability, a focus of commitment for tool purchases, and a suitable climate for tool advocates, champions, and users.

4.0 Define CASE Needs

The first step in the CASE adoption process is the definition of needs. This step consists of three sub-steps:1) Review current CASE capabilities, 2) Assess the organization, and 3)Define user needs..

4.1 Review Current CASE Capabilities

The definition of an organization's CASE tool needs must be anchored in the reality of what is currently available in the tool marketplace. During this phase, it is important to become versed in CASE literature, and attend workshops and seminars sponsored by vendors and CASE advocates. In addition it is important to obtain a realistic impression of tools from actual experiences of users, feedback from user groups, and lessons learned from other efforts.

4.2 Assess the Organization

This substage develops a realistic assessment of an organization's capabilities.

In order to accurately assess needs, an organization should develop serious answers to a number of hard questions about the organization and its software process. The answers to these questions may indicate that revamping of the software process, training programs, and other functions is more appropriate than purchase of a specific tool. Potentially, some of these improvements are necessary before maximum benefit can be obtained from any tool.

Questions concerning the organization's policies and perceived needs include:

- How does your organization's productivity and quality compare to those of your competitors?
- What portions of the software life cycle are working best/worst? Are there specific portions of the life cycle that could be improved with new techniques?
- What additional documentation production capabilities are needed?
- Are inter-personal and group communications adequate? What additional facilities would make communication better?
- Are you currently collecting software metric data?

In addition to questions about the organizations politics and perceived needs, a number of process-specific issues should be investigated. The following set of questions address the organization's process.

- How well defined is the process? How mature is the process from an organizational standpoint?
- Is the process, or portions of the process amenable to automation? What tools are available to enforce process and methods (e.g., bug trackers, CM tools)?

- What type of life cycle or development model is used by the organization (e.g., rapid prototyping, waterfall, spiral)?
- What is the organizational model (e.g., software factory, software pipeline)?
- What methods do you use (e.g., Gane and Sarson, State Charts, Entity Relationship)? How experienced is the organization with the method? What type of training was provided to staff in the method? Has the method been tailored or adapted to your specific organization?
- Are requirements analysis, specification and design, coding, and testing standards documented? Are they formal or informal standards? What method is used to ensure that standards are met?
- What metric information is gathered about the software process? How is it used? How long has it been gathered? What review processes are used?
- What types of documentation are produced during the software life cycle? What additional documentation capabilities are needed? Must a specific standard, like DOD-STD-2167A, be met?

While some organizations adopt technology at an organizational level, in many others technology adoption occurs at the project level. In fact, even when tools are chosen at the organizational level, transition must commonly occur at the project level. Questions concerning the projects that will be using the new CASE technology include:

- What is the average duration of a project in person months?
- How are your projects organized (e.g., dedicated staff, matrix organization, deep reporting structure, flat reporting structure)?
- What is the average size and range of ongoing software projects in terms of staff?
- What is the average size and range of projects in terms of source lines of code (SLOC) or function points (FP)? How do you measure SLOC/FP?
- Are there any special contractor or government security requirements that must be adhered to? How do they affect the project?
- Does a group exist to provide tool support to the project?

4.2.1 Evaluate the Organization's Technology

The technological base of the organization includes not only the hardware resources on which software is developed, but also the languages, tools, techniques, and targets for the software. The organization's technology will heavily influence what tools are appropriate and available. Questions to be answered concerning an organization's technology include:

- What computing resources are available? What is the development platform? The development operating system?
- Are available resources always adequate to perform jobs on demand? If not, what resources are the bottleneck? How long is an average wait for the resource?
- What software tools are currently used in the organization? What other tools exist in the environment? What is the nature of those tools (e.g., commercial, home grown)?
- To what degree are tools used by software engineers integrated?

- What type and degree of networking is available to the development group?
- What programming languages are used?
- On the average, what percent of the code for a project is new? What percent is reused? What percent is maintained?

4.2.2 Evaluate the Organization's Personnel

A primary aim in evaluating the organization's personnel is to determine the extent to which personnel are likely to view a change in a positive or neutral manner, or whether they will view change negatively, or actually sabotage change efforts. Among questions to be answered by an assessment of the organization's personnel are:

- How will employees (as a group and individually) react to the introduction of new tool technology? Is there a history of successful or unsuccessful changes that were attempted?
- Are there leaders, power centers, or brokers who will have a great impact on the manner in which new tool support is perceived?
- Is there a grass roots movement to encourage better tools and technologies?
- How much education will be necessary to orient users to the new technology?
- How stable is the staff? Is there a large turnover rate?
- Are there any specific hindrances or aids to communication in the environment? What are they?
- Are there any mechanisms and procedures in place for change, innovations, or suggestions?

4.3 Define User Needs

The activity, Define User Needs, entails developing a CASE Tool Strategy (or updating an existing one) that matches specific needs with types of tools that can fill those needs.
Each organization should maintain a strategy document that identifies the types of CASE tools that could potential improve the quality and productivity of their efforts.

The CASE Tool Strategy is a preliminary technology insertion planning document that lists the high-level software development and maintenance functions and performance capabilities desired by the organization. The strategy is based on realistic goals and projections.

Each desired function or performance capability is clearly matched with a corresponding set of needs that are being fulfilled. Estimate the return on investment based on past experience (within and without the organization). Prioritize the CASE tool opportunities via the potential return on investment. Recognize that vendor claims may be ideal and actually inflated. Conservative estimates should still indicate favorable returns on investment; otherwise, the CASE tool opportunity becomes a CASE tool liability.

Prioritize the CASE tool opportunities via the risks associated with inserting new technologies and changing the process. Recognize that all risks will be known for all CASE tools.
There are several methods for developing a CASE Tool Strategy.
a. Top-Down CASE Tool Strategy

The top-down CASE Tool Strategy recognizes the importance of investigating all types of CASE tools and of documenting the organization's software development and maintenance processes before defining user needs.

b. Bottoms-Up CASE Tool Strategy

The bottoms-up CASE tool strategy identifies a tool that could potentially help an organization do it's present job better. Then the organization formally or informally assesses the software development and maintenance processes that are anticipated to be affected. The risks associated with conducting formal or informal assessments of the entire software engineering process or some portion of it can be mitigated by the following:

1. The low cost of the tool(s) under investigation (including training, support, etc.). 2. The low cost of a pilot study (including personnel time, setup of environment, etc.). 3. The low number and/or high experience level of the affected people that must use the tool.

Organizations who have not assessed their overall software development or maintenance processes lack the full insight into how a tool will affect their entire process. A partial assessment can give limited insight into the problem areas of the process phase or activity. Likewise, there are risks with the degrees of formality with which a process assessment is conducted. For example, a formal assessment may not be required in order to discern that the process and tools for configuration control need to be improved. However, an expensive configuration control system that will impact the process of many personnel may require a careful and complete analysis of the existing process before identifying tool candidates to evaluate.

A small organization wanting to automate some of its testing activities is not faced with the same decisions and risks that a large organization is faced with when wanting to improve requirements engineering and design processes. Each organization should consider the risks involved with performing limited analysis prior to tool acquisitions.

4.3.1 Functional and Other Capabilities

TBD

4.3.2 Expected Impacts - Economic and Cultural

TBD

4.3.3 Metrics to Measure Change

TBD

5.0 Evaluating and Selecting CASE Tools

This document does not provide guidance on a detailed set of practices for evaluating and selecting CASE tools. Such guidance can be found in IEEE 1209, which distinguishes between 1) CASE tool evaluation which measures tools against predefined criteria and records results, and 2) CASE tool selection which takes data from one or more evaluations and determines whether one or more CASE tools can be recommended for selection. According to ANSI/IEEE 1209, the evaluation and selection processes specified can either stand alone or work together. The overall process model for CASE tool evaluation and selection as specified in ANSI/IEEE 1209 is diagramed in Figure 5-1.

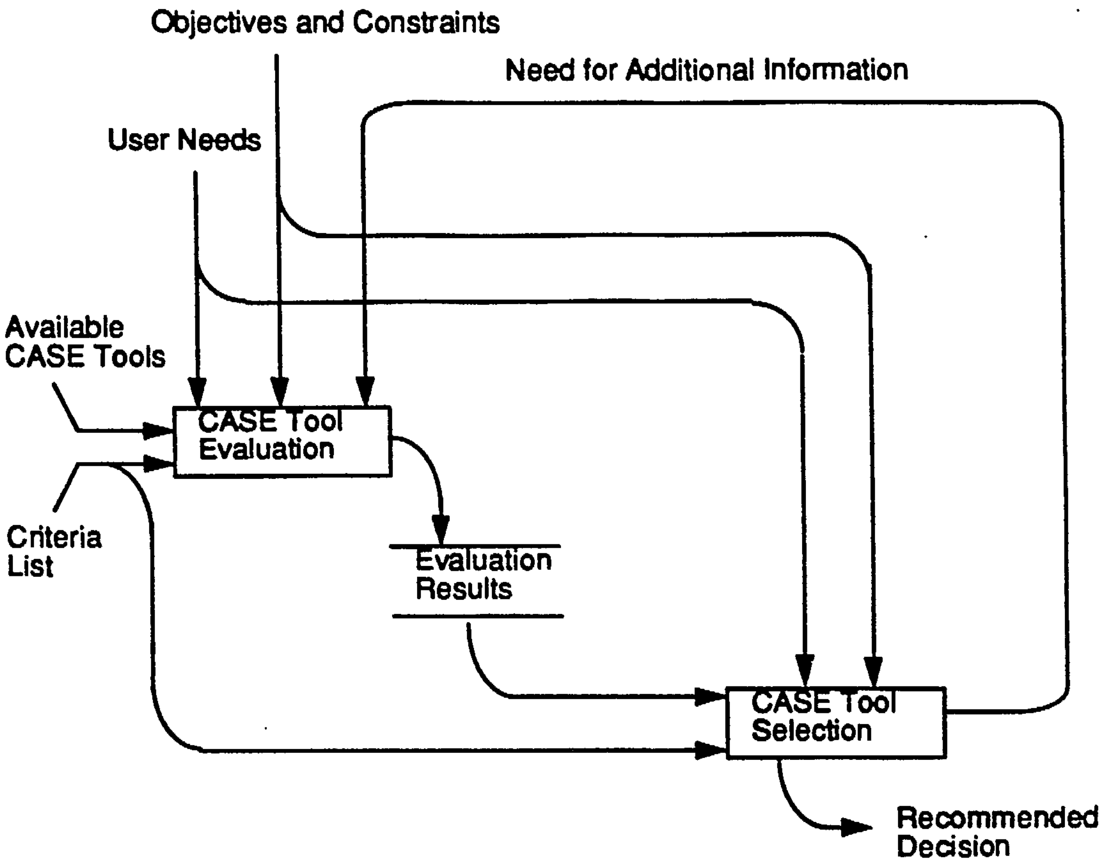

Figure 5-1 Overall Process Model for CASE Evaluation and Selection

As indicated in Figure 5-1, user needs, objectives and constraints, data on available CASE tools, and a list of criteria are employed to select the criteria to be used during the evaluation process to produce evaluation results which can be used during the CASE tool selection process. However, the pathway and termination point through the model can be modified for different activities, including:

- Evaluation for future reference, where the creation of Evaluation Results can be considered the terminus of the activity.
- Selection based on previous evaluations, where the CASE Tool Evaluation activity is not repeated.
- Evaluation of several CASE tools and the selection of one or more, where the entire set of activities is executed.

5.2 Evaluation

The CASE tool evaluation process described in 1209 functions to determine what a CASE tool does, measures tools against user needs, and records this information for use in a subsequent selection process. The evaluation process has a number of steps including:

- Preparation of an evaluation task definition statement containing information about the purpose of the evaluation, the scope of the evaluation, and any assumptions and constraints that apply.
- Identification of evaluation criteria based on the evaluation task definition statement. 1209 provides an extensive set of potential criteria which should be tailored for a specific evaluation.
- Identification of candidate tools by compiling a list of candidates from various sources and obtaining information about the specific candidate tools.
- Evaluate candidate CASE tools in relation to the chosen criteria. Data can be collected by examining the software and documentation, interviewing tool users, viewing demonstrations, executing test cases, applying the tool to trial use, and examining artifacts from previous evaluations.
- Report the results containing an executive summary, and a description of the tools, the approach taken for evaluation, and the results.

5.3 Selection

The CASE tool selection process described in 1209 applies the evaluation results from the previous step as well as a set of selection criteria to assist the choice of a tool. The steps of the selection process include:

- Preparation of a selection task definition statement containing information about the purpose and scope of the selection, and any assumptions and associated constraints that apply.
- Execution of the selection activities. Activities include identification and weighting of selection criteria, identification of candidate CASE tools, gathering of selection data, and applying weighted criteria to the evaluation results in order to identify top ranked tools.
- Iteration as appropriate in order to select (or reject) tools ranked similarly.
- Report the selection results. A recommendation that no tools be purchased since no adequate tool is available may be appropriate.

6 Pilot use

The initial use of the CASE tool should be in a carefully planned and monitored pilot project.

6.1 Pilot project definition and purpose

A pilot project is an initial realistic usage of the CASE tool in its intended environment. A pilot project normally goes beyond the scope of tool use which is possible during a typical CASE tool evaluation effort. The purposes of the pilot project are to:

1. Validate the evaluation and selection efforts and the experience and information gained during those efforts.

2. Make a determination that the tool is appropriate for use within the organization, and further, to identify the appropriate scope of use within the organization.

3. Gather the information necessary to decide how to institutionalize the use of the tool.

6.2 Characteristics of a pilot project

The effort selected as the pilot, or trial use, project for the CASE tool should have the following characteristics:

Scope: the effort should neither be so small as to be trivial, nor so large that it constitutes a major effort. It should be typical of the projects to the which the CASE tool is expected to be applied.

Applicability: in order to help determine the ultimate scope of use, the effort should be typical of and applicable to the normal business of the organization.

Uniqueness: the effort should not be unusual or unique in the context of the organization. The CASE tool should be applied to a problem from a problem domain well understood by the organization. In particular, the pilot project should not be an effort which would pose unusual risks in the absence of the tool.

Criticality: the effort should not be critical to the organization. It should be recognized that the initial introduction of technology involves risk. Initial use on an effort critical to the success of the organization may have an adverse effect on the ability to assess the usefullness of the CASE tool to the organization.

6.3 Planning the pilot project

The pilot project should be carefully planned and that plan should be documented for subsequent use during the evaluation of the pilot efforts. The plan should contain the information identified below.

6.3.1 Project/product definition

CASE tools are used as part of a software engineering effort, which usually results in the production of software and documentation. The project should be defined in terms of its expected output - the end product. The project deliverables should be defined in terms of both form and content. Contractual requirements and relevant standards should be clearly identified.

6.3.2 Pilot goals, objectives and evaluation criteria

Once the project has been defined as above, the pilot aspects of the effort should be defined. Within the context of the purpose of a pilot project described in paragraph 6.1, the general goals for the effort should be defined. These goals will describe the information which is the desired result of the pilot effort. Generally, the user of this standard will want to determine how well and to what extent, the CASE tool will perform in its inetnded environment. For example: Determine whether the CASE tool results in improved document quality.

Specific objectives which implement the goals may then be identified. For example: Use the CASE tool to produce the Software Requirements Specification, Top Level Design Document and Detailed Design Document; then compare document quality to that of document sets produced without the CASE tool.

Finally, it is important that evaluation criteria be identified prior to pilot project initiation. The criteria should provide the means of assessing whether the CASE tool will meet the goals identified above. For example: review the documentation for consistency between documents, traceability of requirements to top level design to detailed design, and conformance to documentation standards.

6.3.3 Resources

Identify the resources necessary for completion of all aspects of the pilot project. Resources identified should include personnel resources, including specific individuals by name, where appropriate and necessary for project success. Other resources may include hardware, related software, and funding. Funding should be specifically identified for acquisition, installation, training and start-up activities, in addition to other, more typical project activities.

6.3.4 Acquisition, installation and integration

Once the selection decision is made, the CASE tool must be acquired, installed in the production environment, and customized to the degree necessary. The scope of these activities is highly dependent upon both the activities which took place as part of the evaluation and selection process(es) and the extent to which the tool must be modified in order to be used in the pilot effort.

Acquisition activities may include contract development, bidding, negotiations, licensing arrangements, and other elements which are not within the scope of this standard. However, these activities require effort and calendar time, both of which should be accounted for in the plan.

When the acquisition process has been completed, the tool must be installed, tested and accepted. The testing referred to should not be confused with an evaluation process. It is intended to ensure that the product, as delivered, is complete and correct and in accordance with contractual requirements. Care should be taken to ensure that any environment-specific requirements agreed to by the CASE tool vendor have been met.

Once the tool has been installed and accepted, it may require some integration and customization. These activities may include such things as the creation of a directory structure for use by the project team, modification of tool default values, establishing user access and privilige s. Existing data may have to be loaded into the tool. If the tool is intended to be used in conjunction with other tools, the desired level of integration must be implemented. Integration can take various forms, from manually transferring data from one tool to another to establishing automatic linkages betweens tools so that they can activate one another and share data, perhaps from a common database.

6.3.5 Standards and conventions

The standards and conventions which will govern the use of the tool during the pilot project should be clearly defined. Examples include naming conventions, directory conventions and coding standards. Where the organization has existing standards and conventions, they should be used if appropriate.

6.3.6 Procedures

Procedures for tool use should be identified and defined.

6.3.7 Training plan

The types and quantity of training necessary for the pilot project should be identified. Personnel to be trained should be designated, and a schedule for the training established.

6.4 Performing the pilot project

6.4.1 Training

6.4.2 Support

6.4.3 Use tools

6.4.4 Periodic reviews

6.4.5 Maintain/update tools

6.5 Evaluating the pilot project

The evaluation of the pilot project may begin informally before the effort is complete. However, the organization should formally evaluate the effort upon its completion, and should develop a summary report containing the following information and recommendations:

A set of realistic expectations and schedules for implementing the tool within the larger organization. This should include the recommended scope of tool use within the organization.

The development of a set of tool experts and advocates ("champions") who can facilitate tool use throughout the organization.

Recommendations for tailoring the tool, the level of integration with other tools, and a process for most effective use of the tool.

The identification of training requirements and a recommended training program.

A recommended set of standards and guidelines for tool use.

The identification of anticipated problems with tool use.

In addition to the summary report, or as a part of it, an implementation plan should be provided which defines a strategy for tool implementation, including identifying projects where the tool is more likely to be used successfully as well as areas which are less ready for tool use.

7.0 Scoping the Institutionalization Plan

After the completion of the pilot project but before moving to adopt the tool fully into the organization's process, the organization's management should compare the results of the evaluation of the pilot project to the original definition of the organization's needs and the expectations for the pilot project. The outcome of this comparison is a determination of how the organization should actually use the tool, information for improving the tool evaluation process in future and an identification of the significant features of the pilot program effecting the usefulness of the tool to the organization. The organization must make three key decisions before moving onto institutionalization of the tool:

1) Should the organization institutionalize use of the tool?
2) What special qualities of the pilot project caused it to succeed (or fail)?
3) Which projects or units within the organization would benefit from the tool?

The organization has to make a decision about whether to go on with the tool adoption process in light of the experience with the pilot project. The staff, resources and constraints of the project effecting its success or failure may or may not be indicative of the whole organization's capacity to adopt the tool or need for the tool's function. The special circumstances of the pilot project may point up parts of the organization whether organizational units or specific classes of projects where the tool would provide substantial benefits and areas where it would not be of use. If the tool failed to meet the requirements in the definition of the organization's needs or the definition itself was faulty, these problems need to be addressed before the tool institutionalization proceeds and before the evaluation process is used in the future.

7.1 Should the Tool be Adopted by the Organization ?

At this point in the tool adoption process, the organization has made substantial investment in choosing the tool. The organization has executed its tool evaluation and selection process, purchased the tool, trained personnel in the use of the tool and used the tool in a pilot program. However, the tool may have failed to even minimally meet the organization's needs or have failed for that project.

If the pilot program fails in its goals, the organization must understand why the pilot program failed. The pilot program may have failed because the tool was the wrong tool for the functions it was purchased to perform. Under those conditions, the organization needs to reconsider its evaluation and selection process. The definition of the organization's needs may not reflect the true requirements of the organization. Under those circumstances management and tool users need to evaluate how the organization defines its requirements. The pilot program may have failed because the resources allocated to training and initial start up costs were inadequate or the specific project was inappropriate for the tool. Under those conditions, a second pilot program may be valuable.

The organization must decide whether to go ahead with the adoption process, abandon the tool or perform a second pilot program. It should only consider this third option if there are identifiable unresolved questions about the organization's adoption of the tool.

7.2 What Qualities of the Pilot Caused it To Succeed (or Fail) ?

Elements of the pilot project crucial to its success or failure may not have been considered significant when the pilot project was established. These elements may not be replicated in the organization as a whole or may only be present in parts of the organization. For example, if the best programmers in the organization were all selected for the pilot project, the project may have succeeded in spite of, rather than because of, the tool. Significant elements to the pilot project's outcome not replicated in the organization could be any of the following:

- Part of the unit's process (as opposed to the organization's process)
- Background of the personnel involved
- Resources available
- Qualities of the project selected

The evaluation of the pilot program should have noted which elements were key to the pilot project's outcome.

7.3 What Projects Would Benefit From the Tools ?

Management should compare the elements significant to the success of the pilot program with the organization as a whole. The comparison of these significant elements determines if the tool adoption process will be more or less effective for the pilot project than for the organization. For example, if the highly motivated and skilled pilot project participants had significant difficulty learning to use the tool, uninterested or less skilled programmers in other parts of the organization will require substantially more training. In addition to the personnel issues are issues about the appropriateness of most of the organization's projects to the tool's methodology. The pilot project may show that the tool is useful for some classes of project but not for others.

The elements identified in the previous step may not exist in all projects or organizational units indicating that some parts of the organization may benefit from using the tool more than others. Possibly some parts of the organization would not have any need or use for the tool. Before proceeding with the developing the institutionalization plan, the organization needs to evaluate the impact of the tool on various organizational units or classes of projects within the organization. If there is significant potential benefit, that unit or class of projects should receive the tool quickly while those units or projects which would derive little or no benefit may not need the tool at all. A good assessment of the organization's current software development process is extremely useful for this step of the tool adoption process.

8.0 Institutionalizing CASE

It is frequently stated that software maint enance is the longest and most expensive phase of the software lifecycle. For a successful and cost effective maintenance process, an infrastructure should be built to facilitate incorporation of periodic upgrades, provide training, and support corporate decisions concerning new directions. Routinization of tool use marks the beginning of the maintenance phase for a CASE tool. A number of efforts to adopt tools have failed because of an inability to incorporate the tool into the day to day activities and planning of the organization.

Major challenges of a CASE tool routine include the indoctrination of new employees into the system and the continual upgrading of skills of existing employees. A common mistake is to provide initial training for a group of early users, followed by only minimal ongoing training. Unfortunately, it is the larger group of users who are not CASE tool "pioneers" who potentially require more training.

Another common mistake is to underestimate the resources necessary to support continual use of complex CASE tools. One factor that adds to resource demands is the complexity of the tool. Many CASE tools require experienced personnel capable of managing the tool databases and responding to problems. A second factor involves the frequent release schedules of CASE tools. While many of the tools have matured to the point where data incompatibility problems between versions are minimized, dependencies on the rest of the computing environment can cause problems.

8.1 Plan Institutionalization Approach

The tools can then be introduced to selected "live" projects based on the implementation plan. The history of transition efforts suggests that complete penetration in the organization can be slow, and loss of support at any stage can doom the new technology. The goals of the implementation effort, therefore, are to encourage tool adoption, maintain support, and disseminate the tool as organizations become ready. This can best be accomplished by acknowledging problems, developing a problem-solving climate for addressing those problems, and rewarding those individuals and groups that achieve success with the tool.

As in the pilot phase, one end product of the implementation phase should be a document containing a set of lessons learned from implementing the tool. Of particular importance are those insights that would facilitate future adoption efforts. A second product may be an institutionalization plan identifying ongoing support needed based on the lessons learned from adopting the tool.

8.1.1 Goals and Objectives and Evaluation Criteria

8.1.2 People and Other Resources

8.1.3 Acquire, Install and Customize

8.1.4 Plan Training

8.1.5 Initial Standards for Use

Imposing standards can present some difficulties, but it is essential to the success of the project. Given the fact that almost everything is built by more than one person, it is important to determine how the tool is used, both individually and by groups. Establishing standards including naming conventions will enable a smoother transition between software life cycle phases. Keep in mind that existing standards should always be considered prior to adopting a new standard.

Below is a list of standards identified:

- Standards for using the tool.
- Naming conventions that will both be consistent with the methodological needs and will enable the use of the required analytical reports.
- Standards for backing up the database, together with standards for data sharing, and for locking and protecting the master copy of the database.
- Security standards.
- Report standards for each stage of the project's life cycle.
- Standards for monitoring the work of individual analysts and developers. A number of tools enable the development of reports on the work of each individual analyst over specific time periods.
- Standards and techniques for interfacing with other tools.
- Standards for documentation and document production.
- Quality assurance standards.

8.1.6 Acquire, Install and Customize

8.2 Use Tools on Actual Projects

8.2.1 Training

8.2.2 Support

8.2.3 Use Tools

8.2.4 Periodic Reviews

To determine how effectively a new CASE tool increases either productivity or quality, or both, the first step is to measure your current effectiveness. Unfortunately, few organizations currently employ an ongoing measurement and process improvement program.

If you are attempting to prove the effectiveness of CASE and its ability to improve productivity, a measurement system is required. The measurement must include, as a minimum, the ability to capture elapsed time and dedicated person hours, project complexity (possibly as measured by function points), and quality as measured by numbers of changes to design and code.

Few metrics exist for determining the success of a CASE tool adoption effort. In fact, many experts believe that the real value of CASE tools lies in improved quality that leads to decreased maintenance costs. This type of benefit can be substantial over a period of time because maintenance often accounts for as much as 70% of the budget of a data processing organization. It is important to recognize that this potential impact will not be felt immediately.

Although a CASE tool can take as long as five years to reach its potential, it may develop incrementally over the short term. For this reason, regularly measuring performance gains can aid evaluation. However, evaluation must start with a realistic measurement of the current environment prior to tool adoption, and must maintain consistent data gathering procedures over time.

8.2.5 Maintain/Update Tools

Many tools which have been purchased and used for a period of time by the intended audience eventually fall into disfavor and are abandoned. This may be a symptom indicating that the tool never was accepted as part of the corporate culture, perhaps because the organization did not recognize the importance of continued emphasis on the tool. Even when a complex tool has moved into general use, it must be supported at a level far greater than more simple tools. Suggestions for continued support of a tool that may help routinize its use include:

- Continue support for ongoing training. Between new revisions of the tool and new staff, it is likely that training needs will continue indefinitely.
- Develop and implement policies for handling tool updates. Installation procedures and responsibilities must be clearly defined. Check-out procedures must be identified to determine whether a new version meets standards for quality, as should upgrade procedures to transform existing tool databases to new formats. Potentially, the configuration of tool versions and the supporting environment (other tools, the operating system, etc.) must be managed.
- Mechanisms should be established for internal sharing of experiences. Potentially valuable devices include bulletin boards, news letters, and reuse libraries.
- Mechanisms should be sought out for the sharing of experiences externally. These may include user groups, workshops, and published articles.
- The relationship with the vendor should be cultivated in order to stay abreast of plans and to insure that the vendor addresses feedback from your organization.
- Mechanisms to continually promote tool use should be developed. These may include recognition for expert use and the establishment of a career path for individuals particularly interested in environments and tools.
- Continual assessment of software quality and productivity is essential to identify that you are in fact improving, and to provide early notification if your strategy is failing.

8.3 Merge into Organizational Process

APPENDIX 4
NEW WORK ITEM FOR SC29/WG11

ISO/IEC JTC 1/SC 29 N 367
Date : 1993-03-29

ISO/IEC JTC 1/SC 29

CODED REPRESENTATION OF AUDIO, PICTURE, MULTIMEDIA AND HYPERMEDIA INFORMATION

Secretariat : Japan (JISC)

TITLE	:	Proposal for a New Work Item: Very-low Bitrate Audio-Visual Coding [ISO/IEC JTC 1 N 2396]
SOURCE	:	ISO/IEC JTC 1/SC 29
PROJECT	:	--
STATUS	:	In accordance with Resolution 92-11/No.33 taken at third Plenary meeting of SC 29, 1992-11-09/11, Ottawa, Canada, this document was forwarded to the JTC 1 Secretariat for NP ballot processing. This document supersedes SC 29 N 287. SC 29 members are reminded that the voting terminates on 1993-06-11.
REQUESTED ACTION	:	For SC 29's information
DISTRIBUTION	:	P, O and L Members Dr. Leonardo Chiariglione, Convener, SC 29/WG 11 UNIFO, Secretariat, SC 29/WG 11

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Date: 1993-03-01

ISO/IEC JTC 1
INFORMATION TECHNOLOGY
Secretariat: USA (ANSI)

TITLE: Proposal for a New Work Item: Very-low Bitrate Audio-Visual Coding

SOURCE: ISO/IEC JTC 1/SC 29

PROJECT: - -

STATUS: New Work Item which, if approved, will be assigned to JTC 1/SC 29, Coded Representation of Audio, Picture, Multimedia and Hypermedia Information, for development.

REQUESTED ACTION: Please complete the enclosed letter ballot and return it to the JTC 1 Secretariat **no later than Friday, 11 June 1993**.

DISTRIBUTION: P and L Members
SC 29 Secretariat

Address reply to:
Secretariat ISO/IEC JTC 1—American National Standards Institute,11 West 42nd Street, New York, NY 10036
Tel: 212 642-4934, 212 642-4884; TX: 42 42 96 ANSI UI; FAX: 212 398-0023

FORM 3

PROPOSAL FOR A NEW WORK ITEM	
date of presentation of proposal 01 March 1993	proposer ISO/IEC JTC 1/SC 29
secretariat USA (ANSI).	ISO/IEC JTC 1 N 2396

A proposal for a new work item shall be submitted to the secretariat of the ISO/IEC joint technical committee concerned, with a copy to the ISO Central Secretariat.

Presentation of the proposal — to be completed by the proposer

Guidelines for proposing and justifying a new work item are given in ISO Guide 26. For ease of reference an extract is given overleaf.

Title (subject to be covered and type of standard, e.g. terminology, method of test, performance requirements, etc.)

Very-low Bitrate Audio-Visual Coding

Scope (and field of application)

(See Attachment 1)

Purpose and justification — attach a separate page as annex, if necessary

(See Attachment 1)

Programme of work

If the proposed new work item is approved, which of the following document(s) is (are) expected to be developed?

- [X] a single International Standard
- [ ] more than one International Standard (expected number: ......)
- [ ] a multi-part International Standard consisting of .... parts
- [ ] an addendum or addenda to the following International Standard(s): ....
- [ ] a technical report, type ......

Relevant documents to be considered

See Attachments

Co-operation and liaison

CCITT SGXV

Preparatory work offered with target date(s)

(See Attachment 2)

Signature J. Miyagawa

	yes	no
Will the services of a maintenance agency or registration authority be required?	[ ]	[X]
If yes, have you identified a potential candidate	[ ]	[ ]
If yes, indicate name:		
Are there any known requirements for coding? If yes, please specify on a separate page	[ ]	[X]
Does the proposed standard concern known patented items? If yes, please provide full information at annex	[ ]	[X]

Comments and recommendations of the JTC secretariat — attach a separate page as annex, if necessary

Comments with respect to the proposal in general, and recommendations thereon

It is proposed to assign this new item to SC 29 /WG 11

Voting on the proposal

Each P-member of the ISO/IEC joint technical committee has an obligation to vote within the time limits laid down (normally three months after the date of circulation)

Date of circulation	Closing date for voting	Signature of the JTC secretary
01 March 1993	11 June 1993	Francis L. Schutter

:lements to be clarified when proposing a new work item (new standard)

ˀitle The title should indicate the subject matter of the proposed new standard.

;cope (and field of application) The scope should give a clear indication of the coverage of the proposed new work item and, if ·ecessary for clarity, exclusions.

ᵓurpose and justification Details based on a critical study of the following elements should be given wherever practicable:

a) The specific aims and reason for the standardization activity, with particular emphasis on the aspects of standardization to be covered, the problems it is expected to solve or the difficulties it is intended to overcome.

b) The main interests that might benefit from or be affected by the activity, such as industry, consumers, trade, governments, distributors.

c) Feasibility of the activity: Are there factors that could hinder the successful establishment or general application of the standard(s)?

d) Timeliness of the standards to be produced: Is the technology reasonably stabilized? If not, how much time is likely to be available before advances in technology may render the proposed standards outdated? Are the proposed standards required as a basis for the future development of the technology in question?

e) Urgency of the activity, considering the needs of other fields or organizations.

f) The benefits to be gained by the implementation of the proposed standard(s); alternatively, the loss or disadvantage(s) if no standard is established within a reasonable time. Data such as product volume or value of trade should be included and quantified.

g) If the standardization activity is or is likely to be the subject of regulations or to require the harmonization of existing regulations, this should be indicated.

If a series of new work items is proposed the purpose and the justification of which is common, a common proposal may be drafted including all elements to be clarified and enumerating the titles and scopes of each individual item.

Programme of work Target date(s) should be indicated and, when a series of standards is proposed, priorities should be suggested.

Relevant documents Any known relevant documents (such as standards and regulations) should be listed, regardless of their source. When the proposer considers that an existing well-established document may be acceptable as a standard (with or without amendments) this should be indicated with appropriate justification and a copy attached to the proposal.

Co-operation and liaison Relevant organizations or bodies with which co-operation and liaison should exist, should be listed.

Preparatory work The proposer should indicate whether he or his organization is prepared to undertake the preparatory work required for the new work item.

Attachment 1

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO/IEC JTC1/SC29/WG11 N 0271
MPEG92/700 Rev
06 November 1992

Source: Leonardo Chiariglione - Convenor
Title: New Work Item Proposal (NP) for Very-Low Bitrate Audio-Visual Coding
Status: Adopted at 20th WG11 meeting

SCOPE

The scope of this project consists of the development of international standards for generic audio-visual coding systems at very-low bitrates (up to tens of kilobits/second).

The generic nature of the work indicates that the scope includes development of provisions that allow application in a wide range of fields.

"Audio-visual coding systems" indicates that the scope includes development of standards for video coding algorithms, audio coding algorithms, and system multiplexing methods.

"At very-low bitrates (up to tens of kilobits/second)" indicates that the scope includes development of algorithms which are optimized for very-low bitrates, from 4.8 kilobits/second up to perhaps 64 kilobits/second.

Work related to videophone and communication applications of very-low bitrate audio-visual coding should be done in close collaboration with CCITT SGXV to achieve a harmonized solution.

PURPOSE AND JUSTIFICATION

Applications for very-low bitrate audio-visual coding systems are those that are restricted in the capacity available for transmission or storage. Limited transmission capacity is a characteristic of several important networks, including Public Switched Telephone Networks (PSTN), Local Area Networks (LAN), and mobile (wireless) networks. Restricted storage capacity is characteristic of interchange media, such as Smart cards and memory cards, and very-large audio-visual delivery systems, such as electronic mail or information databases.

Potential applications that require using such networks or interchange media include videophones, multimedia electronic mail, remote sensing, electronic newspapers, interactive multimedia databases, multimedia videotex, games, interactive computer imagery, multimedia annotation, and sign language captioning. These applications are currently the subject of considerable interest.

The key requirement that is not met by existing visual coding standards (CCITT H.261, ISO 11172) is acceptable visual quality at very-low bitrates. When existing standards are operated at very-low bitrates, the trade-off between temporal and spatial resolution results in visually annoying motion or spatial artifacts.

A solution is needed to provide acceptable audio-visual quality for a wide range of applications at very-low bitrates. The quality must be markedly better than what is available using existing standards at very-low bitrates. It is expected that new coding concepts will be required to obtain the necessary improvement in quality.

The completion of this project will provide the following benefits:

- enable new and improved audio-visual services;
  Potential applications include videophones, multimedia electronic mail, remote sensing, electronic newspapers, interactive multimedia databases, multimedia videotex, games, interactive computer imagery, multimedia annotation, and sign language captioning;
- more efficient use of bandwidth by utilizing narrow-bandwidth transmission channels on PSTN, LAN, and mobile networks;
- more efficient use of storage media, especially in storage-limited systems, such as Smart cards and memory cards;
- generic coding will provide commonality of electronics between applications, facilitating lower costs;
- generic coding will enable easy interchange of audio-visual information between application domains;
- robustness of digital media, e.g. relative permanence of digital storage media;

Additional details in support of this NP, can be found in WG11 N0270 titled, "Project Description for Very-Low Bitrate A/V Coding".

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE NORMALISATION
ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO/IEC JTC1/SC29/WG11 N0270
MPEG 92/699 Revised
5 NOVEMBER 1992

Title: Project Description for Very-Low Bitrate A/V Coding

Source: Kevin O'Connell (Motorola) - Very-Low Bitrate AHG Chairperson

1. Project Title

Very-Low Bitrate Audio-Visual Coding

2. Area of Work

The area of work consists of the development of international standards for generic audio-visual coding systems at very-low bitrates (up to tens of kilobits/second).

3. Subdivisions of Project & Their Titles

Video: Video coding algorithm
Audio: Audio coding algorithm
Systems: System multiplex specification
Requirements: Requirements specification
Implementation: Implementation issues
Test: Subjective testing of proposal simulations

4. Stages & Target Dates

The MPEG Ad-Hoc Group on Very-Low Bitrate Audio-Visual Coding, with participation from members of the CCITT Video Coding Experts Group, has identified a need for a near-term solution and a far-term solution to very-low bitrate audio-visual coding.

In the near-term (within the next two years), a solution is needed primarily for videophone applications on PSTN, LANs, and mobile networks. It is expected to use an "H.261-like" video coding algorithm (hybrid DCT + motion compensation), optimized for very-low bitrates.

In the far-term (approximately five-year time-frame), a solution is needed to provide generic audio-visual coding systems at very-low bitrates with acceptable consumer quality (i.e. not visually annoying), markedly better quality than available with existing standards used at very-low bitrates. The potential applications are detailed in annex A. It is expected that new coding concepts will be required to obtain the necessary improvement in quality.

Since the near-term solution would be primarily for communication applications and based on "H.261-like" technology, it would best be handled by the CCITT, and will not be the task of this project. Since the far-term solution should produce a generic audio-visual coding system, it would best be handled by the ISO, with liaison to the CCITT.

Based on the 5-year time frame for the far-term solution and the example time schedules of MPEG-1 and MPEG-2, a time schedule for this project is proposed below. It is expected that consolidated efforts will lead to availability of adequate technical solutions by 1995-1996.

Stage	Target Date
New Work Item Proposal (NP) Submitted	11/92
Call for Proposals	11/94
Subjective Testing	11/95
First Working Draft (WD)	11/96
Committee Draft (CD)	11/97
Draft International Standard (DIS)	03/98
International Standard (IS)	11/98

5. Liaisons

Work related to videophone and communication applications of very-low bitrate audio-visual coding should be done in close collaboration with CCITT to achieve a harmonized solution.

Annex A. Applicable Fields of the Project

Applications for very-low bitrate audio-visual coding systems are those that are restricted by the transmission or storage capacity available. Limited transmission capacity is a characteristic of several networks, including Public Switched Telephone Networks (PSTN), Local Area Networks (LAN), and mobile (wireless) networks. Restricted storage capacity is characteristic of interchange media, such as Smart cards and memory cards, and very-large audio-visual delivery systems, such as electronic mail or information databases.

Several applications have been identified for this project, including videophone, multimedia electronic mail, remote sensing, electronic newspapers, interactive multimedia databases, multimedia videotex, games, interactive computer imagery, multimedia annotation, and sign language captioning. In the remainder of this annex, a brief description is given for each of the envisioned applications.

Videophone

This application should provide a videophone service on networks such as PSTN, mobile, and LANs. This service should be able to satisfy user expectations which cannot be satisfied by current technology. The main requirement is the easy implementation of real-time encoder and decoder. In the view of a multi-layered standard, videophone applications should be covered by the lowest layer.

Multimedia Electronic Mail

This application should provide a message handling system that is not linked to specific networks or interchange media. Both traditional and new low-cost supports will take advantage of this standard for storage and transmission of huge amounts of information. The main requirement for such a wide consumer market application should be easy implementation for both encoder and decoder.

Remote Sensing

This application includes one-way communications of audio-visual information from a remote location, as required for such systems as security, intelligent vehicle highway systems, harbor traffic management, surveillance, and defense applications. Real-time encoding and decoding is required for some of these systems.

Electronic Newspaper

This application should provide a multimedia news service for distribution on analog telephone network, radio channels and memory and Smart cards. Low-cost implementation for real time decoder is required.

Interactive Multimedia Database

This class of applications requires interactive access to multimedia databases over a variety of limited-bandwidth networks and limited-space storage media. Very-low bitrate audio-visual coding would allow access to a range of media material, including images, motion image sequences, computer imagery, speech, and audio. The main requirement is a low-cost implementation for real-time decoders. The encoder (editing terminal) can be more expensive. It requires "consumer quality" (visually not annoying) for motion image sequences typical in applications such as education. Some specific examples of this class of applications, which are further described below, are Multimedia Videotex, Games, and Interactive Computer Imagery.

Multimedia Videotex

This application should provide a multimedia videotex service for analog telephone networks, radio channels and memory and Smart cards. Videotex is currently a multimedia data-base environment, but lacks capability for motion image sequences. Very-low bitrate audio-visual coding would enable videotex to include motion. The main requirement is a low-cost implementation for real-time decoders. The encoder (editing terminal) can be more expensive. Some compatibility with JPEG ("videotex photographic mode") would be an advantage, but is not a must. Compatibility with higher rate MPEG-standards is not expected. It requires "consumer quality" (visually not annoying) for typical motion image sequences.

Games (TV, multimedia, portable)

This application should provide a powerful tool to overcome the problem of requiring great amounts of memory, which precludes the implementation of real scenes in current portable game machines. A high interactive capability is required.

Interactive Computer Imagery

Virtual Reality (VR) systems allow interactive navigation in a audio-visual environment generated by a computer-driven process. The common understanding is that VR refers to the familiar "immersive" system of headsets, head orientation sensors, data-gloves, etc. However, many applications can be realized using conventional user interfaces including a conventional 2D monitor offering a view "through a window" into the virtual space. Some applications, especially in the educational and games fields, may be realizable using low resolution displays and therefore may benefit from very-low bitrate audio-visual coding.

Multimedia Annotation

This application should provide the capability to insert personal multimedia contributions in electronic messages, the support and transmission means of which were not foreseen at the source for the multimedia amount of information. Real-time decoder implementation is not required.

Sign Language Captioning

This application should provide sign captions associated with some audio-visual material. This application could be viewed as a special case of multimedia annotation. Applications include educational programs for the deaf, captioning of conventional multimedia programs of all types, and deaf videophone communications.

Annex B. Brief Explanations Concerning Functions and Specifications

The requirements placed on the standard by the envisioned applications have been identified. The requirements deal with bitrates, quality, picture format, low encoder complexity, low decoder complexity, low coding delay, error concealment and protection, multi-layered coding, interactive decoding, interactive encoding, annotation capability, harmonization with computer technology, interworking with other audio-visual systems, generic coding, and encryption. A brief explanation of each requirement is given in the remainder of this annex.

Bitrates

The networks and storage media used for the envisioned applications require bitrates ranging from 4.8 to 64 kilobits/second (kbps).

Additional information on the bitrates available on the envisioned networks are given in Annex E.3.1. Additional information on the storage media are given in Annex E.4.

Quality

The primary requirement, common to all envisioned applications (with the possible except of remote sensing applications), is that at very-low bitrates the system must be able to provide audio-visual quality that is not annoying to the consumer. Existing video coding standards, when used at very-low bitrates, do not meet this "consumer quality" requirement, i.e. the video is visually annoying because of temporal and/or spatial artifacts.

The standard should have capabilities to provide good motion rendition and to gain better spatial resolution to the detriment of the motion rendition. At the extreme, the transmission of still frames should be made possible.

Additional requirements are the capability to provide meaningful quality improvements for increasing bitrates and the flexibility to deal with wider classes of audio-visual material. A multi-layered coding scheme may be considered for this purpose.

Picture Format

The effectiveness of the standard should be optimized on formats like QCIF or other formats with still lower resolutions derived in a simple way from CIF. One possible alternate format would be one/Ninth-CIF (NCIF).

Low Encoder Complexity

Low encoder complexity is desirable for applications that require real-time encoding and/or consumer encoding. Videophone, multimedia electronic mail, and remote sensing applications fall in this category. It is less critical to the other applications.

Low Decoder Complexity

Low decoder complexity is required for all applications.

Low Coding Delay

Low coding delay is a requirement primarily for real-time, two-way applications such as videophones. The audio coding delay should not be longer than the video coding delay.

Error Concealment and Protection

Powerful error concealment techniques may be needed by some application fields. The approach should be to identify the error characteristics of the most important interchange media, in collaboration with the respective bodies responsible for the different media. Based on the resultant findings, a single generic error concealment strategy should be developed.

Error correction modes should be identified according to the generic nature of the algorithm, which is foreseen to use different kinds of interchange media with very different levels of required protection.

Multi-Layered Coding

The standard should have the capability for multi-layered bitstreams. It should give different quality levels of performance for both encoder and decoder. This characteristic is particularly important, and should be used as a starting point to cover all the different complexity requirements of the wide range of envisioned applications.

Interactive Decoding

Interactive control of the decoding of previously encoded audio-visual information is required by most of the envisioned applications (exceptions: videophone, and remote sensing). Interactive decoding includes capability to use various play modes (fast forward, reverse, pause, etc...), perspective controls to explore virtual spaces, and game controls.

Interactive Encoding

Interactive control of the encoder by the decoder is desirable for applications with real-time encoders, such as videophone and remote sensing. Interactive encoder control could include camera position and refresh requests.

Annotation Capability

The multimedia annotation and sign language captioning applications require the capability to annotate any multimedia information to existing multimedia information.

Harmonization with Computer Technology

All the applications require some harmonization with computer technology because they are likely to be realized by using computer processing and display technology.

Additionally, some applications require efficient coding of computer generated imagery. These applications include Interactive Multimedia Database, Interactive Computer Imagery, Games, and Multimedia Annotation.

Interworking With Other Audio-Visual Systems

In order to meet the aggressive quality and bitrate requirements, the coding process is likely to be substantially different from existing standards (CCITT H.261, ISO 11172). However, interworking with other audio-visual systems is desirable and should be given consideration.

Interworking between different terminal types must be considered. For example, interworking between a low rate audio-visual terminal and an audio-only terminal may be necessary.

Generic Coding

The standard requires a generic coding method that is common across as many applications as possible and is independent of the channel and/or media. Additional coding techniques and channel/media considerations may be handled by specific applications.

Encryption

All the applications may require this capability of encryption in order to provide privacy and authentication.

Annex C. Application Profile Matrix

Table 1 summarizes the requirements of each of the envisioned applications. It is intended to show the similarity that exist between the requirements of the applications. It is believed that that there is sufficient overlap of requirements to justify the development of a "generic very-low bitrate audio-visual coding standard".

Table 1. Application Profile Matrix

Requirements	Video Phone	Elect. Mail	Remote Sensing	Elect. News	Data Base	Video Tex	Games	Comp. Imagery	Annot ation	Sign Lang.
Bitrate (kbps)	(1)	(2)	(1)	(2)	(2)	(1)	(2)	(2)	(1,2)	(1)
Quality - Video	(3)	(3)	(4)	(3)	(3)	(3)	(3)	(3)	(3)	(5)
Quality - Audio	(6)	(6)		(6)	(6)	(6)	(6)	(6)	(6)	no
Low Encoder Complexity	yes	yes	yes	no	no	no	no	no		yes
Low Decoder Complexity	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Low Coding Delay	yes	no		no	no	no	no	no	no	yes
Error Concealment	yes		yes			yes				
Error Protection	yes		yes			yes				
Bitstream Scal. (multilayer)	yes	yes	no	yes	yes	yes	yes	yes	no	no
Interactive decoding	no	yes	no	yes	yes	yes	yes	yes	no	no
Interactive encoding	yes	no	yes	no	no	no	no	no	no	
Annotation	no	yes	no	yes	yes	yes	no	yes	yes	yes
Harmonize with Computer Tech.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Interwork with other A/V Systems	yes	yes	no	no	no	yes	no	no	yes	yes
Channel/Media Independence	yes	yes	no	yes	yes	yes	yes	yes	yes	yes
Encryption	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Notes:
(1) Limit determined by transmission channel data rate (see Annex E.3);
(2) Limit determined by storage media data capacity and/or data transfer rate (see Annex E.4);
(3) Consumer quality, i.e. not visually annoying;
(4) Spatial resolution has higher priority than motion rendition;
(5) Video quality must be sufficient to easily resolve sign language captioning;
(6) Toll quality for men, women, and children;

Annex D. Benefits of This Project

Although current visual coding standards (CCITT H.261) may operate at very-low bitrates, the trade-off between temporal and spatial resolution results in visually annoying motion or spatial artifacts.

The aim of this project is to produce a generic audio-visual coding standard that results in acceptable consumer quality (i.e. no visually annoying artifacts) when used at very-low bitrates.

The completion of this project will provide the following benefits:

- enable new and improved audio-visual services, described in Annex A. The potential applications include videophones, multimedia electronic mail, remote sensing. electronic newspapers, interactive multimedia databases, multimedia videotex, games. interactive computer imagery, multimedia annotation, and sign language captioning;
- more efficient use of bandwidth by utilizing narrow-bandwidth transmission channels on PSTN, LAN, and mobile networks;
- more efficient use of storage media, especially in storage-limited systems, such as Smart cards and memory cards;
- generic coding will provide commonality of electronics between applications, facilitating lower costs;
- generic coding will enable easy interchange of audio-visual information between application domains;
- robustness of digital media. e.g. relative permanence of digital storage media;

Annex E. Potential Technical Solutions

This annex provides information about some potential technical solutions to meet the requirements that are identified in Annex B and to meet the time frame identified in Section 4. The technical areas addressed here are audio coding, visual coding, networks for data transport, and media for interchange.

The bulk of the information is based on MPEG document 92/233 presented at the July 1992 MPEG meeting. The MPEG Ad-Hoc Group on Very-Low Bitrate Audio-Visual Coding has collected 61 of the 70 references [1-70] listed in MPEG 92/233, but due to copyright considerations, has not been able to make the collection available to interested members. An attempt is being made to get permission from the owners of the copyrights of those papers.

E.1 Audio Coding [2]

Very-low bitrate speech coding technology is already available and is being used for bitrates in the range 4.8 - 8 kilobits/second (kbps). Research is being done for coding speech at 2.4 kbps. The prevailing coding algorithms are based on the Vector Excitation Coding (VXC) method. Two algorithms that have been adopted as standards in the United States are Code Excited Linear Prediction (CELP) and Vector Sum Excited Linear Prediction (VSELP).

Speech coding at 4800 bps is being used extensively by various branches of the U.S. government, particularly where expensive comsat channels are employed. U.S. Federal Standard 1016 specifies 4800 bps using the CELP speech coding algorithm. The CELP algorithm actually allows for a range of compression ratios, 4800 to 7200 bps being the commonly employed rates. There is currently work being done to produce acceptable speech at 2400 bps with modifications to the CELP algorithm. Several references for CELP are provided [4-13].

An 8 kbps version of VSELP has been adopted as a standard for the U.S. digital cellular mobile telephone industry. The VSELP algorithm is described by Gerson and Jasiuk [14].

Other algorithms that have been proposed for very-low bitrate speech coding include Sinewave Transform Coding, advanced Linear Predictive Coding, and model-based methods. Also, adaptive post-filtering that can improve audio VXC quality has been proposed by Chen and Gersho [15].

Taking into account the envisioned applications, three different standards of audio bandwidth have been suggested: 3, 4, and 7 kHz.

E.1.1 3 and 4 kHz bandwidth

State of the art:

At present, toll quality can be obtained at 8 kbps. However, taking into account the probable progress in the field of speech coding within the time span of the project, the objective of toll quality at 4 kbps might be reached. If good (not toll) quality is required, the target bit rate could probably be lowered.

At present, toll quality can be obtained at 8 kbps. However, taking into account that the time span of the project is more than two years and the probable progress in the field of speech coding, the objective of toll quality at 4 kbps could be reached in the near future. If good (not toll) quality is required, the target bit rate could probably be lowered.

Standards:

The CCITT G.758 standard provides toll quality at 16 kbps and a CCITT standard at 8 kbps, aimed at personal mobile communications, is expected within the next three years. If only the quality of digital mobile radio systems is required, there are standards at 8 kbps currently available, and in the near future a standard for the North American Digital Mobile Radio System at approximately 4.8 kbps will be defined. CCITT is planning to standardize a speech coder at 4 kbps.

Speech coding techniques:

Analysis-by-synthesis coding techniques are currently under study due to their potential to produce good quality speech at very low rates. Dynamic allocation of available bits can also be used to cope with the problem of the high non-stationarity of the speech sounds. This technique allows to efficiently distribute the bits among the different parameters used to represent a particular speech sound. Other coding techniques under study are Multi-Band Excitation and Sinusoidal modeling.

E.1.2 7 kHz bandwidth

State of the art:

At present, CCITT G.722 quality can be obtained at 32 kbps, but it is expected that within two years the same quality can be obtained at a 9.6 kbps. In addition, a quality slightly worse than G.722 can currently be obtained at 16 kbps. WG11 is currently working on coding at 16 kbps with the goal of quality better than G.722.

Standards:

At the moment, only the CCITT G.722 standard at 64-56-48 kbps is available. CCITT is planning to standardize a wide-band speech codec at a bitrate around 32 kbps.

Audio coding techniques:

Analysis-by-synthesis coding techniques are also used to code wide-band speech signals. To this aim a two sub-band approach, in which each band is coded with an analysis-by-synthesis scheme, could provide the flexibility of coding the 3, 4, and 7 kHz bandwidths.

E.1.3 Technical approach

Some additional ideas on the technical approach to the audio coding problem are given here.

Bit-rate: fixed, variable, embedded; variable bit-rate is a desirable feature for this standard as it could be used in many applications. Robust signaling procedures for mode commutation play an important role in the use of variable bit-rate or embedded coding.

Delay: the delay could be around 40 ms, that is the minimum achievable delay of an interframe video coder; the codec could have low delay (less than 10 ms) for audio only applications. For audio-visual applications, due to the delay of the video codec, delay can be as high as 100 ms. Variable frame size and/or variable delay according to the selected bit-rate and application could allow to provide better quality for the highest bit-rates with a lower delay and lower audio and/or wide-band speech only quality with higher delay.

Asynchronous Transfer Mode (ATM): as it could be desirable to use this standard with B-ISDN, the standard should include the feature of controlling the coder bit-rate from the ATM network; the embedded property could provide the same feature without the need of informing the coder and could provide an additional flexibility for the strategies of network control.

Statistical multiplexing: variable bit-rate or embedded coding could ease the statistical multiplexing of many audio sources.

E.2 Visual Coding

Although current visual coding standards (CCITT H.261, MPEG, JPEG) may operate at the very-low bitrates targeted for this project, the trade-off between temporal and spatial resolution results in visually annoying motion or spatial artifacts. Existing standards will not meet the requirements for this project.

New coding concepts must be employed to meet the stated requirements for this project. Three possible approaches are currently envisioned: waveform-based coding, model-based coding, and fractal coding.

E.2.1 Waveform-Based Coding

This approach is intended as an improvement of traditional techniques, but not constrained by the use which has been made of them by existing standards. From the time scale point of view, this approach may offer the nearest solution.

A great deal of research continues to be done on waveform-based coding, as evident by the technical literature that continues to be published on this topic. Some of the methods reported in the literature include alternate transforms (e.g. Lapped Orthogonal, wavelets), advanced motion compensation techniques (e.g. fractional-pel accuracy, overlapped blocks, pel-recursive), and joint source and channel coding.

E.2.2 Model-Based Coding

There have been many approaches to model-based coding, though it is still in its infancy. The approaches proposed so far seem to be categorized into some classes based on the complexity of the model, such as 2-D feature-based coding, surface-model-based coding, and 3-D model-based coding.

Among many proposals, the epitome of model-based coding may be "object-oriented coding" and "3-D model-based coding". Object-oriented coding was first proposed by Hotter and Musmann of University of Hannover in Germany, and "3-D model-based coding" was first proposed by Aizawa and Harashima of University of Tokyo and Welsh of British Telecom independently. Prior to their proposals, "semantic coding" had been proposed by Forchheimer of Linkoping University of Sweden, but the image of his original proposal was too synthetic for image communication, though its concept was very similar to model-based coding.

These two approaches are described briefly and the proposals which have been made so far are listed below.

E.2.2.1 Object-Oriented Coding

Object-oriented coding utilizes general models as planes or smooth surfaces for the object model. Information, such as surface orientation and motion information, are estimated from image sequences and are utilized for motion compensation or motion interpolation. Several different approaches have been proposed. Hotter et al. [34-36,51] have proposed a method utilizing segmented surface model, in which changing regions caused by object motion are detected and modeled by planar patches. Ostermann et al. [36,51,55], and Morikawa et al. [49] proposed a coding method utilizing global surface models, in which a smooth surface model of the object is estimated from an image sequence. These methods are used for motion interpolation and motion compensation to improve conventional waveform coding methods. According to Hotter [34], the average rate of compressed motion image of "Miss America" is estimated to be around from 1.5K bits per frame.

E.2.2.2 Object-Oriented Image Coding Research

The following is a list of known research efforts in object-oriented image coding:

- University of Hannover (Germany) - Musmann, Hotter, Ostermann
    - segmented surface approaches [34,35,36,51]
    - global surface model approaches [36,51,55]

- University of Tokyo (Japan) - Morikawa
  - global surface model approaches [49]

E.2.2.3 3-D Model-Based Coding

3-D model-based coding so far utilizes detail parameterized object models. To obtain such a detail model from general scenes is extremely difficult. However, when the object to be coded is restricted to specific classes, special knowledge obtained from a 3-D model of the object can be used in the coding system. From this point of view, Aizawa, Harashima, et al. [17-19] and Welsh. et al. [63-67] have proposed model-based coding schemes which utilize parameterized 3-D models of a person's face. Up to now, most of the contributions to 3-D model-based coding have focused on human facial images, and the parameterized facial models are usually given in advance.

The automatic modeling and analysis are a big problem to these approaches. So far, automatic modeling has not been reported (it is a very difficult problem). Some automatic analysis has been done just for restricted conditions, such that the model is made in advance and the initial position of the face is known. So far, Kaneko of KDD Japan made a real-time coding and decoding experimental system [38]. He assumed that the model and the initial position of the face is given, and tracked the face's motion by using facial feature points which were detected by simple threshold logic. Choi et al. [21,22] and Li et al. [45] reported some automatic analysis method for facial movements.

Because 3-D model-based coding uses parameterized models and is more graphics oriented, the reconstructed image quality is generally considered to be good. There seems to be many applications which cannot be obtained by conventional waveform coding. For example, one interesting application is the idea of a "virtual space image conference".

One interesting branch of this 3-D model-based coding is a "model-based/waveform hybrid coding", in which waveform coding is used to compensate errors which occur in the model-based coding process. There are several methods which have been combined with facial model-based coding, including motion-compensated/DCT [53], vector quantization [29], and contour-coding [48].

General introduction of model-based image coding can be found in Aizawa [17], Forchheimer [26], and Pearson [58].

E.2.2.4 Model-Based Image Coding Research

The following is a list of known research efforts in 3-D model-based image coding:

- ATR (Japan) - F. Kishino, Y. Kobayashi, Y. Nagashima [16,70]
  - virtual space conference [68]
- British Telecom (UK) - W.J. Welsh [63-67]
- Daimler Benz (Germany) - N. Diehl [24]
- University of Essex (UK) - D. Pearson [57,58]
- University of Hannover (Germany) - R. Koch [43]
- University of Illinois (USA) - T. S. Huang, K. Aizawa [17]
  - analysis of facial movements [37]
- KDD (Japan) - M. Kaneko, A. Koike
  - analysis of facial motion [39,40]
  - real-time experimental system of model-based coding [38,44]
- Kogakuin University (Japan) - O. Nakamura, T. Minami [48]
- Linkoping University (Sweden) - R. Forchheimer, H. Li [26,27,45]
- MIT Media Lab (U.S.) - P. Mclean, H.N. Holtzman [32,33,47]
- Mitsubishi (Japan) - T. Fukuhara, T. Murakami
  - model-based/vector-quantization hybrid coding [28,29]

- University of Tokyo (Japan) - K. Aizawa, H. Harashima [18,19,22,50,54]
- University of Tokyo (Japan) - C.S. Choi
    - analysis of facial expressions [21,22]
- University of Tokyo (Japan) - Y. Nakaya [54]
    - model-based/waveform hybrid coding [53]
- University of Tokyo I.I.S. (Japan) - T. Kimoto, Y. Yasuda [42]
- Other efforts:
    - facial motion analysis - D. Terzopoulos [61, 62]
    - facial motion analysis - K. Mase [46]

Additional research mentioned in MPEG 92/376 and MPEG 92/392 from the Finnish National Body and Professor M. Kunt, respectively.

E.2.3 Fractal Coding [71-73]

Fractal coding transforms discrete digital image data into self-referential continuous data. This self-referential data is composed of relational statements describing how a partition element of the image is best described by another piece of the image which has been modified by a contractive affine transformation. An implementation of the fractal coding process requires selection of the geometry of the partition tiles (called domain blocks), selection of the geometry of the image pieces (called range blocks), selection of the set of allowable contractive affine transformations, transformation of range blocks to domain blocks, and selection of an image metric (which provides an objective measure of image distortion).

Once the four selections are made, the encoding process can be made concrete by defining for each domain block, D, in the partition, a search process to determine the range block, R, and transformation T so that T(R) provides the best (as measured by the metric) approximation to D. Encoding may be accelerated by parallel processing and heuristic search strategies. Modern VLSI implementations have rapidly reduced fractal encoding costs.

The fractal code produced for each domain block in the partition, consists of the geometry and location of the range block and the coefficients of the affine transformations. No image data, from either domain or range blocks, is part of the code. In fact, no atomic shapes, code books of image patterns nor statistical data need be passed as part of the code. Since the code is purely self-referential, the image is encoded into a resolution independent format and therefore is continuously scalable.

The decoding process consists of starting with an arbitrary image as a current image, then iteratively transforming the current image into a new image and then making the new image the current image. The image transformation is defined using the fractal code. The iterative process converges to a unique image coded by the encoding process. Decoding is computationally inexpensive. Fractal encoding of video is achieved by either inter- or intra-frame extensions. Motion video decoding has been achieved in software on 386-type personal computers.

E.3 Networks [1]

Limited transmission capacity is a characteristic of several networks, including Public Switched Telephone Networks (PSTN), Local Area Networks (LAN), and mobile (wireless) networks. Some information about the bitrate availability and channel characteristics of these networks is provided here.

E.3.1 Bitrate Availability

On the analog PSTN, modem technology determines the bitrates available for audio-visual services. The bitrates currently possible with modem standards are n x 2.4 kbps, where n = {2, 4, 5, 6, ..., 12}, i.e. from 4.8 to 28.8 kbps. CCITT V.32 operates at 4.8 and 9.6 kbps. CCITT V.32bis extends V.32 to 12.0 and 14.4 kbps. CCITT V.fast (standardization in progress) will operate at rates of n x 2.4 kbps, where 4 <= n <= 12.

On the N-ISDN, the basic interface provides 2B+D channels, where each B channel is 64 kbps and the D channel for signaling is 16 kbps.

On analog mobile networks, the modem technology for the radio channel determines the bitrates available for audio-visual services. For example, current modem technology for United States analog cellular using Cell Plan 2 is capable of 9.6 kbps.

On digital mobile networks, the bitrate available to the user determines the bitrates available for audio-visual services. European Digital Cellular (GSM) and North American Digital Cellular provide about 13 kbps of user data. Several proposed Personal Communication Systems (PCS), such as Cordless Telephone 2 (CT2) and Digital European Cordless Telephone (DECT), provide 32 kbps of user data.

On LANs, there is no fixed upper limit for available bitrates, however, for many LANs it is important to maximize traffic flow by using the total channel capacity in the most efficient manner.

E.3.2 Channel Characteristics

Network operation requires consideration of line coding techniques, likely error rates, forward error correction and the impact of errors on the audio-visual decoder.

All these networks have or will have different characteristics (framing, synchronization, etc...) and different performance in terms of frame erasure rate, residual bit error rate, error burstiness, and error statistics. These characteristics can have a significant impact on the structure and type of the channel coder and the error recovery/concealment techniques.

Therefore, consideration should be given as to the joint optimization of the channel coding, error recovery/concealment, and source coding.

Interleaving techniques could conceivably be used but they introduce an additional delay, so that more sophisticated techniques could be required. This part of the work is likely to be carried out by the application domains either directly or possibly in collaboration with MPEG.

E.4 Interchange Media

The limited storage capacity and/or limited transfer rate of interchange media makes very-low bitrate audio-visual coding necessary. Some information about two examples of interchange media (memory cards and Smart Cards), are provided here.

The Personal Computer Memory Card International Association (PCMCIA) is establishing a standard for memory cards. A memory card is the size of credit card, except it is thicker (100 milli-inches). It has a connector with 30 contacts, allowing it to be plugged into a system. Currently, cards with up to 16 megabytes of storage are available. Some "Memory cards" include circuitry in addition to memory. Apparently, JEIDA and JEDEC are also memory card standards.

Specifications for "Smart Cards" are being developed within the ISO. Smart Cards are the exact same size as credit cards. The physical interface may use contacts or may be contact-less. ISO 7816 standardizes Smart Cards with contacts. The standard includes three parts:

ISO 7816-1 for the physical description of the card;
ISO 7816-2 describes the interfaces;
ISO 7816-3 describes the protocols.

The standardized transfer rate is 9.6 kbps, but there is also an option which enables transfer rates of 19.2 kbps. This option must be signaled at the beginning of the transfer. Apparently, a standard for contact-less Smart Cards is also being considered.

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APPENDIX 5
COMMITTEE DRAFT (CD)
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COMMITTEE DRAFT ISO/IEC CD **13522-1**

DATE 1993-06-15

THIS DOCUMENT IS STILL UNDER STUDY AND SUBJECT TO CHANGE. IT SHOULD NOT BE USED FOR REFERENCE PURPOSES.

Title **Information Technology - Coded Representation of Multimedia and Hypermedia Information Objects (MHEG) -**

Part I:
Base Notation (ASN.1)

Technologies de l'information - Représentation Codée d'Objets d'Information Multimédia et Hypermédia (MHEG) -

Partie 1 : Notation de base (ASN.1)

Introductory note

Please find attached the text of CD 13522-1 which is submitted for your approval during the next three months. Please note that a number of minor changes have been made to the text at the request of national body experts. No change has been made which alters, extends or reduces the scope of the proposed specification.

The principal changes are:

1) A clear separation has been made between the use of the composite object as a container and as a specification of a behaviour. This has resulted in a change to the arrangement of material in the clauses which facilitates understanding and reference. The arrangement of text now reflects more closely the object oriented design chosen for this standard.
2) A clearer description has been provided of the naming addressing and referencing mechanisms in MHEG, and two examples have been provided of the use of other international standards to address external objects. Figures have been added to clarify the addressing of component objects within composite objects.
3) The null class has been removed from the inheritance tree since there is no meaningful definition of the class in the text. The null objects are provided by the MHEG engine and referenced by a reserved address value. This does not modify the functionality of the specification.
4) It has been made clear that the MHEG generic space may have multiple instances. This was previously only implicit. The channel number attribute which maps the channels to the generic space instances had previously to be defined by the using application, but is now defined within the text. This facilitates interchange by improving consistency.
5) The set transparency and set perception attributes have been combined into one single set opacity action. This change makes conforming implementation easier on minimal resource terminals as required by the scope, without reducing any of the functionality possible on more sophisticated workstations.
6) The descriptor object now includes information required to facilitate the use of containers of MHEG objects on minimal resource terminals as required by the scope. The container now specifies allowable degradation and omission. This information was previously defined by the using application. This change improves the consistency of interchange.

These changes are accompanied by other smaller prerequisite changes needed to ensure consistency between the different technical provisions.

Contents

APPENDIX 6
SC29/WG11
RELATED PATENTS TO MPEG-2

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO/IEC JTC1/SC29/WG11N0541

MPEG93/
September 1993

Source: **Leonardo Chiariglione - Convenor**
Title: **Status of MPEG-2 related patents**
Status: **Draft**

Company	V	A	S
AT&T	X	X	X
BBC Research Department	X		
Bellcore	X		
CCETT	X	X	X
CSELT	X		
David Sarnoff Research Center	X		
Deutsche Thomson-Brandt GmbH	X		
France Telecom CNET	X		
Fraunhofer Gesellschaft		X	
GC Technology Corporation	X		
General Instruments	X		
Goldstar	X	X	X
Hitachi, Ltd.	X		
International Business Machines Corporation	X		
IRT		X	
KDD	X		
Massachusetts Institute of Technology	X		
Matsushita Electric Industrial Co., Ltd.	X	X	X
Mitsubishi Electric Corporation	X		
National Transcommunications Limited	X	X	X
NEC Corporation	X		
Nippon Hoso Kyokai	X		
Nippon Telegraph and Telephone	X		
Nokia Research Center	X		
Norwegian Telecom Research	X		
Philips Consumer Electronics	X	X	X
OKI	X		
Qualcomm Incorporated	X		

V: Video
A: Audio
S: System

3

Nordicity Group Ltd.
Le Groupe Nordicité ltée

ISO 9000 AND THE RESIDENTIAL CONSTRUCTION INDUSTRY

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EXHIBITS

EXECUTIVE SUMMARY

This study, prepared by NGL Nordicity Group Ltd. for Canada Mortgage and Housing Corporation (CMHC) and Industry Canada (IC), provides the housing industry with some facts about the ISO 9000 standards (e.g., what they are and why they are important) and discusses the implications of these standards for the residential construction sector.

The purpose of the study was to provide sufficient information to engender an appreciation of ISO 9000 as it could apply to the residential construction industry, and to identify areas for follow-up work and for a possible role for federal and provincial housing agencies in this regard.

Information gathered for this study was based on a number of personal and telephone interviews with experts in Canada, the United States and Europe, and a review of the growing literature on ISO 9000.

The study demonstrates how the standards are proliferating in Europe, North American and other parts of the world. Managing for best quality results is now not only desirable, but also necessary.

Already in North America there are several companies, including manufacturers of housing components, architects and construction engineering firms that are either certified for ISO 9000 or are in the process of becoming compliant with ISO 9000 requirements.

In addition, several residential construction sector associations have begun to examine and/or encourage their members to become ISO 9000 certified (e.g., Canadian Manufactured Housing Institute and the Council of Forest Industries (COFI)). Other applications include the Canadian Construction Materials Centre (CCMC), which is introducing conformance to ISO 9000 as a minimum requirement for quality assurance to be used by proponents requesting evaluations of new and improved products.

This study also provides discussion about the potential relevance of ISO 9000 to various players in the residential construction industry, including manufacturers of housing products and builders. The relation of ISO 9000 series to existing standards in the residential construction industry is a complementary one. The need for quality assurance in workmanship and inspection processes, at the

building construction phase is well recognized by the industry. ISO 9000 provides a recognized standard for introducing quality management as a tool for ensuring quality as well as safety, and offers some protection against risk and liability to builders and manufacturers of housing products.

A clearly appropriate application of ISO 9000 within the industry is in the area of manufactured housing. The Canadian manufactured housing industry is currently involved in expanding its export potentials in U.S., Japan and several countries in Europe. These countries have all officially adopted ISO 9000, and its requirements are increasingly becoming the method for quality assurance in contractual situations, both within and across national borders. The Canadian manufactured housing industry could benefit by introducing ISO 9000 as a competitive tool, as a means for assuring international customers that internationally recognized mechanisms for quality are sustained in the production processes of Canadian companies.

This study also provides a description of the ISO 9000 registration process as it applies in Canada, and suggests several areas of participation by federal and provincial housing agencies regarding ISO 9000 standards and their implementation in the housing sector. ISO 9000 could be one tool for promoting quality in the housing industry, which is one of the housing agencies' mandates. Housing agencies could provide training and disseminate information on ISO 9000 applications, and trends in quality assurance systems within the housing industry. A number of specific areas of application are of particular interest to federal and provincial housing agencies, such as using ISO 9000: to reduce regulatory requirements; as a supporting factor in house warranty programs; as a means to reduce multiple inspection and testing prerequisites; as a procurement tool in agency contracts; as a quality assurance system for situations with high liabilities and risk; and as a means for streamlining supplier-contractor and sub-contractor relationships in the industry.

I. INTRODUCTION

1.1 Purpose and Approach

ISO 9000 is the international set of standards developed by the International Organization for Standardization to assess the quality of management in any organization, large or small. This report is intended to provide some facts about the ISO 9000 standards (e.g., what they are and why they are important) and to identify the implications of these standards for the residential construction industry.

The mandate for this study is limited by a modest budget, hence not all areas of interest are pursued to as great a depth as they could be. Nonetheless, the intention is to provide sufficient information to engender an appreciation of ISO 9000 as it could apply to the residential construction industry, and to identify areas for follow-up work and for a possible role for federal and provincial government agencies in this regard.

Information gathered for this study is based on a number of personal and telephone interviews with experts in Canada, the United States and Europe, a review of the growing literature on ISO 9000 and the experience of the authors with regard to applications of this standard.

1.2 The Standards in Brief

The ISO 9000 series of standards represent the state-of-the art in quality management systems (QMS) worldwide. These standards provide the elements of a QMS that are needed for organizing and controlling operations that achieve quality results in products and services.

ISO 9000 standards have all but replaced more parochial standards around the world. The term "ISO 9000" has become internationally synonymous with quality. The ISO 9000 quality management standards, ISO 9001, 9002, and 9003, describe three distinct quality management models, each with a different level of emphasis and degree of stringency. Each of the models is appropriate to different expectations and organizational set-ups.

ISO 9001, the most stringent of the series, involves all phases of product development and distribution, including design and development, production, installation and servicing. ISO 9002 covers quality assurance in production and installation, while ISO 9003 deals with quality assurance in final inspection and testing.

II. WHAT ARE THE ISO 9000 STANDARDS?

This section of the report is a summary based on the abundant and recent harvest of information on these standards (in books, journals, newsletters, magazines, publicity materials and information services) across North America and worldwide.[1]

2.1 Who Developed the Standards?

The ISO 9000 series of standards is a set of documents written by members of an international delegation known as ISO/Technical Committee 176. This is a committee of the International Organization for Standardization, an agency based in Geneva whose purpose is to promote the development of international standards and related activities to facilitate the global exchange of products and services. ISO has a membership from over 90 countries, of which the Canadian member body is the Standards Council of Canada.

Canada holds both the Secretariat and Chairmanship of the ISO 9000 Technical Committee 176. Canada has played a leading role in the development of these standards, working with the national standards organizations of ISO member countries. The ISO/TC 176 consists of three standards subcommittees and several working groups. Four national associations participate in the ISO/TC 176 as conveners of subcommittees, they are: AFNOR (Association Française de Normalisation), ANSI (American National Standards Institute), BSI (British Standards Institute), NNI (Nederlands Normalisatie Instituut), and SCC (Standards Council of Canada). Other member countries are also represented in TC 176 by their respective national standards bodies.

ISO 9000 standards have now been adopted as national standards[2] in over 60 countries around the world, including Canada, the United States, Japan and

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[1] See bibliography for a selection of references on ISO 9000.

[2] A "national standard" means that it has been reviewed by an accredited standards development organization and approved by the country's most representative institution of standardization (in Canada this is the Standards Council of Canada). The term "National Standard of Canada" has been registered by the Standards Council of Canada under the Trade Marks Act. National standards are "voluntary", but in effect become binding when the market demands this. The National Building Code of Canada references many "voluntary" standards, that become mandatory when adopted as part of the building regulatory process.

all other major industrialized countries. Among companies in Canada who have taken the ISO 9000 route are IBM Canada Ltd., Shell Canada, Mitel Corporation, Teknion Furniture Systems, E.B. Eddy Forest Products Ltd., Monsanto Canada Inc., SPAR Aerospace, and many more. In all, to date, over 700 companies in Canada are now registered for an ISO 9000 standard and many more are working their way towards compliance to the standards.

2.2 The ISO 9000 Family of Standards

The quality management requirements specified in the ISO 9000 series of standards are complementary (not alternative) to the technical, specified requirements of products or services. For example, ISO 9000 standards do not replace any part of the National Building Code.[1]

There are basically five standards that make up the ISO 9000 family: ISO 9000, ISO 9001, ISO 9002, ISO 9003, and ISO 9004 (see Exhibit 2-1). ISO 9000 and ISO 9004 together give guidance to all organizations for quality management purposes. ISO 9001, ISO 9002 and ISO 9003 are used for external quality assurance purposes in contractual situations.

ISO 9000-1 is intended to help organizations to decide which quality assurance model (ISO 9001, ISO 9002, or ISO 9003) is most applicable to their situation. Using ISO 9000-1, an organization can determine which of the three models to select and implement. Factors that influence the selection process include: design-process complexity of the product; design maturity; production-process complexity; product or service characteristics; product or service safety considerations (e.g., risk of failure); and economics (e.g., costs to supplier and purchaser of the product).[2]

ISO 9000-2 is a generic guideline for the application of ISO 9001, ISO 9002 and ISO 9003. The purpose of this part is to enable users to have "improved consistency, precision, clarity, and understanding" when applying the

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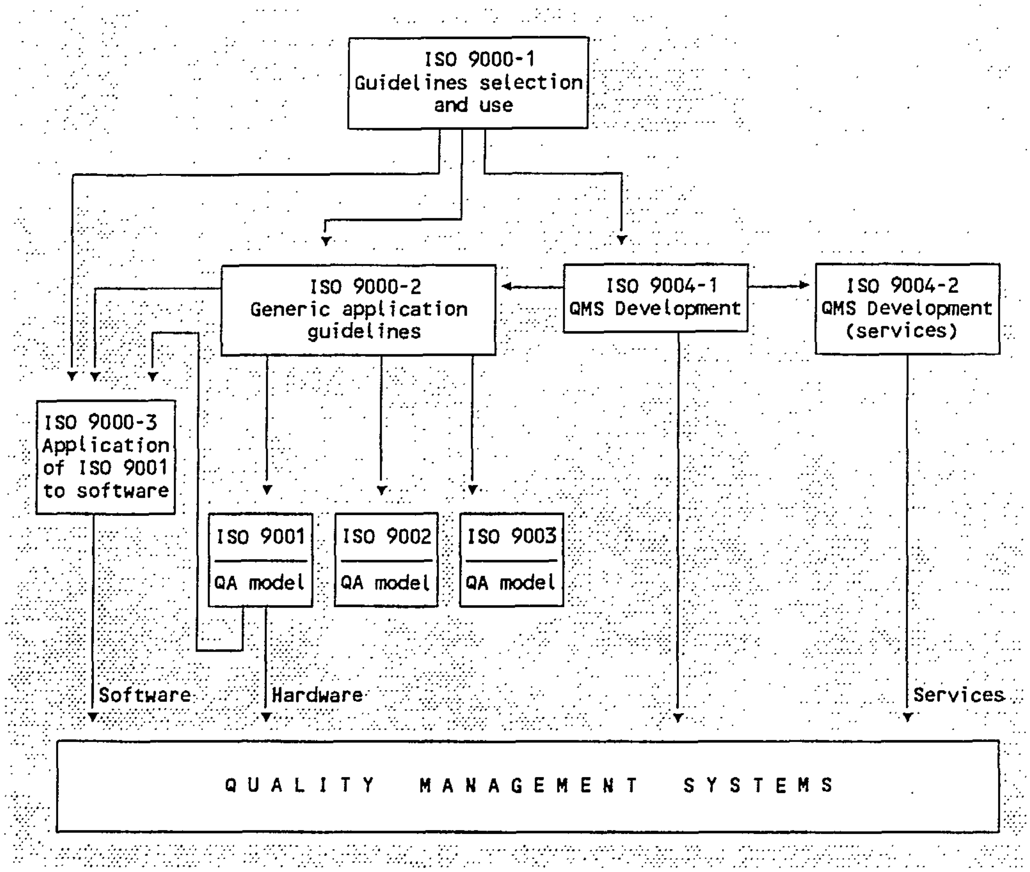
1 Implementing ISO 9000 standards in the residential industry could provide assurance to purchasers of buildings (or of building materials) that builders (or manufacturers of building materials), have in place the necessary procedures and quality checks to ensure, for example, consistency of performance, timeliness in delivery, and adherence to appropriate building (or materials) standards. ISO 9000 in this sense could serve as a complement to the Building Code, to warranty programs and to regulations requirements. This will be discussed further, in more detail, in a later section of this report.

2 International Standard ISO 9000: 1987 (E), "Quality management and quality assurance standards -- Guidelines for selection and use", *ISO 9000 International Standards for Quality Management*, 3rd Edition. Geneva, ISO 1993. This standard has been redrafted and renamed as *ISO 9000-1* (or ISO 9000 Part 1), 1993.

requirements of the quality assurance standards. It provides detailed explanations of the elements of the standards and how they might be applied.

After ISO 9000 has been consulted, reference should be made to ISO 9004 in order to develop and implement a quality system and to determine the extent to which each quality system element is applicable.

Exhibit 2-1: ISO 9000 Series



ISO 9004-1 provides guidance on the technical, administrative and human factors affecting the quality of products or services, at all stages of production, from detection of need (marketing) to customer satisfaction. Throughout ISO 9004, emphasis is placed on the satisfaction of the customer's need, the establishment of functional responsibilities and the importance of assessing (as far as possible) the potential risks and benefits. All these aspects should be considered in establishing and maintaining an effective quality system.[1]

After ISO 9004-1 has been consulted, the organization seeking compliance to an ISO 9000 standard should refer to ISO 9001, ISO 9002 and/or ISO 9003 to determine what specific adaptations it needs to make.

ISO 9001 is usually required of organizations in which design and product development is a substantial activity. This standard is used when conformance to specified requirements is to be assured by the supplier during several stages which may include design and development, production, installation and servicing. An organization that meets the requirements of ISO 9001 also satisfies ISO 9002 and 9003.[2] This model covers organizations such as, engineering and construction firms and manufacturers that design, develop, produce, install, and service products.

ISO 9002 is the model most frequently required by private manufacturing firms. As its title indicates, ISO 9002 is for use when conformance to specified requirements is to be assured by a supplier during production and installation only, in addition to all the elements found in ISO 9003. An organization that meets the requirements of ISO 9002 also satisfies ISO 9003.[3] This level is particularly suited to the process industries (food, chemical, pharmaceutical, etc.) where the specific requirements for the product are stated in terms of an already established design or specification.

ISO 9003 is of interest to those organizations in which the quality of the final product or service can be assessed solely by virtue of the final inspection and testing routines.[4] ISO 9003 is suitable for small shops, divisions within an organization, laboratories, or equipment distributors that inspect and test supplied products.

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1 International Standard ISO 9004: 1987 (E), "Quality management and quality system elements -- Guidelines", *ISO 9004 International Standards for Quality Management*, 3rd Edition. Geneva, ISO 1993. This standard has been redrafted and renamed as *ISO 9004-1* (or ISO 9004 Part 1), 1993.

2 International Standard ISO 9001: 1987 (E), "Quality systems -- model for quality assurance in design/development, production, installation and servicing", *ISO 9000 International Standards for Quality Management*, 3rd Edition. Geneva, ISO 1993.

3 International Standard ISO 9002: 1987 (E), "Quality Systems -- Model for quality assurance in production and installation", *ISO 9000 International Standards for Quality Management*, 3rd Edition. Geneva, ISO 1993.

4 International Standard ISO 9003: 1987 (E), "Quality systems -- Model for quality assurance in final inspection and test", *ISO 9000 International Standards for Quality Management*, 3rd Edition. Geneva, ISO 1993.

Guidance for applying the ISO 9000 standards to services is provided in *ISO 9004-2*. This standard, published in 1991, presents quality system principles and operational elements, including service performance analysis and improvement. The scope of ISO 9004-2 is as follows:

> "This part of ISO 9004 gives guidance for establishing and implementing a quality system within an organization. It is based on the generic principles of internal quality management described in ISO 9004: 1987 and provides a comprehensive overview of a quality system specifically for services.
>
> This part of ISO 9004 can be applied in the context of developing a quality system for a newly offered or modified service. It can also be applied directly when implementing a quality system for an existing service. The quality system embraces all the processes needed to provide an effective service, from marketing to delivery, and includes the analysis of service provided to customers."[1]

While this part of ISO 9004 is written principally with respect to "external" customers, outside the organization, it can also apply to customers within the organization (especially in larger organizations) for overall achievement of the required quality.

Exhibit 2-1 also shows *ISO 9000-3*, which is a set of guidelines for the application of ISO 9001 by organizations involved in the development, supply and maintenance of software.

2.3 Some Relevant Definitions About Quality

There are at least as many definitions of quality as there are books and papers written about it. The literature on quality management and models of achieving quality and excellence in business has been extensive over the past three decades. Exhibit 2-2 provides a summary of some of the notions of "quality" that have emerged over the years.

Over the last ten year in particular, the concept of quality has evolved dramatically from a focus on products (i.e., quality meant a product's ability

[1] International Standard ISO 9004-2: 1991 (E), "Quality management and quality assurance standards -- Part 2: Guidelines for services", *ISO 9000 International Standards for Quality Management*, 3rd Edition. Geneva, ISO 1993.

Exhibit 2-2: Notions of Quality[1]

- Quality is customer satisfaction.
- Quality means conformance to specified requirements.
- Quality means fitness for use.
- Quality means value for money.
- Quality means zero defects.
- Quality means guarantee of confidence.
- Quality is efficiency and productivity.
- Quality is an investment for profitability.
- Quality means on-time delivery.
- Quality is a collective attitude of mind.
- Quality is thought revolution in management.
- Quality means innate excellence.
- Quality is a systematic approach to excellence.
- Quality is the ultimate expression of craftsmanship.
- Quality is excellence in output.
- Quality is a never-ending cycle of improvement.
- Quality means constancy of purpose.
- Quality means pride of ownership.
- Quality means consistently producing conforming products.
- Quality means credibility.
- Quality means continued and expanded market share.

ISO 9000 Definition:

- Quality is the totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs.

to conform to specifications), to a focus on the customer (i.e., to anticipate and exceed customer expectations).

One can interpret the ISO 9000 definition of quality as providing emphasis on customer satisfaction and fitness for purpose, i.e., around the ability of a product or service to satisfy "stated or implied needs".[2] But all the other notions identified in Exhibit 2-2 are also subsumed in the philosophy and purpose of the standard.

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[1] Adapted from *ISO 9000 Certification and Total Quality Management*, by Subhash C. Puri, Standards-Quality Management Group, Ottawa and Washington D.C., 1992, p. 6.

[2] In a contractual environment, needs are specified, whereas in other situations, implied needs should be identified and defined. Needs are usually translated into features and characteristics with specified criteria. Needs may include aspects of usability, safety, availability, reliability, maintainability, economics and environment.

Some other ISO 9000 definitions that are relevant are as follows:

Quality policy: The overall quality intentions and direction of an organization with regard to quality, as formally expressed by top management.

Quality management: All activities of the overall management function that determine the quality policy, objectives and responsibilities and implement them by means such as quality planning, quality control, quality assurance and quality improvement, within the quality system.

Quality assurance: All those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.

Quality system: The organizational structure, responsibilities, procedures, processes and resources for implementing quality management.

Process: A set of interrelated resources and activities which transform inputs into outputs. (Resources may include personnel, facilities, equipment, technology and methodology.)

Procedure: A specified way to perform an activity.

Product: The result of activities or processes. ("Product" includes hardware, processed materials, software or service, or combination thereof.)

Service: The results generated by activities at the interface between the supplier and the customer and by supplier internal activities, to meet the customer needs.

Supplier: The organization that provides a product to the customer. (In a contractual situation, the "supplier" may be called the "contractor". The "supplier" may be for example the producer, distributor, importer, assembler, or service organization.)

Customer: The recipient of a product provided by the supplier. (In a contractual situation, the "customer" may be called the "purchaser". The "customer may be for example the ultimate consumer, user, beneficiary or purchaser.)

Purchaser: The recipient of a product provided by the supplier in a contractual situation.

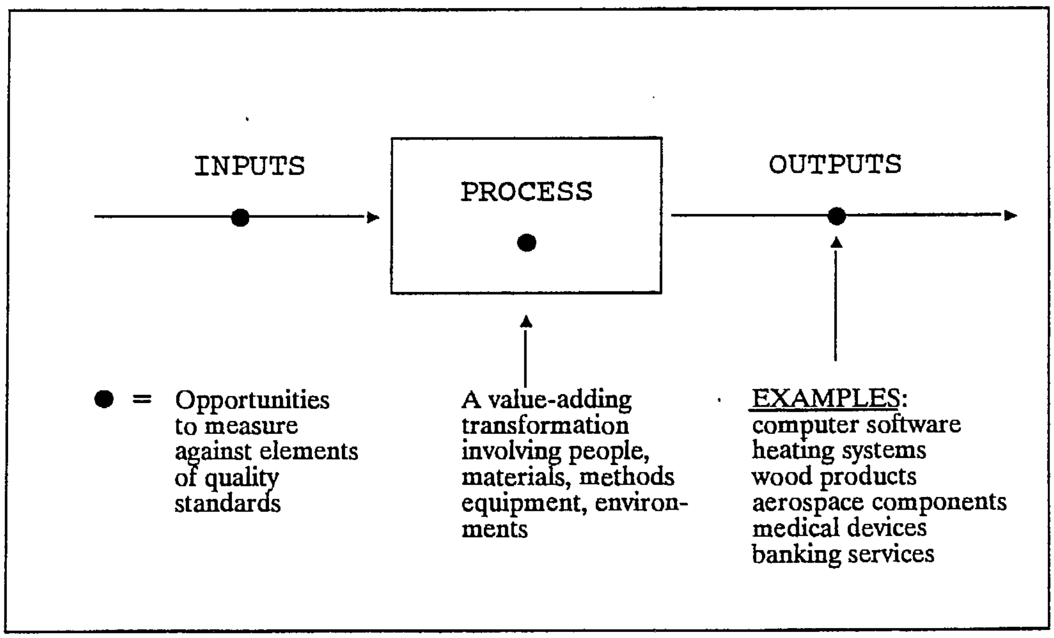
2.4 Building Blocks

2.4.1 Work As a Process

One of the understandings which the ISO 9000 standards builds on is that all work is accomplished by means of a process (Exhibit 2-3). Every process has inputs and outputs. The outputs are the results of the process and represent transformations that add value to the inputs. Every process could involve people, equipment, materials and/or other resources as inputs.

Quality management can then be accomplished by managing the processes in the organization. Opportunities for measurements against quality requirements are available at the input, value-added activities and output phases of production. For example, inputs and outputs can be inspected/tested against specifications, people can be assessed against training requirements, and equipment measured against performance standards. These measurement opportunities provide the operational basis of ISO 9000 and its quality assurance systems: ISO 9001, ISO 9002 and ISO 9003.

Exhibit 2-3: Work As a Process[1]



[1] Adapted from "ISO/DIS 9000-1, Quality management and quality assurance standards -- Guidelines for selection and use (Revision of ISO 9000:1987)", *ISO 9000 International Standards for Quality Management*, 3rd Edition. Geneva, ISO 1993.

2.4.2 ISO 9000 Requirements Apply to Products and Services

The ISO 9000 series of standards incorporate explicitly the following generic product categories: hardware, software, processed materials and services. These four generic categories encompass all the types of product and service offerings supplied by organizations. The potential of the standards becoming a basis for doing business is far reaching, covering all industry sectors.

However, it should be made clear that the ISO 9000 requirements do not specifically refer to products and services as such, but to the systems that produce them. The standards are designed to give customers the confidence that companies complying with the standards will consistently deliver the quality they expect. The standards are generic: that is, they apply to all industries, and are intended to complement product-specific standards for quality assurance.

2.4.3 Emphasis on Documentation of Quality Systems

Generally, the ISO 9000 series provide a systematic approach to quality by compelling an organization to keep a detailed accounting of its procedures and work. Customers are always looking for quality companies. A company with an ISO 9000 system in place can affirm that all its procedures that could affect quality have been documented.

2.4.4 Emphasis on Performance

ISO 9000 is not simply about documenting procedures. What gets written up should be what is actually done in an organization that results in products and services. While documentation provides what a company says it does, the company also has to do what it says.

2.4.5 Emphasis on Proof of Performance

The standards cover all procedures that affect quality. To comply with ISO 9000 (i.e., to pass an ISO 9000 audit), the quality system that is in place must work as formally documented. The auditing process that is part of the ISO 9000 scheme provides the proof of performance. An unwritten quality concept regarding ISO 9000 systems is: "if all personnel were suddenly replaced, the new people could use the documented quality system to continue making the product or providing the service as before."

2.5 ISO 9000 Audits and System Registration

Audits are an important part of implementing a quality management system in an organization. Evaluating the effectiveness of the system can be done by the organization itself (first-party, i.e. internal, audits), its customers (second parties) or independent, accredited bodies (third parties). Second or third-party audits provide an enhanced degree of objectivity from the customer's perspective.

Third-party quality audits may be carried out to gain registration/certification by accredited registration bodies, thereby providing confidence to a range of potential customers and reducing the need, and expense, of having customer (second-party) audits.

In Canada, the Standards Council of Canada provides accreditation of registration organizations for third-party audits of quality management systems. To date, there are eight accredited registration organizations (or "registrars") that do ISO 9000 audits (Exhibit 2-4) and more are likely to be accredited over the next year.

These registrars are independent bodies with the knowledge, skills and experience to evaluate an organization's quality systems. Registrars provide

Exhibit 2-4: Accredited Organizations Providing Third-Party Registration of Quality Management Systems

- Canadian General Standards Board
- Quality Management Institute, a division of Canadian Standards Association
- Canadian Gas Association
- Underwriters' Laboratories of Canada
- Warnock Hersey Professional Services Ltd.
- Bureau de normalisation du Québec
- SGS International Certification
- Litton Systems Canada Limited

two basic services: they audit against one of the three ISO quality assurance standards (ISO 9001, ISO 9002 or ISO 9003), and they place the audited organization on a list of suppliers that have been registered by their auditors.

Typically, the registration process involves the following steps:

- the applicant approaches a registrar and applies for registration;
- the applicant selects the most appropriate ISO 9000 model;
- the registrar evaluates the ISO 9000 applicant's quality system (first the written documentation is assessed and second an on-site assessment/audit of procedure compliance is made);
- if the audit is successful the registrar places the applicant on on its publicly available register/listing of ISO 9000 companies;
- ongoing quality system audits to ensure that the system is maintained.

Once a company is successful and registered for an ISO 9000 model, this is only the beginning. The quality system needs to be maintained. The initial registration is generally good for three years, but the registrar will periodically do "surveillance" audits, to ensure the quality system remains intact. The frequency (usually annual) of surveillance depends on the registrar. A surveillance visit is only a partial audit, but if serious nonconformities are identified at this time, registration can be revoked.

Failing the first audit is <u>not</u> the worst thing that could happen to an ISO 9000 aspiring organization (the failure rate generally in North America is over 50 percent--mainly because of the inexperience of many companies in industry areas where ISO 9000 is a relatively recent phenomenon). What is bad, however, is succeeding in the first audit and subsequently losing the ISO 9000 designation because of major non-conformances in follow-up audits. When a company buys into a quality management system, it should do so as a permanent commitment to quality.

Before going further the terms certification and registration need to be clarified. In Canada, "registration" means " the "procedure by which an accredited third-party registers the <u>quality systems</u> of suppliers with respect to nationally or internationally recognized quality systems standards." In Europe, and sometimes in North America, "registration" is used synonymously with "certification". However, the Standards Council of Canada defines certification as "the action of certifying that a <u>product or service</u> conforms with all the requirements of specific standards or technical specifications."

Registering a QMS should not be confused with <u>product certification</u>.

Product certification is primarily the process of conducting a product assessment to determine its conformance to, for example, customers' requirements, engineering drawings and calculations, or specific performance standards. "Registration" is considered the all-encompassing term for registering quality systems.

2.6 Relation of ISO 9000 to Other Quality Management Standards

ISO 9001, ISO 9002 and ISO 9003 are quality assurance systems, developed for contractual situations where the customer requires assurance that a supplier has a quality system in place which will ensure consistency, appropriateness and timely delivery of the product.

ISO 9001, the most stringent of the ISO 9000 series, specifically encompasses the entire production cycle, from product design to distribution and servicing. However, as a model of quality management, it represents <u>minimum</u> requirements compared to other world class quality management models.

Exhibit 2-5 shows where the ISO 9000 series could be placed along the quality management continuum. Basic specifications and regulatory requirements that are expected to be met as an obligation under a contractual arrangement are shown towards the lower end of the scale. Early military standards for quality management -- e.g., U.S. Department of Defense (DOD), MIL-Q-9858 (1959); NATO Allied Quality Assurance Publication 1, AQAP-1 (1968); U.K. Ministry of Defence DEF/STAN 05-8 (1970) -- provided additional assurance in contractual situations. The ISO 9000 series represents an evolutionary stage beyond these earlier standards, but in various respects ISO 9000 is less demanding than many of the models of Total Quality Management (TQM) that have proliferated over the past couple of decades.[1]

This is perhaps one of the strengths of ISO 9000, in that it is more accessible to a larger variety of firms, large and small. In addition, being an <u>international</u> standard it represents a unified model which is generic to all countries. With increasing globalization of industries and liberalization of trade, the significance of international standards, including quality management, has significantly increased in the past few years.

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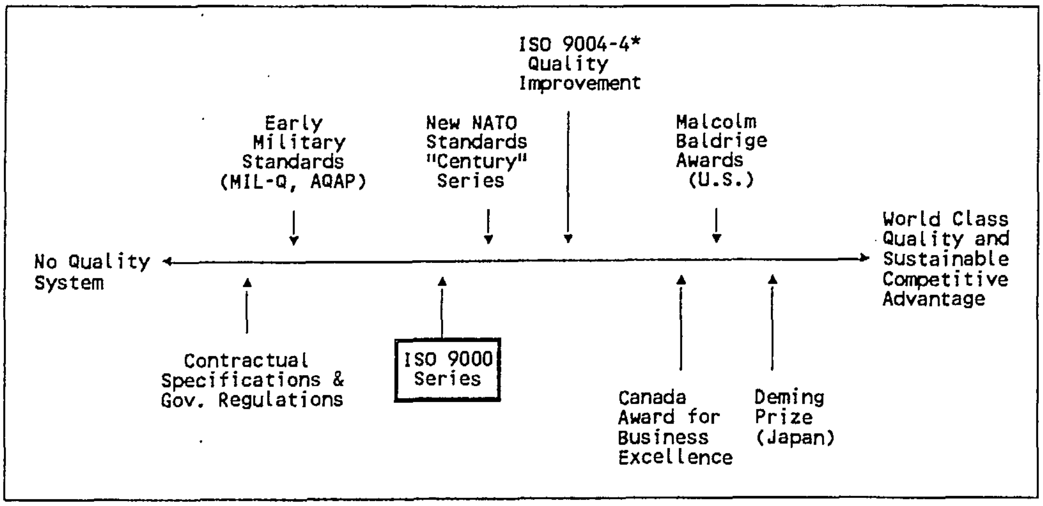
[1] Most of the earlier military standards used by, e.g., NATO and the Canadian Department of National Defence, either have been or are being revised to reflect the provisions of ISO 9001-9004.

Exhibit 2-5: A Representation of the Quality Management Continuum



Note: * ISO 9004-4 is a recent addition to the ISO 9000 series, which is a guideline for quality improvement providing elements and requirements to facilitate and promote continuous quality improvement.

Comparing ISO 9000 to some of the other, more comprehensive, quality management systems (TQM models), on the quality management continuum (Exhibit 2-5), we can see roughly where it fits in the scheme of things. The Malcolm Baldrige National Quality Award, for example, addresses much broader criteria than the ISO 9000 series. The Malcolm Baldrige Award assesses the overall results of a company's operations under seven general categories:

1. Leadership
2. Information and Analysis
3. Strategic Quality Planning
4. Human Resource Utilization
5. Quality Assurance of Products and Services
6. Quality Results
7. Customer Satisfaction

ISO 9001 addresses primarily only one of these categories: "Quality Assurance of Products and Services". The purpose of Malcolm Baldrige, however, is very different. It is designed to recognize and award those select firms with outstanding records of quality performance. ISO 9000 is much broader in coverage of organizations across the world. Malcolm Baldrige has three eligibility categories for the award: manufacturing companies, service companies and small businesses. Generally, up to two awards are given in each category per year.

The Deming Prize was instituted in 1951 by the Union of Japanese Scientists and Engineers (JUSE) in recognition of Dr. Edwards Deming's contributions to the quality improvement and achievement efforts in Japan. Selected individuals and companies are awarded the prize based on the following ten categories (1989):

1. Policy
2. Organization and Its Management
3. Education and Dissemination
4. Collection, Dissemination and Use of Information on Quality
5. Analysis
6. Standardization
7. Control
8. Quality Assurance
9. Results
10. Planning for the Future

There are three different categories for the Deming award: The Deming Prize for Individual Person, the Deming Application Prize, and the Quality Control Award for Factory. The prizes/awards were originally given to Japanese companies only, but since 1984 some overseas candidates have been allowed.

The Canada Award for Business Excellence was created in 1984 to honour businesses in all industry sectors for their outstanding achievements. The award covers achievements in eight categories: entrepreneurship, environment, industrial design, innovation, invention, marketing, quality and small business. The award for "quality" is given in recognition of outstanding achievement in overall business quality through a commitment to continuous quality improvement. High customer satisfaction, competitiveness of the products, involvement of all employees and a focus on all business functions of the company is emphasized in selecting the candidates for the awards.

As outlined above, other more comprehensive models exist which emphasize the dynamics involved in the integration of all aspects of a firm's quality system and the firm's continuous improvements in quality. The use of the ISO 9000 standards, however, are a good starting point in establishing quality systems in companies, and appear for a majority of applications to provide sufficient assurance to meet the requirements of customers.

Like other standards, the ISO 9000 standards are subject to revisions and additions. The ISO Technical Committee 176 working on the ISO 9000 series is active and continues to build on the original 1987 ISO series. TC 176 have developed the ISO 9004-4 guidelines (1992 draft), *Quality management and quality system elements -- Guidelines for quality improvement.* These guidelines are to help companies develop a business environment which will facilitate and promote continuous quality improvement, and to strive for customer satisfaction. The purpose is to sustain the gains achieved from a quality system established by a company.

Other additions to the ISO 9000 series are targeted for 1996, which should carry the standards and their users to the year 2000. Specifically, the revisions to the ISO 9000 series expected for 1996 will result in a quality management system suitable for all organizational management systems, encompassing: products and services, the environment, health, safety, personnel, finance and cost.[1]

2.7 The Elements of the Standards

The definition of quality that is most relevant within the context of ISO 9000 involves simply that the product meets the requirements of the users/customers, and that production is controlled in such a way as to ensure reliability, consistency and timeliness of the product. This implies that requirements and procedures to meet quality specifications are appropriately documented and followed.

In order to ensure that a complete and reliable quality management system is in place it is necessary to have quality procedures built into every critical stage of the production process. Whenever something goes wrong, the system should allow the organization to easily identify where in the process corrections are needed. Each step must be defined and quality checks must be built into each stage. Inspecting and testing the final product before delivery is not sufficient if compliance to ISO 9001 or 9002 is required, but is sufficient for ISO 9003 compliance.

The most comprehensive of the standards, ISO 9001, incorporates all twenty quality elements of the standard (Exhibit 2-6). ISO 9002 has eighteen of the elements; and ISO 9003 has twelve of the basic elements of the standard. These elements will be detailed in Section IV and their relevance to the residential sector will be discussed.

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1 "ISO 9000 well suited to procurement activities", by Reginald N. Shaughnessy (International Chairman, ISO/TC 176), in *Consensus*, Summer issue, 1993, Standards Council of Canada.

Exhibit 2-6: The Twenty Elements of ISO 9000[1]

	ISO 9001	ISO 9002	ISO 9003
1. Management responsibility	●	●	●
2. Quality system	●	●	●
3. Contract review	●	●	○
4. Design control	●	○	○
5. Document control	●	●	●
6. Purchasing	●	●	○
7. Purchaser supplied products	●	●	○
8. Product identification and traceability	●	●	●
9. Process control	●	●	○
10. Inspection and testing	●	●	●
11. Inspection, measuring & test equipment	●	●	●
12. Inspection and test status	●	●	●
13. Control of non-conforming products	●	●	●
14. Corrective action	●	●	○
15. Handling, storage, packaging & delivery	●	●	●
16. Quality records	●	●	●
17. Internal quality audits	●	●	○
18. Training	●	●	●
19. Servicing	●	○	○
20. Statistical techniques	●	●	●

● = element is required
○ = element is not required

[1] These elements are discussed in more detail in Section IV.

III. THE INCREASING IMPORTANCE OF ISO 9000 STANDARDS

There is today a growing and real interest in excellent quality for goods and services amongst business, government, producers and consumers. Managing for best quality results is now not only desirable, but also necessary.

Global markets, in all industries (including housing manufactured products) have become so intensely competitive with product variety, and multiple options for purchasers, that it is now fairly easy to demand and receive quality products and services at competitive prices.

3.1 Proliferation of the Standards

Current world marketplace trends and free trade practices, and agreements between countries of different regions (e.g., NAFTA, European Community, Association of Southeast Asian Nations--ASEAN) are driving many standards users toward strategic recognition that they need and should conform to International Standards. The ISO 9000 standards, and the plans for continuing additions and modification of these standards, to the turn of the century and beyond, are intended to provide the needed scope, content, and flexibility to meet current and emerging marketplace needs for quality assurance in business transactions.

The ISO 9000 family of standards are now being used worldwide in many industry/economic sectors for products of all kinds. In the few years since their first publication in 1987, the influence of these international quality management standards has grown enormously. All industrialized countries of the world have adopted the ISO 9000 series as national quality management standards, and most have put in place accreditation and registration systems to back up the implementation process for ISO 9000.

The surge in the demand for ISO 9000 registration of organizations around the world has come from several quarters, including the following:

- government departments adopting ISO 9000 as a procurement requirement;

- large corporations such as IBM, Mercedes Benz, General Electric, the Big Three (General Motors Corp., Ford Motor Co. and Chrysler Corp.), and many others, requiring their suppliers to conform to the standards;

- regional organizations such as the European Community recommending use of the standards as a basis for quality assurance in cross-border contractual situations;

- subsidiaries of multinational companies which are implementing ISO 9000 globally;

- companies whether joint ventures or completely domestic-controlled, which are widening their export markets;

- companies which are strengthening their domestic market base, while seeking to increase their exports to existing and new foreign markets; and

- companies which are not yet export-oriented but operate stringent safety measures in their operations.

3.2 Canada

Federal Government Procurement: The Canadian government has formally adopted the ISO 9000 series of quality standards as a government procurement quality assurance system. Government Services Canada (GSC) is committed to phasing in the standards over the next few years. ISO 9000 requirements for microcomputer purchases are already mandatory and application of the standards to business furniture and aerospace products have been targeted. Other products and services are also being considered by the federal government for ISO 9000 conformance, for the purpose of procurement.

Supplier Quality Initiative: The Supplier Quality Initiative (a joint GSC and Industry Canada initiative) is promoting the proliferation of conformance to the standards, so that Canadian industry can have a competitive edge in markets around the world.

This initiative seeks to make the federal government itself a demanding customer. An industry consultation group with representatives from ISC, GSC, and other major buying departments, industry organizations, and quality practitioners are helping shape the terms of the new procurement initiative.

The SQI also involves the preparation of supplier and consultant training packages, to help the adjustment process towards conformance with ISO 9000 standards. Some packages have already been developed in this context.[1]

Detailed consultations with key stakeholders is ongoing. This includes: industry representatives and associations, sector branches, regional offices, other government departments (such as DND and Treasury Board), and accredited registering bodies (e.g., Quality Management Institute and Canadian General Standards Board).

GSC and IC are working with suppliers and federal government departments to reach the new quality goals through a "partnership" arrangement. Advisory committees for each industry sector will help phase in the new requirements. The advisory committees include interested suppliers, GSC buyers, IC representatives, other federal department representatives and industry associations.

These advisory committees will "decide which of the three ISO 9000 models apply to their sectors. They'll look at what tools industry needs to upgrade to the standards and set the timeframes for registration."[2]

The advisory committees will continue to advise GSC and IC on industry needs after the standards are in place.

The Supplier Quality Initiative is being managed by the Centre for Supplier Promotion of GSC and the Services to Business Branch of IC.

Department of National Defence: The Department of National Defence (DND) has already started to phase in ISO 9000 series for procurement purposes. The seventy or so major military suppliers of DND already meet many of the ISO 9000 standards requirements under the Allied Quality Assurance Publications (AQAP) standards. These companies are now being encouraged to start adopting ISO 9000 standards as a basis for quality

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1 See, for example, ISO 9000: Making Quality Happen, by Devon Hunter Consulting, May 1993, Issue 2.

2 "Your ticket to world-class quality", outline on Supplier Quality Initiative, Supply and Services Canada and Industry, Science and Technology Canada, Ottawa, June 1993.

assurance.

DND has opted to adopt the ISO 9000 series as their main quality requirements, to provide a single standard for both contract quality requirements and registration of quality systems. The focus on a single standard, plus the international acceptance of ISO as the recognized commercial standard, is expected to enhance Canadian contractors' quality programs and their competitiveness in the world market.

Implementation of ISO 9000 started at DND as of May 1, 1993. The Department, at this point in time, however, is not requiring its suppliers to be registered for ISO 9000. To ensure a positive transition, the Department is undergoing an extensive awareness and training campaign. Training of personnel, in field offices and at headquarters, has been taking place over the past several months. Information briefings to industry, other DND staff and other government departments is ongoing.

<u>Assistance Programs</u>: Canada has a selection of regional development programs (Western Economic Diversification Program, Atlantic Canada Opportunities Agency, Federal Office of Regional Development--FORD-Q, and FedNor Business Incentive Program) which are appropriate for assistance to companies, particularly small and medium sized firms, to adapt to ISO 9000 standards. Provincial programs are also being tapped for aid related to implementation of quality standards (e.g., New Brunswick Quality Assurance Program, Enterprise Newfoundland and Labrador Corporation, and others).

<u>Registered Firms</u>: The number of Canadian firms currently registered to ISO 9000 are over 700. In addition to these firms, many more are now preparing themselves for registration and/or currently conform to all or to elements of these standards, but are not yet registered, but are planning to apply for registration.

Several key manufacturing industries are involved in registration activities. Most of the firms are registered for ISO 9002 or ISO 9003. The more comprehensive standard, ISO 9001, accounts for roughly 15 percent of the total firms that are currently registered in Canada.

<u>Industry Associations</u>: Many industry associations are actively promoting ISO 9000 registration. The Canadian Manufacturers Association, for example, has projected a need for 7,500 manufacturing firms by 1998 to build a competitive quality infrastructure in Canada. CMA provides an ISO 9000

quality systems service to its members, to help them conform to the requirements of the standards.

Other associations are also looking into how they may help their members begin the road to ISO 9000 compliance. The Canadian Manufactured Housing Institute,[1] in its recent Annual Meeting and Conference, in Vancouver (March 1994), introduced ISO 9000 in its series of seminars presented during the Conference. Many of the attendees expressed interest in the application of the standards to manufactured housing processes, and a few have already begun to examine the requirements to convert to ISO 9000 compliance.[2]

Canadian industry sectors that have been most active, to date, in adopting ISO 9000 standards are paper and allied products; fabricated metal products and primary metal industries; electronic and other electrical equipment and components; industrial and commercial (particularly computer) equipment; and chemicals and allied products -- some because it is a requirement to do business; and some because they are convinced that ISO 9000 will give them a competitive advantage.

There are companies almost in every industrial sector in Canada that are now actively pursuing quality management as a competitive tool, and ISO 9000 is the standard being considered by these companies. Canadian General Standards Board (CGSB) officials (CGSB is one of the accredited Canadian registrars for ISO 9000 systems) have suggested that the ISO 9000 implementation business could become a $1 billion industry in North America over the next few years.

Residential Industry Applications: In the residential products and related industries sectors, there are a few companies already on their way to ISO 9000 compliance, or are investigating the implications. In Canada, for example, Triple E Homes Ltd. of Lethbridge, Ontario, have begun their journey towards ISO 9000 compliance.[3]

Mr. Rod R. Kardam of Dayliter, the second largest skylights company in

[1] CMHI recently changed its name to Manufactured Housing Association.

[2] More will be discussed about this in Sections 4 and 5.

[3] In a brief discussion with Mr. R.W.(Bob) Lenz, President of Triple E, at the CMHI Annual Conference, the author was told that Triple E is currently in the process of implementing ISO 9000 requirements.

Canada, also indicated to the author, at the CMHI Annual Conference, of his company's interest in introducing ISO 9000 to his firm.

Another example of ISO 9000 application in the residential industry is the architectural firm of Michael Byrne and Associates in Halifax, Nova Scotia. This firm is also apparently well on its way to introducing ISO 9001. They have recently expanded and developed a new subsidiary, and their success is being attributed to having adopted ISO 9000 principles in their operations.

Canadian Construction Materials Centre (CCMC): Another residential construction related application of ISO 9000 is being introduced by CCMC of the Institute for Research in Construction (National Research Council). CCMC offers a national evaluation service for innovative materials, products, systems and services in all types of construction. CCMC's objective is to help the construction industry meet the challenge of competition in the market-place at home and abroad. CCMC Listings and Reports of evaluations of products are recognized nationally by regulatory agencies as a basis for determining the suitability of products.

As part of the product evaluation process, the proponent for a new product to be tested will be required by CCMC to provide evidence that all finished construction products are of a consistent quality equal to or greater than the level represented by the sample being tested and evaluated. In this respect, CCMC will require the ISO 9000 standard as a minimum requirement for quality assurance to be used by proponents requesting evaluation. Evidence of quality assurance may be demonstrated by the proponent being certified to ISO 9003 or higher. CCMC generally recommends that a proponent consider the ISO 9002 standard for products that could benefit from operating under a program that addresses quality assurance throughout the production process and installation of the product. CCMC arrived to this approach after consultation with experts and the need to balance credible evaluations against the impact on the proponents.

Council of Forest Industries (COFI): The COFI appointed a Task Group to examine the implications of ISO 9000 for the forest industry. The Task Group met with members of the industry and made recommendations for further study of the standards in connection with the market benefits of adopting the standards. Some wood products companies such as Northwood in Prince George and Weldwood of Canada are looking into becoming ISO 9000 compliant. The Task Group concluded that there are some practical benefits to ISO 9000 adoption: from an image perspective (providing assurance of commitment to quality) and from the safety and reliability point of view.

The next steps to consider is to look into how to rewrite existing practices and quality procedures in the forest industries to conform with ISO 9001. Within COFI they are training auditors for ISO 9000 and are considering becoming a quality registrar themselves.

3.3 United States of America

The U.S. government is considered to be the world's largest purchaser of goods and services. Purchases by military and civilian government installations averaged about $US 185 billion annually in recent years (with over $US 190 billion in each of 1990 and 1991). The government buys just about every category of commodities and services available. The Department of Defense (DoD) is the largest of the government purchasers, accounting for over 70 percent of total contract dollar awards.[1]

It is therefore quite significant that the U.S. federal government is now beginning to introduce ISO 9000 as a quality assurance system in contractual situations. DoD, for example, has formally adopted the standard and, although moving cautiously through a transition period to allow contractors to adjust smoothly from existing military standards to the use of the ISO 9000 series, DoD is encouraging companies to become compliant with ISO 9000.

The U.S. federal government has many players acting independently to implement policy on ISO 9000 standards (with no consolidated government strategy), and many are looking into the usefulness of the ISO 9000 standards within the context of their regulatory (e.g., for medical devices--Food and Drug Administration) and procurement programs.

At this point, in the U.S., there are no active financial assistance programs (awards/grants) which directly aid businesses to adjust to ISO 9000 standards requirements. There are, however, various actual (and potential) support programs which provide (or could provide) counseling, information and training for this purpose. For example, one of the Manufacturing Technology Centers (of NIST's MTC program) has developed a package (workshops, seminars, training modules) and established a Quality Systems Resource Facility to assist small manufacturing firms with becoming registered to ISO

[1] The State of Small Business: A Report of the President, Small Business Administration, transmitted to the Congress, 1992, Appendix C.

9000 standards. It is anticipated that this package will be used as a benchmark that will be extended to the other MTC's throughout the country.

In the U.S. some state trade assistance/ development authorities, alone or in conjunction with local colleges and universities have begun providing training or offer other assistance, to support firms to achieve compliance with ISO 9000 requirements.

The National Institute of Standards and Technology (NIST) is heading an Interagency Committee on Standards Policy (ICSP). This Committee has set up an ISO 9000 working group which acts as a clearinghouse for the dissemination of agency activities related to the ISO 9000 Standards. Several of the ICSP members have reported their specific activities related to ISO 9000. NIST has compiled a summary of these activities which include initiatives of Department of Commerce, Food and Drug Administration, Department of Defence, Department of Energy, Department of Health and Human Services, U.S. International Trade Commission, and many others.

In the U.S. an increasing number of companies are seeking quality system registration to one of the ISO 9000 standards. The number of ISO 9000 registered companies in the Summer 1992 *Register Company Directory* published by CEEM Information Services were over 400, and by December 21, 1992 this figure had risen to 621. As of March 1, 1994, ISO 9000 registered firms in the U.S. were 2,892 (CEEM Information Services), and these figures will continue to rise, as the number of companies that are currently involved in ISO 9000 implementation programs in North America are estimated to be in the 1,000s.

The top 12 list of U.S. companies and their subsidiaries that had recorded the greatest number of ISO 9000 registration certificates as of March 1, 1994 is as follows:

COMPANY	No. of Sites
E.I. duPont de Nemours & Co. Inc	74
Minnesota Mining & Mfg. Co.	56
IBM Corporation	39
AT&T	38
General Electric Company	33
Square D Company	29
Union Carbide Chemicals & Plastics Co. Inc.	25
Eastman Kodak Company	25

Hewlett-Packard	24
NCR Corporation	22
Digital Equipment Corporation	21
Union Camp Corporation	21

Engineering and Construction Firms: Some engineering and construction firms in the U.S. have taken the ISO 9000 registration route. M.W. Kellogg, a Houston-based international engineering and construction firm, and John Brown, another U.S. engineering firm, are two examples.[1] Statistics from branches of John Brown show that projects having an active, audited quality program turn more profit and have fewer accidents than those that don't.

3.4 Japan

The Standardization Division of the Ministry for Industrial Science and Technology, Ministry of International Trade and Industry (MIST/MITI), has advised[2] that Japanese government procurement represents only a "small portion" of the overall economic activities in Japan, and, as such, its influence on standards setting is minimal. There are no specific government policies for encouraging adoption of quality systems standards such as ISO 9000 series.

The setting of standards is done through a consensus building process, coordinated by the Japanese Industrial Standards Committee (JISC). It is not the practice in Japan for government to unilaterally impose a standard on industry. On industry's side, the view is that once a standard has been set, and by definition agreed to by industry, there is no need for government to stimulate acceptance or application of the standard through its procurement activities.

JISC is working to make the Japanese Industrial Standards, where appropriate, compatible with ISO standards. Over 400 Japanese firms have received ISO 9000 designation. Essentially all of these companies are exporting to Europe, therefore obtaining the ISO 9000 designation is essential for them.

However, the Japanese government, in its procurement activities, uses

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[1] See reference in March 1, 1993 issue of *Construction and Engineering*, p. 15.

[2] This information was supplied by Canada's S&T counselor in Tokyo.

Japanese industrial standards, and apparently will continue to do so -- since they believe them to be higher than the ISO 9000 series.

In Japan, there has been some competition, however, between ISO 9000 and the existing quality conformance system -- Company Wide Quality Control, or CWQC -- which was standardized through a process that began decades ago when Deming first began working in that country. For the average Japanese company, compared to Western companies, complying to ISO 9000 is a shorter process, because so much of the ISO 9000 standards overlap with CWQC.

Regarding support programs to encourage companies to meet Japan's own quality standards, there does not appear to be any programs specifically intended for this purpose.

The Japanese do, however, operate "networks" of research and technology centers across Japan (approximately 180), which assist companies to develop and adopt new technology. These centers, called "kohsetsushi", provide product testing services, product development research and training programs. These activities, by their nature, assist companies to improve their quality and help them adjust to meet required standards, whether these be national or international standards.

3.5 Australia and New Zealand

Both Australia and New Zealand have adopted ISO 9000 series as their national quality standards for business and for government procurement purposes (including military purchasing). The two countries have established, by treaty, a Joint Accreditation System.

Government departments decide which purchases will require ISO 9000 compliance. Whenever a government buyer has identified the need for compliance this is specified in the request for proposals.

A number of support mechanisms are in place both in Australia and New Zealand, for aiding small and medium sized companies to adjust to the national adoption of international standards such as ISO 9000 series. Both countries, respectively, appear to have adopted a strategic approach towards standards and recognize their significant role and impact on international competitiveness of their national industries.

The accredited certification bodies in both these countries assess suppliers' quality systems against the requirements of ISO 9000 series, known as AS 3900-1987 (in Australia) and NZS 9000-1990 (in New Zealand). European standards bodies are working to establish a single system based on mutual recognition of accreditation bodies. JAS-ANZ (the Joint Accreditation System of Australia and New Zealand) is working to achieve mutual recognition with these and other national/regional bodies around the world.

In its policy statement regarding quality, the Australian government notes that government purchasers will seek quality assurance, in general, when:

- performance or outcome is important; and
- there will be a net benefit to the Commonwealth.[1]

Government buyers decide which goods and services should conform with ISO 9000 series by considering:

- the consequences of failure and/or non-compliance with specifications or expected performance;
- the risk to health and safety and/or property due to failure and/or non-compliance;
- the performance history of particular categories of goods and services; and
- the objectives of other Commonwealth policies.

Quality Support Programs: The Australian federal government provides support to firms in adopting quality requirements through the National Industry Extension Service program. The NIES is a joint Australian Commonwealth/State venture offering advisory and referral services and subsidy assistance to small and medium sized firms in the manufacturing industry to improve business efficiency and international competitiveness. About $A 5 million was spent by the Commonwealth under the NIES in 1990-91 and a further $A 10.5 million was paid to the States and Territories as their component of the NIES. The NIES was extended in 1991, as a government industry service, to June 30, 1995.

The NIES has developed packages of quality enhancement programs which, through the use of licensed quality consultants and workshops, NIES

[1] "Quality Assurance for suppliers, a quick quide to the Commonwealth's Quality Assurance Policy", Australian government publication, 1993.

products can help businesses to understand the steps necessary to adopt quality management principles (ISO 9000) and maintain international competitiveness.

Three years ago an Australian Quality Council was established as a prime focus for the encouragement and development of quality within Australian companies. Those companies which achieve excellence in the area of quality receive recognition for their achievements and an opportunity to be a role model for other companies aspiring to excellence. Through the Australian Quality Council, a range of awards recognize quality achievements by Australian companies.

In New Zealand the government's business development policy is generally aimed at assisting regions to identify and capitalize on their own opportunities for development. As part of this policy the Government provides targeted assistance through its Business Development Program, Ministry of Commerce. The objective of the Business Development Program is to encourage New Zealand businesses to become more innovative and internationally competitive (e.g., through adopting ISO 9000 standards). Currently the program comprises a network of 21 Business Development Boards, three grant schemes, and the ExcelleNZ quality products program.

One of the major responsibilities of the Business Development Boards is to administer the Business Development Program Grant schemes. The Expert Assistance Grant Scheme provides up to $NZ 8,000 for firms to engage consultants in key management areas (e.g., quality assurance--ISO 9000) where better performance will lead to sustainable improvements in efficiency and competitiveness.

The Ministry of Commerce, under the brand name "ExcelleNZ", delivers a package of quality enhancement programs licensed from the Australian National Industry Extension Service. ExcelleNZ incorporates Total Quality Management and world competitive manufacturing practices (ISO 9000). Through the use of licensed quality consultants and workshops ExcelleNZ products helps businesses adopt quality management principles.

3.6 ASEAN

ISO 9000 lies at the heart of the upgrading efforts by the ASEAN countries (Association of Southeast Asian Nations, comprising Brunei, Indonesia, Malaysia, Philippines, Singapore and Thailand), to help increase the competitiveness of their industries in national, regional and international markets. In these countries, ISO 9000 is not a mandatory standard, but the goal of customer satisfaction has led many market-driven companies to rely on ISO 9000 for guidance.

The ISO 9000 series has been adopted as a national standard in all ASEAN countries, and each have their national certification scheme in operation. ISO 9000 is a subject of major training and promotional programs in all ASEAN countries. National standards bodies have been joined by prominent national political and business leaders in promoting its use.

Certified or applicant companies in these countries come from such industries as electronics, telecommunications, chemicals, food and beverages, automotive, construction, medical devices and services.

3.7 Hong Kong

The government of Hong Kong adopted the ISO 9000 series almost immediately after their publication. One interesting application in Hong Kong is by the Hong Kong Housing Department.

The Hong Kong Housing Department is requiring all building contractors to achieve ISO 9000 certification. The following category of contractors will also be required to achieve ISO certification:

Contractors Category	Anticipated date of implementation
piling contractors	Dec. 1, 1995
demolition contractors	Apr. 1, 1995
electrical contractors	Oct. 1, 1995
lift and escalators contractors	Oct. 1, 1995
fire services and water pump contractors	Oct. 1, 1995
air conditioning and ventilation contractors	Oct. 1, 1995

Currently, 25 percent of building contractors doing business with the Housing Authority of Hong Kong (total number of contractors are 130) are certified to ISO 9002; 65 percent have either applied for certification or are in the process of applying. The remaining 10 percent have no intention of applying for certification.

One of the motivations of the Housing Authority in requiring their contractors to comply with ISO 9000, is to put in place a quality assurance system which will ensure that building construction practices will provide for the safety of residents and will protect the Authority against litigation due to inferior workmanship. ISO 9000 audits of the contractors procedures and work processes also lessens the requirements for multiple inspections by the Authority.

3.8 European Community (EC)

The European Community directives have opened up national procurement and have engendered a process of harmonization of national standards and the development of new European standards which are largely adopted from the international standardization bodies.

The movement towards an integrated market requires the opening up of national public procurement markets to other EC members, which collectively are worth about 10 per cent of the EC's GDP. Directives have been set in place aimed at eliminating discrimination in national public procurement. These directives are consistent with the rules in the GATT Agreement on Government Procurement (GPA).

Every procurement contract, above certain thresholds must be advertised throughout Europe through inclusion in the Official Journal of the European Community. In the utilities and construction sectors advertising may take the form of a qualification system.

Common technical specifications are needed to support the move to an EC wide procurement policy. Therefore the harmonization of standards is essential. The EC directives on procurement require reference in specifications to national standards which implement any European standards which are relevant, or the European standards where these alone exist. The latter is increasingly becoming the case.

Regarding the ISO 9000 quality standards, the EC Commission has made the following statement:

> "The Commission upholds ISO 9000 in the form of EN 29000 as a European standard, compliance with which will help companies to supply consistently, and, therefore, to be better placed to meet the

requirements of tenders."[1]

The European Community issued a Construction Products Directive in December 1988 which was to be adopted by the 12 EC national governments. This Directive established mandatory requirements for building construction, building materials and all equipment installed in buildings. Construction products were defined as those "produced for incorporation in a permanent manner in construction works, including both building and civil engineering works." The essential requirements in this directive cover six general areas: mechanical resistance and stability; safety in case of fire; hygiene, health, and the environment; safety in use; protection against noise; energy economy and heat retention.[2]

The construction products directive has also recommended that products be manufactured under "factory production controls" such as the ISO 9000 requirements.

The impact of the construction products directive on North American manufacturers of building products who plan to market in Europe is that they should initiate action to implement a quality assurance program based on the provisions of ISO 9000 standards for the production of products to be sold in Europe.

The EC construction products market is valued at approximately $270 billion (Canadian) per annum, of which approximately 15 percent comprises timber and wood products.

3.9 United Kingdom

In the U.K., the mandatory requirement to conform to the ISO 9000 standard to qualify for defense procurement was the principal catalytic factor which resulted in a large number of firms (i.e. some 25,000) adopting the standard.

In turn, this requirement has led to a large uptake (60%) of the major support program for small and medium sized firms, the Enterprise Initiative, for quality management assistance.

In 1979, the Ministry of Defence (MOD) launched the ISO 9000 movement by requiring the BS 5750 (equivalent to ISO 9000) quality standards from its

[1] Official Journal of the EC, No. C145/39, May 25, 1993.

[2] D. Mackay, "EC 1992 and the Construction Products Directive," ASTM Standardization News, February 1992, p.48.

prime contractors. The purpose for imposing BS 5750 was to improve the poor quality image of British industry. In turn, prime contractors encouraged their suppliers to adapt the BS 5750 standards. Some prime contractors made this requirement mandatory. Other government departments began to uphold the BS 5750 standard. This cascading effect has apparently resulted in some 25,000 firms currently conforming to the BS 5750 standard.[1]

The Department of Trade and Industry (DTI) is actively promoting the adoption of BS 5750, which is equivalent to the European EN 29000 standard (which is identical to ISO 9000), so that British firms can be more competitive within the EC.

The principal U.K. program aimed at supporting small and medium sized firms is the Enterprise Initiative Program which is a comprehensive, self-help package of advice, assistance and guidance from DTI to help businesses improve their cutting edge at home, across the Single European Market and beyond.

Consultancy help is available to most manufacturing and service businesses and groups with fewer than 500 employees. It comes as confidential guidance and advice from independent consultants in key management areas including business planning, design, financial and management information systems, manufacturing and services systems, marketing and quality. DTI will subsidize most of a consultancy project lasting between five and 15 days. Sixty per cent of the uptake of this aspect of the program is for quality management assistance.

This program provides information and advice on the integrated management of design, quality, manufacturing, and purchasing and supply.

3.10 France

France has set in place a structure that links standards to industrial strategy and to public procurement.

It is obligatory in public procurements to refer to French and/or European standards if they exist. Otherwise, a specification has to be formulated.
As well as having the usual programs that support firms, there are two programs aimed directly at assisting firms with standardization. One program is the "Partenaires pour l'Europe", the other is the extension of the definition of the research tax credit to include standards related expendi-

[1] In some contracts, sub-contractors could also be required to conform to ISO 9000.

tures. These programs can be used by firms to help them develop quality systems to comply with ISO 9000.

In France, some 2,000 firms are currently certified to ISO 9000, and more are in the process of complying to the standards.

3.11 Globalization of ISO 9000

Global acceptance of ISO 9000 registrations across borders is not yet a full reality. Most registrars across the globe, however, are busy concluding mutual recognition agreements (MRA) which allow companies to register in one country and have their registration recognized in another. This is the case between Canada and the United States, and between Canada and many of its European partners. Canadian quality registrations organizations, such as Quality Management Institute, Canadian General Standards Board, and SGS International Certification Services Canada, have already established MRAs with counterparts across the globe.

ISO 9000 registration, and other conformity mechanisms for international standards, can pave the way for selling products across national borders and be used to facilitate global trade. A major reason for many of the free trade agreements evolving around the world is to facilitate a harmonized environment where products could move freely. If the registrar is a recognized body--accredited by a national authority--audit results will become transparent and comparable throughout the world.

3.12 Summing Up

This section has demonstrated that ISO 9000 quality standards are now being adopted worldwide, by governments for procurement purposes and within the private sector. All countries described in this study recognize the significance of these standards for developing and maintaining the competitive position of their industrial sectors. Several government programs have been introduced in some countries which directly assist firms to adjust to the requirements of ISO 9000 series.

In Canada, the ISO 9000 series has been formally adopted by the federal government, for procurement purposes. However, opportunities for program assistance to encourage the actual adoption of quality standards, particularly by small and medium sized firms, have not been fully explored.

The next sections of this report will deal with ISO 9000 as it could apply specifically to the residential building products and construction industry.

IV. ISO 9000 STANDARDS AND THE RESIDENTIAL CONSTRUCTION INDUSTRY

4.1 Relation of the ISO 9000 Standards to Existing Standards in the Residential Construction Industry

The ISO 9000 series do not replace existing standards of building materials, products and processes. ISO 9001, 9002 and 9003 are quality assurance standards. This basically means that these standards are intended to provide adequate confidence to customers/purchasers that a producer (e.g., manufacturer of housing components/systems) will fulfill requirements for quality (e.g., existing performance standards) within the production stages. This means that a quality management system is in place, with work procedures and practices that are followed as planned and documented, and that this is demonstrated with assurance that existing standards are met as required.

Traditionally, in the residential construction industry a system of inspections and tests is the approach used for quality assurance. Inspection and testing are also a part of ISO 9000. What ISO 9000 adds to the process, however, involves other requirements before and after the inspection and testing phases (e.g., management requirements for contractual relationships, purchasing controls, product identification and traceability, packaging and storage of materials).

ISO 9000 is a system for management of process quality. Process quality is directly related to the procedures in place at every stage of the production line involved in producing building products, or in the construction process itself. Process quality could also pertain to the quality level achieved by subcontractors, manufacturers and suppliers.

Canadian homes are well built and reflect some of the highest standards of construction in the world. However, builders usually wait until a project is well along before applying detailed inspections and post-production adjustments to ensure quality. This could add significantly to the costs of construction. ISO 9000 provides a means for controlling construction quality through **prevention** as opposed to correction. Correction increases costs, and prevention reduces it.

To help explain what ISO 9000 is about and how it could contribute to quality in the residential construction sector, a comparison is in order. To encourage the U.S. housing industry to pursue quality improvement, the National Association of Home Builders (NAHB) Research Center and *Professional Builder & Remodeler* magazine began sponsoring a U.S. National Housing Quality Award in 1992. The award recognizes U.S. home building firms that excel in housing and management quality. Modeled after NIST's Malcolm Baldridge National Quality Awards (see page 14), this program has been designed to challenge builders in creating quality-driven companies. The role of quality in control systems, management, and new home design and construction techniques are judged based on eight basic criteria.

These criteria are: leadership (e.g., overall quality values of the company), business planning, customer focus and satisfaction, management of process quality, human resource development and management, information and analysis (e.g., market intelligence), quality planning and operations results, and finished product quality. The awards are given out annually to a handful of companies (eight in 1993).[1]

What is the difference between ISO 9000 and the NAHB quality awards? While both these quality systems focus on quality in the production process, they have differences which include:

- ISO 9000 is an international standard recognized by almost all countries in the world (NAHB awards program is U.S. based);

- ISO 9000 is accessible to a broader base of firms, it is not an "award" or prize that a company wins by achieving a higher level of quality compared to other applicants, but rather a company gets certified/registered to ISO 9000 based on compliance to set standards and based on an audit by a third-party accredited organization;

- under ISO 9000 any firm involved in a production process for a good or service can apply and achieve certification (under NAHB only a select few get chosen);

- maintaining ISO 9000 certification requires ongoing commitment by the registered company (achieving registration is only the start, maintaining the system requires surveillance audits--e.g., annually--there are no surveillance audits under the NAHB awards program);

[1] *A Builder's Introduction to Total Quality Management*, by F.Gary Lewis, NAHB Research Center, 1993.

- ISO 9000 could be a quality management system for builders, manufacturers and other participants in the residential construction business (NAHB awards are for builders only);

- ISO 9000 provides a distinct competitive advantage for companies doing international, cross-border business.

4.2 The Elements of ISO 9000

The residential construction industry is made up of a number of players, including builders, contractors, manufacturers of housing or building products, regulatory authorities (federal, provincial and municipal) and, of course, the users of buildings (owners and tenants).

What could ISO 9000 standards mean to these stakeholders in the residential building industry?

The answer to this question lies partly in the specific elements of the standards. A good understanding of these elements and how they each relate to the production process is necessary.

ISO 9001 covers all the twenty elements of the standards. These elements are, therefore, discussed below in the context of ISO 9001.

First, a description of each element and the requirements that need to be in place to achieve compliance to ISO 9001 are presented (Sections 4.2.1 to 4.2.20).

An interpretation of the relevance of ISO 9000 and practical implications of applying these standards to the residential industry are also discussed (Section 4.3).

Not all of the ISO 9001 elements are of the same relevance to all organizations. There is room for interpretation in terms of emphasis and applicability, depending on the scope of implementation of the standards.

The application of the standards should be scoped based on:

(i) The organizational breadth of coverage: for example, are all plants/divisions of the company to be included? A specific plant of a manufacturing firm, or a department (e.g., purchasing or marketing) of a company, could become ISO 9000 registered.

(ii) The functional depth: at this level, a specific product line, or several product lines, of a company could be registered for the full product life cycle from design to production and distribution (this covered by ISO 9001); or the design phase and after-sales services could be excluded (as in ISO 9002).

(iii) The choice of the ISO 9000 model required: depending on the scope of implementation (breadth and depth), the appropriate ISO 9000 model should be chosen (see Section 2.2).

The ISO 9000 series is generic, so it can be applied to a wide number of industries. As a result, the elements of the standards are open to interpretation. This means that highly trained quality auditors and consultants, who understand quality systems and have specific industry experience, are needed to assess specific applications of the standards. The descriptions of the elements provided below are appropriate to all residential industry participants, but are specifically appropriate to supplier-customer contractual situations involving housing products and materials manufacturers and builders.

4.2.1 Management Responsibility

This element deals with management commitment to a quality culture. The companies top management needs to develop a quality policy and quality objectives, and demonstrate its commitment to quality. While the objectives should be ambitious they should also be achievable.

Requirements:[1]
- Management is familiar with quality policies.
- Top management person is responsible for quality.
- Top management person periodically assesses quality system.
- Quality responsibilities, authorities and interrelationships are defined.

4.2.2 Quality Systems

A quality system is usually documented by means of a quality manual. The

1 Lists of requirements in each of the following sections are adapted from T.Zahner, "Quality Assurance Certificates: How, Where and Why," Zurich, Switzerland: Swiss Association for Quality Assurance Certificates, 1991. Auditors basically follow similar procedures for determining compliance to ISO 9000, whether they are from Switzerland or Canada.

documented quality system needs to be appropriate, practical, up to date, correspond to what really happens and be effectively implemented.

> Requirements:
> - Quality systems are described in quality handbooks or manuals.
> - Quality documentation reflects ISO requirements.
> - Knowledge of quality systems is appropriate to the organizational level & function.

4.2.3 Contract Review

This element is concerned with developing a thorough understanding of the purchaser's needs, at the formulation of the contract, including at the tendering stage, and in subsequent stages. There needs to be procedures in place to cover contract reviews, on an individual contract basis concerning specifications, contractual obligations and capability to meet them.

> Requirements:
> - All contracts are reviewed for ability to meet specifications.
> - Quality-relevant features are identified in contracts.
> - Production or other procedures are developed to meet contract requirements.
> - Contract-review records are maintained.

4.2.4 Design Control

Deficient design can be a major cause of quality problems. ISO 9001 focuses on essential quality aspects such as safety, performance, and dependability of the product. These quality aspects are established during the design and development phase.

> Requirements:
> - Design procedures are developed.
> - Design plans identify responsibilities, time-lines, budgets, etc.
> - Technical design interfaces are identified.
> - Design input requirements are identified.
> - Designs are reviewed and approved by appropriate parties.
> - Design modifications are reviewed and approved by appropriate parties.

4.2.5 Document Control

Appropriate documents need to be available at all essential locations and records of changes need to be kept as they are made.

Procedures governing approval and issue of documents and for their modification need to be established. After a predetermined number of changes have been made, essential documents need to be reissued.

Requirements: - All quality documents are reviewed and approved. - Document production, verification, approval, distribution, and filing is controlled. - Document amendments are reviewed and approved. - Master list of modified documents is maintained.

4.2.6 Purchasing

This element is primarily focussed on ensuring that purchased equipment, materials and services (from sub-contractors) are to specified requirements as well as regulatory requirements. Incoming material may not be used until it has been inspected and verified as conforming to specifications.

Requirements: - Supplied products satisfy requirements. - Purchasing documents are accurate, complete and current. - Suppliers are selected and monitored based on their ability to satisfy customer requirements. - Assessment criteria are identified. - Supplied products are inspected and/or tested.

4.2.7 Purchaser Supplied Products

A purchaser supplied product is a product owned by the purchaser and provided to the supplier for use in meeting the requirements of a contract. A procedure needs to be in place to make sure that such a product is in the correct quantity, has been received and identified, is undamaged and has been inspected and appropriately stored.

Requirements: - Purchased products are stored and handled properly. - Nonconforming products are segregated and supplier is informed of their condition.

4.2.8 Product Identification and Traceability

Traceability means that a product can be identified from specification through all stages of production, delivery and installation, including either individual item or batch identification. To achieve traceability, the supplier needs to identify products by marking or tagging them or the containers they put in (e.g., using serial numbers, date codes, batch codes, lot numbers). The identifiers should be unique to the source of operation.

> <u>Requirements</u>:
> - Products are identified throughout production.
> - Unique products or batches are tagged.

4.2.9 <u>Process Control</u>

The control of processes to prevent nonconformities from occurring is preferable to inspection of finished products or services. Prevention is cheaper and more efficient than correction after the fact. Work instructions need to be written, to identify the manner of manufacturing or processing, suitable manufacturing equipment and any special working environment needs.

> <u>Requirements</u>:
> - Documentation defines process requirements.
> - Production and installation requirements are defined and controlled.
> - Production and installation processes are approved.
> - Special processes are monitored and controlled.
> - Production personnel are qualified.

4.2.10 <u>Inspection and Testing</u>

This element of ISO 9001 is to ensure that procedures are implemented to ensure that inspection and testing takes place (i) for procured items, to verify that sub-contractors have fulfilled their contractual obligations; (ii) for products in process, to allow for early recognition of nonconformities and timely disposition of the product; and (iii) for finished products, to complete the evidence of their full conformance with specified requirements..

> <u>Requirements</u>:
> - Incoming materials are inspected and/or tested. .
> - In-process materials are inspected and/or tested.
> - Before released for delivery, final products are inspected and/or tested.
> - Inspection and testing procedural documents are accurate, complete and current.
> - Documents are available for review.

4.2.11 <u>Inspection, Measuring and Test Equipment</u>

Calibration of inspection and test equipment needs to follow international or national standards. Where these standards do not exist, the basis for calibration needs to be documented. Generally, written calibration procedures are required which include details of inspection and test equipment, frequency of calibration, methods of calibration and limits of accuracy.

> <u>Requirements</u>:
> - Inspection, measuring and testing equipment are controlled.
> - Measurability and accuracy of equipment are ensured.
> - All measuring equipment is identified.
> - Measuring equipment is referenced to international and national standards.

4.2.12 <u>Inspection and Test Status</u>

The quality system should also have built into it procedures that ensure that at all times it is possible to know the status of interim products: i.e., whether they have not yet been inspected, inspected and accepted or not accepted, as appropriate.

> <u>Requirements</u>:
> - Inspection and/or testing status of products is positively identified.
> - Status records are accurate, complete and current.

4.2.13 <u>Control of Nonconforming Products</u>

The identification of items that do not conform to specifications is obviously important, to ensure that these items are not mixed up with conforming items. Such a system includes identification of items by marking, tagging or other appropriate means.

> <u>Requirements</u>:
> - Nonconforming products are positively identified.
> - Nonconforming product disposition is defined.
> - Nonconforming products are reworked, accepted, or scrapped.
> - Rejected products are disposed of properly.

4.2.14 <u>Corrective Action</u>

Detecting and correcting problems is an important part of the ISO 9001 standard. Procedures should be developed to establish responsibility for taking corrective actions and how these actions are to be carried out, to prevent recurrence (or occurrence), as appropriate.

> <u>Requirements</u>:
> - Causes of nonconforming products are systematically analyzed.
> - Preventive measures are instituted to eliminate nonconformances.
> - Efficacy of corrective action is analyzed.

4.2.15 Handling, Storage, Packaging and Delivery

Incoming materials, materials in process and finished products need to be protected against abuse, misuse, damage, deterioration or loss. Thus documented procedures have to be enforced for the handling, packaging, storage and delivery of all materials and parts, from the time of receipt, through the entire operation and subsequent distribution.

> Requirements:
> - Internal transport movements are identified.
> - Handling, storage, packaging and delivery damage are minimized.
> - Stored materials are systematically and periodically assessed.
> - Material packaging effectiveness is assessed.
> - Materials are protected during delivery.

4.2.16 Quality Records

Documented evidence needs to be kept to show whether the product meets technical specifications, complies with regulations and fulfills contractual requirements. This is done to demonstrate that the product achieves the required quality.

> Requirements:
> - Records are properly identified, maintained, filed and indexed.
> - Personnel are assigned for record maintenance.
> - Records are traceable to a process or product.
> - Retention and location of records are determined.

4.2.17 Internal Quality Audits

The purpose of internal audits is to ensure that the quality system is effective and continues to be maintained.

> Requirements:
> - Periodic, comprehensive internal quality audits are conducted.
> - Auditors are qualified.
> - Audits follow a process of planning, implementation and reporting.
> - Auditors use comprehensive checklists that reflect customer requirements.
> - Corrective action effectiveness is monitored.

4.2.18 Training

Obviously, having appropriately trained personnel is essential for an organization to achieve its quality objectives. Both specific training to perform assigned tasks and general training to maintain a quality culture is needed.

> Requirements:
> - Training needs are periodically assessed.
> - Training personnel are qualified.
> - Training records are accurate, complete and current.

4.2.19 Servicing

When maintenance of a product is essential to preserve its functionality, procedures need to be in place to ensure that servicing meets specified requirements.

> Requirements:
> - Servicing scope is identified.
> - Servicing meets customer requirements.

4.2.20 Statistical Techniques

Where it is appropriate, the application of statistical methods can be an effective means of ensuring conformance to requirements for quality. Statistical methods can be applied at all stages of production, e.g., for verifying the acceptability of process capabilities (such as length of production time) or product characteristics (such as performance limitations).

> Requirements:
> - Statistical techniques are used when required.
> - Statistical effectiveness is analyzed.

4.3 Implications of ISO 9000 For the Residential Construction Industry

4.3.1 Status of ISO 9000 in the Residential Industry

A consensus is apparent, from the Canadian and U.S. interviews, that ISO 9000 standards are not well known or understood by the overwhelming majority of managers and executives in firms in the residential construction industry. However, most of the particular persons interviewed (see Appendix B for list of interviewees), were well or very-well informed about ISO 9000. These individuals represent in some cases, industry associations or government agencies. Accordingly, it seems like ISO 9000 is much better placed to be adopted in the future, both in Canada and the U.S. than its current lack of profile within the mainstream of the industry would indicate.

To the question **"would the residential industry accept ISO 9000 standards in the long run, or would they attempt to adopt or invent different standards of their own?"**, those persons interviewed, on balance, indicated that ISO 9000 would be accepted. The industry would not likely make up its own, different, standards. The expression "on balance", however, must be emphasized, since there are those who believe that existing quality assurance practices within the industry are as good or higher than ISO 9000 requirements.

This overall conclusion is perhaps more pertinent to the builders and contractors. Manufacturers of housing products are more likely to adopt the ISO 9000 standards, since the environment of factory built housing and housing components is clearly one for which ISO 9000 is suitably designed.

4.3.2 How is Quality Assurance Currently Accomplished in Residential Construction?

Currently individual builders must pass one or two quality assurance hurdles. In the case of on-site builders, the construction project must pass local, provincial (or state--U.S.), or federal building codes. Physical inspection is undertaken to certify compliance. In the case of "manufactured housing", such as mobile homes or modular homes, there has to be a first-stage approval that the design and engineering of the manufactured housing is acceptable and meets the appropriate building code requirements, before delivery to a site is permitted. The manufactured housing final product also has to be licensed and inspected by the appropriate on-site inspectors.

4.3.3 Impacts on the Residential Construction Industry

There is consensus among those interviewed that ISO 9000, were it to become widely accepted as an industry norm, it would have a huge impact on the residential construction industry.

First, a potential major impact of ISO 9000 would be to make more formal the supplier-contractor relationships within the industry. This would be true for both on-site construction and manufactured housing. The relevant "final builder" could insist on ISO 9000 standards for the manufacture of each of the components and sub-assemblies that went into the final building: windows, frames, doors, finished lumber members, roof shingles and parts, etc. This would be a very convenient way (to the final builder/assembler) of obtaining quality products to go into his home construction.

However, suppliers are currently not attuned to this sort of standard. It would not be easy for the builders/assemblers to unilaterally demand such a system on the part of their suppliers.

A second major potential impact of ISO 9000 would be to make exports of manufactured housing from Canada more competitive. As one interviewee put it, "ISO 9000 certification is mandatory for such exports to Europe and some parts of Asia."

On a related matter, the presence of NAFTA means that the potentially large Mexican market might become available soon. Canada and the U.S. might well be able to attack vigorously the Mexican market for low-cost, quickly-built housing. However, none of those interviewed for this study seem to have appreciated the role that a quality management system such as ISO 9000 might play in terms of gaining an edge on competitors within the North American NAFTA context.

Similarly, in the recent Canadian Manufactured Housing Institute's annual conference (March 2-5, 1994), a joint session with The Japan Society extolled the many rising opportunities in Japan for the Canadian manufactured housing industry. Japan is Canada's leading overseas market for forest products (dimension lumber, logs, plywood, pulp and paper). 1992 exports to Japan exceeded $2.3 billion. The Japanese housing market is very large, with 1.4 million starts in 1992. However, Canadian export of value-added building products and construction materials have captured only a small share of this market. Again, the role of ISO 9000 as an internationally recognized quality assurance system could provide some competitive edge, particularly when dealing with a country like Japan in which company-wide quality management systems have been a mainstay since the 1950s.

Third, one of the interviewees said that ISO 9000 standards would have a major impact on builders. This person's argument was that ISO 9000 standards in building construction could eliminate or significantly reduce the inspection process, i.e., as long as a builder was ISO 9000 certified, his construction or assembly could be accepted prima facie of evidence of meeting building codes. He would not need to be inspected, since his procedures would have been audited to ensure he met all quality standards.

The elimination (or reduction) of inspections would be a major change in municipal and provincial government operations. It would speed-up sales and possession. It would cut municipalities' costs. Very possibly, consumers would also obtain a better quality home. Once a builder/assembler had incurred the up-front costs of certification/registration, in all likelihood he would actually gain a cost-competitive edge.

There would be more consistency in individual housing construction quality: frequency of repairs could be rendered much less and hence cheaper. In sum, a promising potential exists for ISO 9000 in the residential building industry.

The potential impact of ISO 9000 is far reaching also in that there is general agreement that the complexity of modern building codes and building standards in general are such that no one inspector can follow them all. All the contract trades like electricians and welders, etc., have their own separate inspection processes. If ISO 9000 could in any way reduce all this leg work it could produce a profound impact on the industry.

4.3.4 What Will Bring About Acceptance of ISO 9000 in the Residential Construction Industry?

All those who were interviewed agreed that market demand was the only viable means of bringing ISO 9000 into acceptance. If it is necessary for export, then exporters of building products and systems will embrace it as a necessity for doing business. At present, this seems to be only a trivial factor within the industry in North America. Nonetheless, the way ISO 9000 is proliferating in other industries, building construction may not be too far behind. **The opportunity is ripe, over the next 2-3 years, for a vanguard of companies in the residential construction industry to gain a competitive advantage.**

Mortgage and finance, real estate services, legal support services and insurance companies are likely to take an interest in ISO 9000 if it proliferates into the residential industry. From the point of view of mortgage, finance and insurance firms, companies involved in producing residential building products and builders themselves, are much better customers if they have a proven quality management system in place. The assurances of a third-party audit is likely to produce business or contractual relationships which engender confidence and produce a greater accessibility to the services provided by these firms.

Manufacturers, professionals and the building trades associations in Canada are unanimous in their interest in achieving quality products in the residential industry. Naturally, no one wants to be against "quality". However, how this is achieved is a different matter. In 1993, the Canadian Construction Association adopted a resolution: *"CCA consider a total quality management program which will include the distribution of presently prepared manuals and/or videos, providing such material can be obtained economically."* There has been a preoccupation during the past decade within the construction industry, both in Canada and the U.S. regarding the application of TQM in particular. There are many reasons for this. One is that increasingly contractors, builders, manufacturers and others in the industry are looking for ways to do something to increase their competitiveness and profitability. Prices have skyrocketed, but so have costs. There is not much leeway on the price side. Profitability and competitiveness are more likely to be achieved by technological innovation and improved management practices.

While TQM has been promoted as "a well proven and established approach to turning a business around",[1] it has not been fully understood or appropriately implemented and customized specifically for the residential construction industry. In comes the ISO 9000 series, which are in some respects less demanding and perhaps easier and less costly to implement. ISO 9000 also comes with an infrastructure of accredited organizations that provide an auditing service and licensing agreements to use their quality trade marks.[2]

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[1] *The Revay Report*, Volume 12, Number 2, November 1993, Revay and Associates Limited, p.1.

[2] See specifics on the workings and benefits of ISO 9000 registration in the next Section.

The persons interviewed for this study, some of whom represent industry associations, have suggested that it is much more likely that both manufacturers and builders in the residential industry would adopt ISO 9000 before committing to TQM.

In spite of the many success stories attested to by ISO 9000 firms in many industries, there are still some key questions to ask about ISO 9000 standards and their actual economic benefits. Most of the positive conclusions about ISO 9000 stem from testimonial evidence from firms that have adopted the requirements of the standards and from stakeholders in the ISO 9000 business. The author is not aware at this point of any professional study on the economic impacts of ISO 9000 -- for example, addressing effects on labour productivity, or on costs of production. There is now several years of experience with these standards, since 1987, to merit an empirical investigation (longitudinal and cross-sectional) of the impacts of the standards on company operations, and to measure economic benefits. A comparative analysis of the impacts of ISO 9000 against other models of quality management is also due. However, there is not enough experience with ISO 9000 specifically in the construction industry to customize such a study for this industry.

V. IMPLEMENTING ISO 9000 AND THE REGISTRATION PROCESS

5.1 For Whom Is ISO 9000?

ISO 9000 was developed essentially for contractual relationships between suppliers and customers. Supplier-customer interactions could occur at any stage of the production process, from sales of raw materials to the finished product ready for distribution to the public consumer. External interactions occur between a company and its suppliers and customers. ISO 9000 is also appropriate as a quality system which deals with internal company interactions. As a company begins to implement its quality system, it quickly discovers that a network of internal "supplier-customer" relationships begin to develop (Exhibit 5-1).

In the housing industry, there are supplier-customer interactions, for the sale and purchase of building materials (wood, bricks, etc.), for the sale and purchase of housing components (windows, skylights, doors, heating systems, plumbing, etc.), and for the sale and purchase of housing units, services and repairs. Exhibit 5-2 demonstrates the potential ISO 9000 interfaces between

Exhibit 5-1: ISO 9000 for Supplier-Customer Interactions

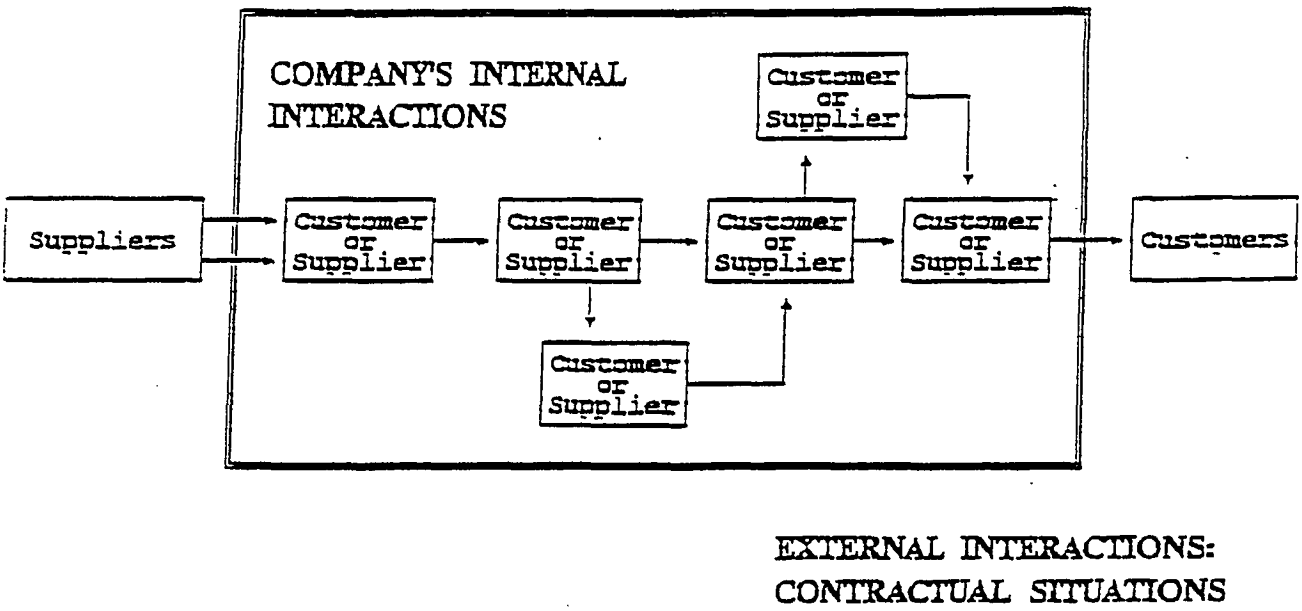
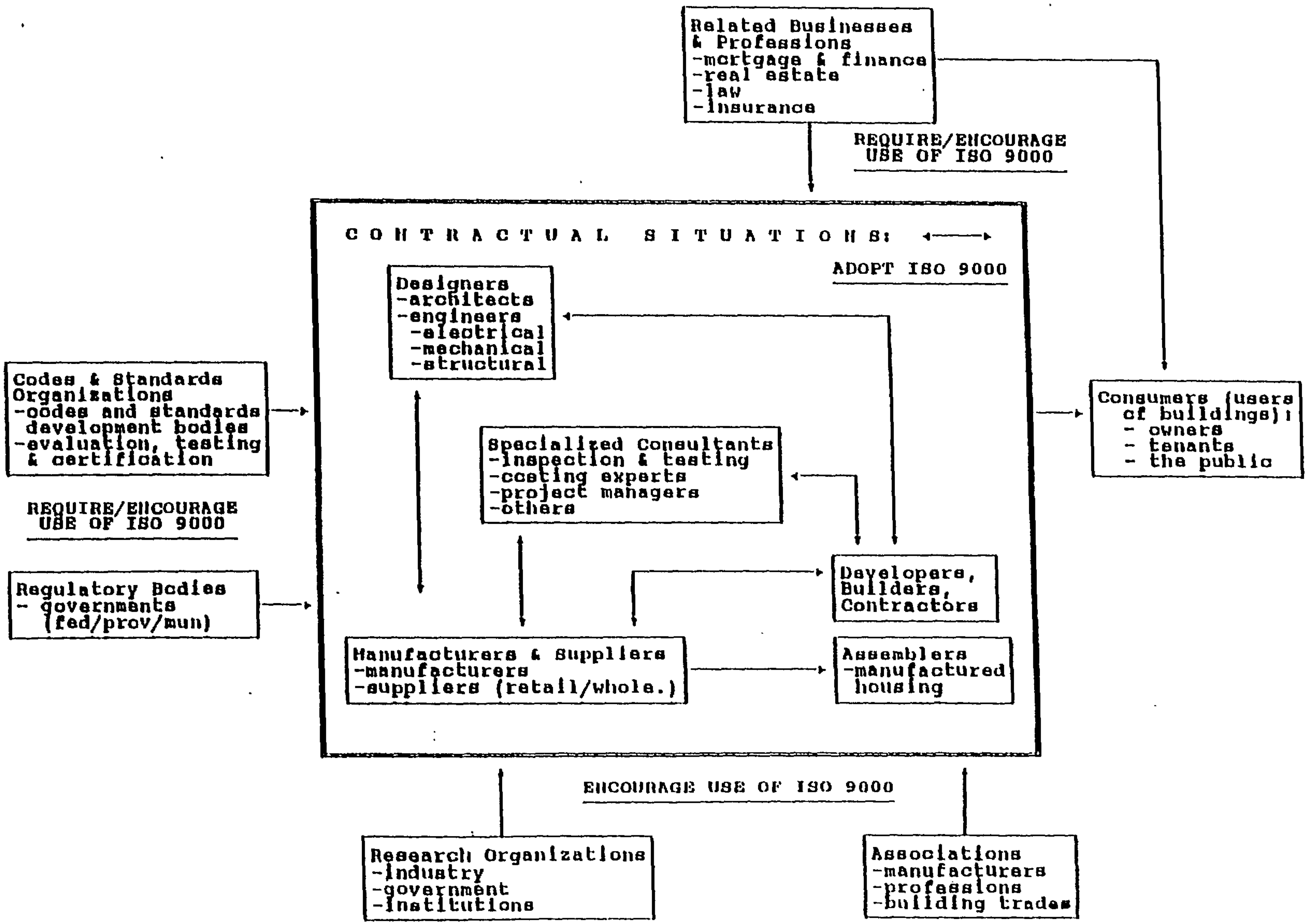


Exhibit 5-2: Potential ISO 9000 Interfaces In the Residential Building Industry



the different players in the residential building industry. The players within the double-lined box (designers, manufacturers, developers, builders, contractors, assemblers and specialized consultants) usually work on a contractual basis, with supplier-customer relationships established, involving activities that are covered by the twenty ISO 9000 quality assurance elements. ISO 9000 is not a mandatory standard. Its application is proliferating in some industries, around the world, because of market forces and because the large purchasers of goods and services are beginning to require it for doing business (e.g., the Big Three-- Chrysler, Ford, General Motors).[1] Exhibit 5-2 demonstrates only the **potential** use of ISO 9000 in the residential building industry. The role of players outside the double-lined box (codes and standards organizations, regulatory bodies, research organizations, associations, and related businesses and professions), with respect to ISO 9000, could be one of encouraging or requiring the adoption of ISO 9000 in the residential building industry. An example, of this was discussed in Section 3.2 where CCMC (Canadian Construction Materials Centre) will generally recommend that proponents requesting evaluations of new or improved building products comply with an ISO 9000 quality assurance system, to ensure consistency throughout the production process. Another example, outside Canada, is the Hong Kong Housing Department's requirements that builders and other building construction contractors become ISO 9000 certified.[2]

The role of associations, such as the Canadian Home Builders Association and the Canadian Manufactured Housing Institute, could be to foster the adoption of ISO 9000 among its members, and to develop training and seminar programs which promote the use of the standards. Similarly, government agencies such as CMHC and its provincial counterparts could encourage the use of ISO 9000 through information dissemination and training programs.

5.2 Scope of Implementation

The important difference between ISO 9000 and many customer requirements for quality systems is that ISO 9000 is a third-party registration scheme. This means that an independent accredited organization, under-

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[1] "Before the summer ends, Detroit's Big Three auto companies are expected to confirm ISO 9000 as the core quality gauge for their frontline parts makers--along with two industry specific sets of standards..."; *Big Three adopt new standard*, Globe and Mail, Monday, March 28, 1994.

[2] See pages 30-31 for reasons for this.

takes a professional audit of a company's quality system and provides the assurance that that system meets international standards requirements for quality management. The audited company is issued a certificate and a license to use the accredited bodies quality trade mark.

The selection of the proper standard (ISO 9001, ISO 9002, or ISO 9003) depends on the required scope of implementation. This is contingent as much upon the type of business involved as in the economic benefits and risks involved with conforming. The selection of a standard, if any at all, is really decided between the company (supplier, manufacturer, builder) being registered, the accredited registration organization, and the customer's requirements or the market in general.

It is important to clarify, however, that existing industry standards should be examined closely and the processes involved with complying to these standards should be built into the company's ISO 9000 system. In the housing industry, manufacturers and builders are regulated under various municipal and provincial regulations and by the National Building Code and other codes (National Fire Code, Canadian Plumbing Code, Canadian Farm Building Code, etc.). The requirements of these codes need to be combined with ISO 9000 to create a single assessment of the company. ISO 9000 guidelines allow a company to add elements, or to reference the requirements of existing product and process standards, to help it conform to other customer or regulatory requirements. The benefit of ISO 9000 in this context is that it provides a quality management framework which ensures that a company will undertake the appropriate procedures to comply with existing standards and regulations. This quality framework includes not only inspection and testing procedures, but also other mechanisms involving, for example, contract review, purchasing controls, and other process related controls to prevent nonconformances from occurring.

Deciding which standard to choose depends on the following rules of thumb:[1]

Choose ISO 9001 when any of the following apply:

- Your company has full control of the design and development of the product or service.

[1] See Quality Manager's Complete Guide to ISO 9000, by Richard Barrett Clements, Prentice Hall, New Jersey, 1993, pages 23-24.

- You ensure conformity to customer requirements through the processes of design/development, production, installation, and servicing.

- Regulations require compliance with ISO 9001, or major safety and other regulatory controls are involved.

- A complex or newly developed product is involved and you are active participants in the design/development work.

- You have a contractual obligation to provide servicing of your product.

Choose ISO 9002 when any of the following apply:

- The customer retains decision making powers during design and development work.

- You build to print.

- You are a subsidiary to a corporation that sends you the engineering information.

- You can only assure customer requirements during production and installation.

- A simple or very mature design is being used.

Choose ISO 9003 when any of the following apply:

- You only need to assure customer requirements during final inspection.

- The production process is extremely simple or nonexistent.

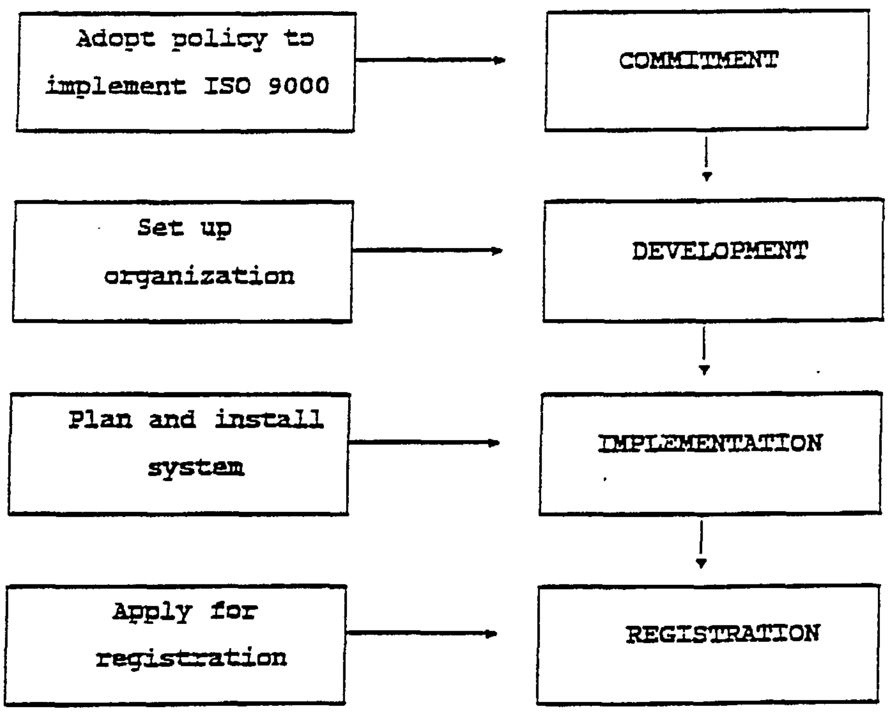
- You subcontract all design, development, and production work.

The lists provided above are not exclusive. There could be other considerations and reasons for choosing one ISO model over another. Many outfits (Quality Management Institute of CSA, Canadian General Standards Board, etc.) involved in assessing compliance to ISO 9000 are also organizations with a long history of registrations to a variety of other standards (including building regulations and standards). Since ISO 9000 allows a company to add elements to satisfy other requirements, it would be wise to discuss these matters with the registrar and how the adoption of ISO 9000 relates or can be integrated with other requirements of the building construction industry.

5.3 Implementation Strategy

The broad decision points for an organization, along the ISO 9000 route, are shown in Exhibit 5-3. First and foremost, management has to be committed to the initiative. A policy to implement ISO 9000 should be adopted and an organizational commitment made with a budget and an implementation team appointed. The development process, implementation and registration are described in the next sections.

Exhibit 5-3: Decision Points for Establishing ISO 9000 Compliance



5.4 Typical Activities During the Implementation Phase

During the implementation phase a company might go through a process which approximates what is shown in Exhibit 5-4. To begin with, there is an ISO 9000 awareness phase when the company becomes familiar with ISO 9000 and its requirements. The company has already decided that it will adopt the standards, and that for its purposes the benefits outweigh the costs. The company is committed to the process of bringing quality assurance into the companies management plan.

To make this process work, responsibility for implementation is assigned to a person/team to spearhead the initiative. This person/team cannot work in isolation. The quality system being implemented is for all the people/departments involved in activities that result in products and services that have been designated for ISO 9000 registration.

The ISO 9000 implementation team has a number of tasks to undertake which could include the following (follow Exhibit 5-4):

Planning the implementation:

- decide whether to go it alone or engage outside help (consultants)
- decide on the scope of implementation
- establish a schedule that is agreeable to all parties involved
- prepare a budget for implementation and estimate time required with milestones
- identify training needs and arrange for courses/seminars as required.

Deciding which registrar to engage:

- request brochures/information from several registrars
- invite quotations from two or three registrars
- discuss and agree on the scope, service and cost of the registration
- select best proposal based on value for money.

Coordinating the documentation process:

- use team approach
- decide functional scope (what products/services and associated activities/projects will be covered by the quality system)
- decide organizational scope (which departments, sections of the

company will be covered by the quality system)
- decide the level of ISO 9000 compliance (9001, 9002, or 9003).
- oversee process for first tier documentation (quality policy, management commitment, and objectives for each of the pertinent ISO paragraphs)
- oversee process for second tier documentation (departmental procedures and responsibilities)
- oversee process for third tier documentation (details of how specific tasks are done: work instructions, machine/equipment instructions, etc.).

- Monitoring the implementation process:

- assess progress and provide activity updates
- review milestones.

Arranging internal audits and the registrar audit

- review management systems (documentation) with the auditors
- ensure that required modifications are made to the management system documentation
- training of internal auditors
- estimate the duration of the audits (days)
- arrange schedule for internal and registrar audits
- select projects and functions to demonstrate capability
- plan/arrange for the on-site audit.

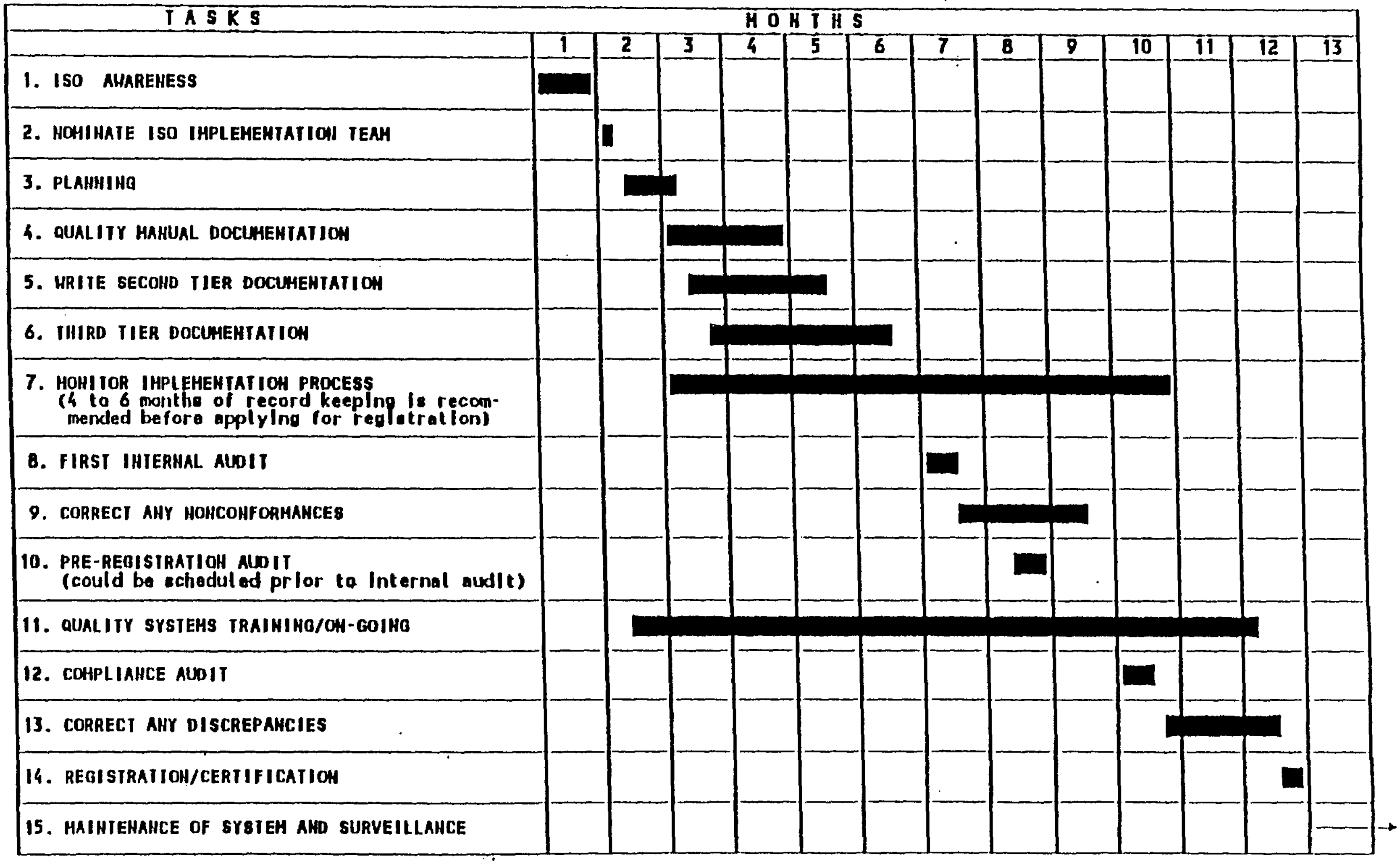
Ensuring that corrective actions are taken for nonconformances:

- any significant nonconformances identified during an audit will need to be corrected before a registrar will issue a registration agreement.

Follow-up and surveillance of quality system once in place:

- Once a quality assurance system has been established in a company, it needs to be maintained. The registrar is likely to do annual surveillance audits as part of its agreement with the registered company. These surveillance audits are more limited in scope and time, and are of the nature of a "maintenance check-up" on the system.

Exhibit 5-4: An Example of an ISO 9000 Implementation Schedule[1]



[1] Timing indicated for each phase of implementation is only demonstrative. Actual timing for a company depends on its "state of readiness"--i.e., the extent to which the company already has a quality assurance system in place; on the scope of implementation desired or needed; on the size and complexity of the organization; and on the level and concentration of effort it is able and prepared to put into implementation.

5.5 The Registration Process

Typically the registration process involves the following:

- The company approaches a registrar and applies for registration. This usually involves completing an application form, which could also involve answering a questionnaire or a checklist, so that the registration office can determine the extent to which the applicant is prepared for the process and to plan the audit approach. An application can be submitted at any time during the implementation process, but the sooner the better so that the registrar can meet the scheduling requirements for registration.

- The registrar can usually provide an assessment of the company's quality system in general terms, on request, to give the company an appreciation of the status of its quality system. Once the quality documentation is written, the registrar reviews it to make sure that it meets all requirements. The registrar will identify any information which is missing so that the applicant can promptly make the necessary corrections.

- When the quality system is in place, an on-site audit by the registrar is arranged. At this stage any nonconformances are identified and corrections need to be made before the next stage.

- When these corrections are completed to the satisfaction of the registrar, the registrar then places the applicant on its register of ISO 9000 companies and authorizes the company to use the quality trade mark of the registration organization.

- Compliance audits are usually required annually to maintain registration.

The flow chart which follows (Exhibit 5-5) gives a view of the process as it is applied by one registrar: Quality Management Institute (QMI, a division of CSA). Exhibit 5-6 provides typical registration fees, paid to the registrar, as identified by QMI. These costs, however, depend very much on the size and complexity of the organization being registered, and they do not include the applicants internal costs of implementation (training, document preparation, etc.).

Exhibit 5-5: A Typical Registration Process

QMI REGISTRATION PROCESS

ACTIVITY BY	ACTIVITY	
1. COMPANY	Company requests details of registration	
2. QMI	Customer Service specialist discusses all aspects of the registration program and decides if the company's application would fall within the scope of accreditation	◇
3. QMI	Prepares a proposal & mails this to the company	
4. COMPANY	Reviews the proposal completes and signs an application form and returns to QMI with a deposit cheque for $1,000	
5. QMI	File No. given to application. Director of Registration allocates auditor to file & company is informed	◇
6. AUDITOR	Explains how registration program works & how company is to complete their section of the QMI checklist and visits the company if required to do so	
7. COMPANY	After ensuring manual fully meets the requirements of the standard, then returns manual and checklist to registrar	
8. AUDITOR	Reviews quality manual, ensures manual meets full requirements of the standard; returns comments to applicant – if required	◇
9. COMPANY	Revises manual – if required & resubmits to QMI	
10. AUDITOR	Reviews manual and if acceptable sends letter to company – accepting the manual subject to audit	◇
11. AUDITOR/COMPANY	Establish date for audit & sends audit plan & letter to company	
12. AUDITOR/COMPANY	Audit of Applicant's Plant	◇
13. AUDITOR/COMPANY	Resolution of any non-conformances; re-audit if required	
14. AUDITOR	Preparation of Registration Documentation	◇
15. DIRECTOR OF REGISTRATION	Reviews registration packages; approves registration of company; advises customer	◇
16. GENERAL MANAGER	Congratulatory letter, registration certificate	
17. CUSTOMER SERVICE SPECIALIST	Sends Marketing Kit	
18. AUDITOR	Compliance Audit (1 Year after registration)	◇
19. AUDITOR	Compliance Audit (2 Years after registration)	◇
20. AUDITOR	Re-registration (3 years after registration) (from Step 11 onward)	◇

◇ = Decision Point

Source: *The Quality Registration Guide*, Quality Management Institute, Mississauga, Ontario.

Exhibit 5-6: Typical Registration Costs With QMI

STANDARD	REGISTRATION COST
ISO 9003	$ 2,000 - $ 3,000
ISO 9002	$ 8,000 - $12,000
ISO 9001	$12,000 - $15,000+

Source: *The Quality Registration Guide*, Quality Management Institute, Mississauga, Ontario.

VI. THE COMPETITIVE CONTEXT: BENEFITS OF ISO 9000

6.1 Why Register?

Third-party assessment is one of the main factors that sets ISO 9000 apart from other quality systems such as Malcolm Baldrige National Quality Award (U.S.), the Canada Award for Business Excellence or the National Housing Quality Award (U.S.). The requirements of other quality systems such as these are based on the concept that a customer or a committee of assessors is going to examine a company for compliance to the criteria of the system. An ISO 9000 certificate, on the other hand, allows a company to be instantly recognized nationally and around the world. In fact, for many companies in North America and elsewhere ISO 9000 is becoming a substitute to other quality system requirements. ISO 9000 is accessible to almost any company, if it sets out to achieve compliance.

With third-party registration, the most immediate benefit is that a company need only register once to qualify for several industrial markets. Eventually this means that markets all over the world will open up and that the need for preparing for multiple quality assurance surveys for doing business across borders, and within national borders, will diminish.

ISO 9000 registration opens up markets such as the European Community. The EC requires a few groups of products to have ISO 9000 registration to comply with health or safety regulations. The types of products under this regulation include construction products, medical devices, industrial safety equipment, telecommunications terminal equipment, gas appliances, commercial scales and used machinery. However, the number of European and North American companies requiring registration as part of normal contractual obligations is growing every day.

Another reason for pursuing ISO registration is to limit product liability exposure. There is a current view that asserts that a company may have a stronger defense in a liability suit if it has a quality assurance system registered to one of the ISO 9000 standards. Having the necessary documents on hand, and also having the mark of an accredited quality registrar who performed the registration, may assist or protect the producer in the case of a liability claim.

ISO 9000 registration forces a discipline upon a company, and entrenches the commitment to quality. Once a commitment is made to the registration process, and what comes after registration, a company becomes involved in a cultural change which streamlines its production processes, improving internal operations and avoiding daily problems that could occur, for example, as a result of bad communications, misinformation or out of date manuals and procedural guidelines.

Another advantage, is that the registration mark of the registrar can be used on a company's letterhead and publicity materials, to promote the company's capability for quality management.

Immediate paybacks of ISO 9000 registration could range from quality system improvements derived from the registrar's findings during the ISO 9000 audit, to fewer surveillance inspections by clients and regulators. If customers, registrars and regulatory bodies accept the ISO 9000 registration obtained by a company, then the company may be subjected to fewer inspections and compliance surveys.

In summary, the benefits of ISO registration which are offered by most ISO 9000 supporters include:

- listing the company in a public directory of ISO 9000 organizations;
- use of a recognized logo of an accredited registrar in advertising and promotion;
- an improved corporate quality image;
- an ability to bid for "ISO 9000" contracts at home and abroad;
- reduced number of customer audits/inspections;
- improved records in case of litigation;
- constructive quality assessment by experienced professionals.

6.2 Trade and Business Requirements

As a competitive tool in the international trade context, ISO 9000 provides a company with the following business benefits:

- worldwide recognition and credibility;
- access to new markets;
- qualification to bid on contracts otherwise not accessible;
- expansion and continuation of market share; and
- improvement of partnerships with suppliers and customers around the world.

To the extent that Canadian residential construction stakeholders are involved in international markets, ISO 9000 becomes an appropriate competitive instrument for them. This applies particularly to manufacturers of housing products that are sold abroad. The U.S. market is not exempt either. As was shown earlier, the U.S. is increasingly becoming attuned to the requirements of quality assurance as it is extolled by ISO.

Some North American companies have questioned whether they can afford to take the ISO 9000 route to quality management. The question is: Can they afford <u>not</u> to?

The global trading system is in a state of transition due to harmonization of technical standards and to the international cross-border acceptance of conformity assessment mechanisms. ISO 9000 is emerging as the most commonly used approach to ensure consistency of quality assurance requirements.

The Europeans and other countries are developing laws, standards, or other regulations that affect many industries and companies. More will be developed dealing with the environment, packaging, labeling, and product disposal. To ensure compliance, these standards will likely follow similar conformity assessment procedures as have been developed (and continues to develop) for ISO 9000.

In light of this backdrop, the acquisition of strategic intelligence on standards has become very important: to inform national industries of international developments and requirements to enhance competitiveness. ISO 9000 is a prime example of this requirement. Strategic intelligence for the residential industry applies to any situation in which international standards requirements impact on construction methods and products--e.g., NAFTA (see Section 6.3 below).

6.3 Strategic Importance of Standards Such as ISO 9000

While the residential building industry in Canada has a strong domestic orientation, and while many technological innovations have been developed in Canada, still most of the building technology and products used are adopted or adapted from foreign sources. With increased globalization and international competition, amongst manufacturers in particular, Canada needs to be active in the international arena--to monitor technological developments as they occur, particularly within our major industrial partners.

The processes involved in development of national and international standards are a vital forum for intelligence about new technologies and products in any industry.

ISO 9000 third-party registration is but one element of a larger set of standards and conformity assessment issues that impact on trade and industrial competitiveness. The Free Trade Agreement between Canada and the United States has brought about the increased importance of the enforcement of standards, and the role of evaluation and testing, for assessment of conformity of imported products and materials. As a result of FTA, and now NAFTA, Canadian markets are seeing an increase in imported materials, equipment and systems in building projects. It is sometimes difficult to confirm that these products comply with the requirements of provincial and federal building codes.

The need for compatibility of requirements between national markets therefore affects the procedures for conformity assessment in addition to the technical requirements themselves. This means that the international accreditation of testing and certification and the wider recognition of evaluation reports and certification marks are becoming more important to product manufacturers.

North American harmonization (of standards, evaluation and testing, and conformity assessments) is a key part of making sure that the benefits of NAFTA are realized. ISO 9000 could play a major role in this context.

While ISO 9000 is not explicitly referred to in the NAFTA agreement, quality management is noted in one chapter and the ISO 9000 guidelines are a logical choice for application.

NAFTA lays a framework for developing standards, including those that deal with quality. Chapter 9 of NAFTA, "Standards-Related Measures," includes the following elements:

- Quality assurance is among the legitimate objectives that any of the three countries may pursue through the use of standards.

- When necessary, sub-committees will be established to develop and harmonize standards. Sub-committees may be formed to discuss quality, accreditation of conformity assessment bodies, and implementation.

NAFTA has thus set the stage for a scheme for continent-wide implementation of ISO 9000 quality systems standards. ISO 9000 standards are particularly appropriate for NAFTA, because they do not resort to legal mandates on quality assurance. As the ever-increasing worldwide use of ISO 9000 over the past six years has shown, market forces can be a powerful catalyst for product quality improvement.[1]

The major issue in this respect for the residential construction industry is to understand to what extent ISO 9000 registration will become a trade issue and a business requirement to enter certain markets. So far, this is a trivial factor in North American residential construction. However, judging by developments in other industries, it cannot be ignored or dismissed as such.

Quality assurance and ISO 9000 requirements represent one mechanism in trade situations ("free" or otherwise) for ensuring that an appropriate level of quality is achieved, to enhance our national industry's competitiveness while protecting the health and safety of our citizens based on conformance to our own national and provincial technical standards.

[1] See "Will NAFTA Succeed? ISO 9000 May Be Key", by Stanley A. Marash and Donald W. Marquardt, in *Quality Systems Update*, CEEM Information Services, Fairfax, VA.

VII. ROLE OF GOVERNMENT HOUSING AGENCIES AND THE ISO 9000 STANDARDS

As previously discussed, there is insufficient experience with ISO 9000 in the residential building construction industry to empirically demonstrate to what extent these standards are an advantage for the manufacturer of housing products or the builders of houses. The previous sections of this report, however, have demonstrated that current trends worldwide suggest that there are potential benefits and possibly far reaching impacts, should the residential construction industry adopt these standards. The possible roles of the various stakeholders in this industry were summarized in Exhibit 5-2 (page 51).

The federal and provincial government agencies responsible for housing policies and programs could be involved in exploring how ISO 9000 might benefit the housing industry.

7.1 Promoting Quality in the Housing Industry

This has been a traditional role of federal and provincial housing agencies. Quality in Canadian housing has been achieved through various mechanisms (awards, enforcement of product standards, regulations, housing programs, training and information dissemination, etc.). Quality management system requirements for builders and manufacturers of building products, however, have not been fully explored as a mechanism for achieving quality in the housing industry. While the concepts of Total Quality Management have been discussed, and various manifestations of this concept have emerged within the building construction sector over the past decade or so, it has generally proven to be inaccessible or too difficult to implement for most companies in the business.

ISO 9000 provides an alternative, an accessible mechanism for promoting quality. The extent to which this mechanism would be accepted in the industry, however, should be examined in some detail. In addition, the various means by which it can be encouraged and promoted (e.g., through regulations, as a prerequisite in government contracts, incentives in terms of reduced inspections and testing requirements or reduced loan insurance requirements, debt-loan ratios, lower interest rates, etc.) should be studied for possible benefits.

7.2 Training

ISO 9000 training seminars and workshops could be prepared, tailored for the housing manufacturer and builder, by housing agencies. These could be developed jointly with some of the interested industry associations, such as the Canadian Manufactured Housing Institute and the Canadian Home Builders Association. The demand for, relevance and content of such a training program would first need to be established. Discussions with interested stakeholders in the industry would have to be initiated, to determine if the timing is right for ISO 9000 training that is specifically tailored for this industry.

7.3 Information Dissemination

Monitoring and gathering of information on ISO 9000 and quality assurance applications and trends in other industries and countries, as well as in the construction related sectors. This can be done, for example, by the Canadian Housing Information Centre (CHIC). As this information accumulates, a format for disseminating the knowledge gained could be developed (for example, through CMHC publications and information sharing packages).

7.4 Contractual Requirements

Federal and provincial government agencies could begin to promote ISO 9000 by requiring compliance in their own contractual situations with developers and builders, in insured lending and social programs activities. How this might work, and the benefits/disadvantages of introducing elements of ISO 9000 in housing agency contractual situations should be studied further.

7.5 Warranty Programs

The increasing claims being made to warranty programs across Canada (e.g., Ontario New Home Warranty Program) is causing some concern among provincial housing and industry officials. Claims in Ontario due to building code infractions and various structural defects have risen to unacceptable proportions.[1] Construction workmanship and inferior materials used in home construction are some of the reasons cited to explain why claims have risen. Introducing quality management as a mechanism that complements other requirements within warranty programs, is an option to consider which could result in improved builder performance and reduced claims. Conformance to ISO 9000 requirements could be introduced as an option in warranty programs which would increase ISO 9000 builders' excellence ratings. In this regard, some further study is required to examine the implications of ISO 9000 for warranty programs. Government housing agencies could undertake a study of this option, how it might work, the advantages/disadvantages, and whether it would be practical and acceptable within the residential building industry.

7.6 Reduced Costs

One of the great by-products of the ISO 9000 registration is its impact on reducing costs of production. Companies who have adopted ISO 9000 have cited reduced costs as one of the many benefits. If the quality management system has been implemented and is working effectively, costs associated with rework, repair, scrap and inefficiencies (due, for example, to lack of appropriate training, misinformation, bad communication with customers) will be reduced or eliminated. ISO 9000 quality standards focus attention on the process of problem prevention in the interest of time and labour savings. Can ISO 9000 help in the manufacture of building products and in the house building process itself, to prevent such problems and hence to reduce costs? What are the potential cost reductions for manufacturers and builders if they were to implement ISO 9000? The answers to these questions could be sought after by housing agencies, to help identify if indeed it is worth encouraging the adoption of ISO 9000 within the residential construction industry.

7.7 Summing Up

The above areas of interest are examples for further study and examination of the possible role that government could play in identifying the potentially useful applications of ISO 9000 in the residential construction industry. ISO 9000 was created for all industries and all companies, but it is not a panacea.

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[1] The Ontario New Home Warranty Program lost between $7.5 million and $8 million last year, as claims for repairs to defective homes outstripped its revenues.

It cannot address or answer all the needs and requirements for achieving quality within any specific industry. Its generic nature, however, is also one of its strengths, allowing broad applicability and acceptability by all the industrialized countries of the world. It provides a common foundation for quality management requirements that can be used in contractual situations across borders. Each industry, however, needs to establish the particular relevance and interpretation of each of the elements of the standards and their appropriate applications. Some industries are further ahead in this than others. The residential building construction industry is only just discovering ISO 9000.

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LIST OF INTERVIEWEES

The following persons were interviewed in person or by phone.

Doug Bateson
Deputy Director, Quality Systems Branch
Canadian General Standards Board (CGSB), Ottawa

Maureen Breitenberg
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National Institute of Standards and Technology
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Ed Caldeira
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Head, Technical Evaluation Services
Canadian Construction
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National Research Council

Omar Nath-Channan
City of Calgary
(Governor of the Board of Governors for the
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James Cooke
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1.0 OBJECTIVES

This final report integrates all the findings from the study of federal microcomputer procurement. Since the federal government now requires ISO 9000 standards to be met by all microcomputer manufacturers supplying to it, particular emphasis was to be placed on the leveraging effects of this federal procurement with respect to promoting the adoption of international quality standards (e.g. ISO 9000) in the Canadian microcomputer industry. As well, the question of whether there was any relationship between international quality standards and the overall technical competence and creativity of the Canadian microcomputer industry, was also explored.

This final report follows an interim report on this same project dated March 22, 1993. Some of the findings and observations contained in that interim report have been modified in light of new information.

2.0 ISO 9000 STANDARDS: WHAT ARE THEY?

The ISO 9000 series of standards can be briefly described as a series of formal procedures or measures that a company has to follow in terms of the consistency and precision with which it conducts certain activities. While the expression "ISO 9000" refers to the entire matrix of activities and related individual standards established by the International Organization for Standardization, in fact the important standards from the standpoint of this project are the two subgroups, ISO 9001 and ISO 9002, and in particular the latter.

The ISO 9001 subgroup refers to all aspects of production processes, inventory control and "traceability" of components and output, as well as the original design process. The ISO 9002 subgroup is more narrowly focused on the production processes of the company. In this way, ISO 9001 actually incorporates all of ISO 9002's standards in a hierarchical relationship.

In this report "ISO 9000" should generally be taken as really referring to 9002 as, in practical terms for Canadian microcomputer suppliers, it is 9002 (production process standards) that is of primary importance. However, in one or two cases, Canadian firms had gone further and also achieved ISO 9001.

It should be borne in mind that compliance with ISO 9000 standards are not necessarily indicative of the usefulness of any product. The standards simply indicate a certain care with which the product has been created. A buggywhip manufacturer could, in principle, apply to be certified to ISO 9000 standards, and achieve this level of quality. However, the market potential for the product would not be significantly enhanced by this accomplishment. Very few people require such an item these days. One could only say they were buggywhips of a decidedly superior quality.

Two key elements of ISO 9000 standards are <u>procedures</u> and <u>documentation</u>. First, to achieve ISO 9000, a firm has to understand, analyze, appreciate, and accurately describe its key activities and functions. Secondly, it has to preserve the analysis and description according to an ISO 9000-specified recorded form. Moreover, there is a requirement to keep these records up-to-date in a certain approved manner, in case of any subsequent product or process changes. A firm receives ISO certification from a qualified certification organization or company. The latter agency has to be approved by the International Organization for Standardization in Geneva. ISO 9000 certification is usually given on a plant-by-plant basis, but occasionally, an entire company can receive it, if its production processes are similar in different plants, and if its documentation is seen to apply to all of them.

Two organizations in Canada are currently qualified to do ISO 9000 certifications: Quality Management Institute (QMI) Ltd. and the Canadian General Standards Board (CGSB).

In actual practice, while Canada is among a great many non-European countries to have adopted ISO 9000 as a national "benchmark" of production quality, ISO 9000 has achieved a higher level of acceptance and promotion in Europe than anyplace else. Accordingly, it is to be expected that firms having strong links to Europe in terms of sales, component suppliers, etc., are more likely to be familiar with these standards and to have taken steps to achieve them.

In the course of this project, a particular piece of information came to light that helps to put ISO 9000, as a group of quality standards, into perspective. One of the computer firms interviewed in this project had hired a consultant to compare the ISO 9000 benchmarks against the equivalent quality standards of a major automobile assembler. The issue of quality in automobile production has been a highly visible one in recent years. The intense competition between U.S. and Japanese assemblers for global markets has made all aspects of automobile production a fair ground for competition and improvement, and this has certainly included quality of production. The well-known consumer surveys of defect rates has served to emphasize quality issues also.

Interestingly, the comparison showed that both sets of standards were comparable overall and, moreover, that the ISO 9000 standards were usually at least as tough as the automobile assembler's benchmarks for quality. Thus, given the high profile and market importance that quality standards have achieved in the automobile sector, being able to meet ISO 9000 standards, it could be argued, does indicate high production quality.

3.0 METHODOLOGY AND PARTICIPANTS

A series of interviews were conducted to investigate the overall impacts and implications of federal procurement on microcomputer technology in Canada. The names of the interviewees are given in Appendix A. A particular focus was placed on the interplay of the federal procurement of microcomputers, quality standards and especially the new ISO 9000 benchmarks, and Canadian firms' responses to these standards.

Interviews were conducted within the federal government with senior representatives of Supply and Services Canada in Supply Program Management, Office Automation, Services and Information Systems (OASIS) and in Economic and Statistical Analysis, and with the Canadian General Standards Board (CGSB).

Related interviews and discussions were also conducted with senior executives of three Ottawa-area and seven southern-Ontario-area information technology firms in the private sector. Four of these 10 firms were CIRCLE-status firms, i.e., Canadian-owned designers, assemblers, and suppliers of microcomputers; four (actually five different interviews; one was interviewed twice) qualified as MERIT companies, i.e. multinational organizations whose Canadian facilities or Canadian partners export and/or undertake other activities as well on a sufficiently large scale so as to offset company imports, and hence be granted equivalent status to Canadian-owned firms; one was "other"-status of importer only, i.e. neither CIRCLE nor MERIT; and the 10th was of unknown status, as it is not a microcomputer assembler nor supplier at all but, rather, a supplier of computer components, nevertheless strongly affected by ISO 9000 standards (this last firm was not formally interviewed like the others, but a reasonable discussion was possible, justifying inclusion in this report). These 10 firms, taken together, make for an interesting cross-section of Canadian information technology/microcomputer business (see Exhibit 3-1).

All of the firms interviewed throughout the project were on the National Master Standing Offer list for supplying the federal government with microcomputers and peripheral equipment (There are a total of 22 firms on this list). The size and mix of this sample provided a balanced survey.

The questions raised in the course of all the interviews broadly related to:

- identifying the nature and scope of the companies' commercial activities particularly with respect to microcomputer assembly and market distribution;

- whether or not the company fully met ISO 9000 standards and what costs and other drawbacks were involved in attaining and sustaining them;

Exhibit 3-1
Status of Firms Interviewed

	FIRM	STATUS
1)	Cemtech	CIRCLE
2)	Sidus Systems Inc.	CIRCLE
3)	Primax Computer Corporation	CIRCLE
4)	Trillium Computer Resources	CIRCLE
5)	Digital Equipment of Canada Ltd. (DEC)	MERIT
6)	Hewlett-Packard (Canada) Ltd. (2 interviews)	MERIT
7)	NCR	MERIT
8)	Apple Canada Inc.	MERIT
9)	Amdahl Canada Limited	OTHER - IMPORTER
10)	KAO Infosystems	UNKNOWN

- the benefits to companies that attained ISO 9000 in terms of Canadian and international market penetration;

- the benefits of ISO 9000 in terms of Canadian technological development;

- how the companies perceived that ISO 9000 impacted on their customers' acceptance and how it impacted on their choice of suppliers (upstream and downstream linkages);

- the relative impact of ISO 9000 standards on companies as opposed to alternate differentiating federal procurement policies/practices, such as rules of origin and/or tariff transformation classifications; and,

- should information technologies equipment be treated differently from any other apparatus in terms of federal procurement policy/practice, i.e. was there anything special about information technologies that had a disproportionate effect on national interests?

Exploring each of these points required several different questions, and each interview took at least one full hour and usually more, in order to obtain full information.

4.0 IMPORTANCE AND SIZE OF THE FEDERAL PUBLIC SECTOR MICROCOMPUTER MARKET

Supply and Services Canada has confidential statistical data on federal procurement of microcomputers and peripherals. However, it is believed from interviews with Supply and Services officials that this data shows the federal government, including federal Crown Corporations, to be a highly significant customer, although not overwhelming - perhaps 30% of all Canadian microcomputer procurement. It is also believed that approximately 90% of this is purchased through DSS.

From the interviews conducted in this project, however, the importance of the federal government market to individual firms varies considerably. For several of the larger firms, typically MERIT-status or OTHER-status multinationals, the federal government market represents only about 10% of their total sales. For the CIRCLE-status firms, however, the usual figure cited was between 30 and 60% but in the case of one CIRCLE-status firm, it was 90%. While Canadian federal government procurement has a limited but still noticeable effect on the sales of multinational firms in Canada, it has a very considerable effect on the CIRCLE-status firms.

5.0 FINDINGS FROM THE INTERVIEWS

5.1 Levels of ISO 9000 Achievements

Nine of the companies interviewed had achieved ISO 9000 compliance and the 10th - a MERIT firm - was close to achieving it. The specific level of ISO 9000 compliance in eight cases was ISO 9002, relating to production processes. However, one of the MERIT companies had also achieved ISO 9001, and the MERIT company that was in the process of obtaining ISO 9000 compliant status also formally planned to achieve ISO 9001 as well as ISO 9002 in due course.

It should be noted that the two "other status" (i.e. non-CIRCLE and non-MERIT) companies interviewed did not actually do any assembly of equipment in Canada. They were merely distributors. In these two cases, their ISO 9000 compliance refers to their assembly plants located off-shore or in the U.S.A.. Although ISO 9000 standards do exist for service operations, such as distribution, these two firms' Canadian operations were not ISO 9000 compliant, but this is not a factor in Canadian federal procurement; the quality standard applies to the actual assembly plant, not the distribution operation.

Accordingly, all the interviewees had considerable experience with ISO 9000.

5.2 Costs and Obstacles

The costs of ISO 9000 compliance for an individual company varied widely; the lowest cost figure suggested was $15,000 and the highest cost figure given was $1 million.

For the four CIRCLE-status firms, the costs given in interviews ranged from $15,000 up to $500,000. However, the high figure seems anomalous, in light of the two intermediate figures being $70,000 and $125,000. Moreover, the CIRCLE firm that incurred the $125,000 cost figure volunteered that they believed their costs were unusually high because they used the ISO 9000 compliance process for a complete re-organization of their work activities (including the development of new software for inventory control and tracing), and this re-organization was included in that cost figure.

It is important to differentiate between direct costs and "fully burdened" costs. Direct costs include salaries paid to the firm's employees to achieve certification (typically for preparing the formal documentation that ISO requires), the costs of review and fee for certification by the qualifying examining organization, and the costs of subsequent audits. A "fully burdened" cost accounting would also include the theoretical share of company overhead, senior management time, etc. dedicated to the ISO 9000 certification process. Such costs could double the overall figure. Whether they should be included is debatable. Some interviewees felt the latter set of costs should not be included; the firm would incur them anyway. On the other hand, other respondents felt they should be included for consistency with the accounting of other parts of their firm's business.

For the larger firms - the three MERIT and two other-status companies - the costs of ISO 9000 compliance were given as larger than the figures for the CIRCLE firms. The MERIT-status company that had achieved ISO 9001 - a more exhaustive exercise - quoted a figure of $50,000 including only direct costs and suggested it would be closer to the $150,000 level on a "fully burdened" basis. Other cost figures ranged from $400,000 to $1 million for these firms on a "fully burdened" basis.

Of course, if ISO 9000 compliance costs were fixed in the range of $500,000 - $1,000,000, it would be a disproportionately heavy cost to smaller firms, representing a higher proportion of their sales revenues. The CIRCLE-status firm that incurred compliance costs of $500,000 even considered that this large outlay really constituted, in effect, a tax on the information technologies industry imposed by government because the federal government, now insisted on its microcomputer suppliers meeting ISO 9000 standards. However, ISO 9000 compliance costs do not seem to be a fixed absolute amount; smaller firms can avoid costs by streamlining their activities and hence requiring simpler certification.

However, an interesting illumination of how costs can readily escalate was offered by one of the larger firms' interviewees. He suggested that mental attitudes towards quality procedures had a major impact on eventual real costs. Companies whose employees understood the need for, and embraced, quality procedures, could expect to accommodate the procedures' analysis and necessary documentation with a minimum of fuss and internal controversy. But a company that reacted negatively to the formalization of the procedures, and refused to use ISO 9000 compliance as an opportunity to learn and improve, invariably wound up incurring extra costs as employees in the company resisted formal changes.

This particular suggestion may or may not be a valid explanation for cost differences. What was noticeable in the interview process, however, was that no less than seven respondents indeed referenced "mind-set", "attitudes", "resistance to change", or similar expressions, as the critical obstacle the company had to overcome in order to achieve ISO 9000 status.

On the question of whether or not smaller firms were disproportionately and/or unfairly cost penalized by the imposition of ISO 9000 standards, one respondent offered a particularly interesting answer. He suggested that start-up firms with 5-20 employees would have few or no problems. In fact, they could actually gain, he said, because they could set their procedures up correctly in the first place. They would have only a limited number of assembly activities, and hence the ISO 9000 documentation would involve relatively few extra burdens. Similarly, firms with larger and more stable sales, e.g. over $10 million annually, could also usually spare the resources from their cash flow to achieve ISO 9000 status. But problems, according to this interviewee, could be expected for fast growth firms in the $1 - $10 million annual sales range. They would require (or think they would require) all their cash flow for new or expanding facilities. As well, these firms might be changing their production processes and organization relatively frequently, and hence ISO 9000 - status updating would be burdensome. These firms would have potential problems owing to their specific growth characteristics.

None of the companies interviewed believed that ISO 9000 in itself had necessitated investment in new manufacturing or assembly process machinery. In one or two cases, the assembly line was re-organized, but the machinery was retained. Also, in one or two other cases, new machinery was acquired, but not specifically for ISO 9000 purposes. The company would have purchased it anyway. The ISO 9000 status was achieved far more from work arrangement analysis and social (and, in some cases, physical) re-organization than from capital investment.[1]

In summary, in nine of the 10 firms that were interviewed, the costs of obtaining ISO 9000 status were considered by the firms themselves as well within a reasonable range of expenses for Canadian assemblers and suppliers of microcomputers. Certainly this is true if only direct costs are taken into account, but even if "fully-burdened" costs are used, nine out of 10 companies still agreed that as long as the company is moving to ISO 9000 out of a genuine desire to improve, the costs are still low enough that no firm need be deterred. Only in the one case of the CIRCLE firm which had the highest costs to reach ISO 9000 status was there the conviction that the costs were not reasonable.

5.3 Impact on New Product Innovation

The government procurement officers felt that compliance with ISO 9000 did not have much impact on product innovation. The CIRCLE and two MERIT company representatives generally concurred. But, the component supplier and two MERIT company representatives did <u>not</u> concur with this assessment. They felt that their companies suffered "constraints in flexibility" in having to meet ISO 9000.

This remark is particularly significant in light of its source (i.e. the component supplier). It is, of course, illogical for a large volume <u>component</u> supplier to complain that compliance to ISO 9000 is hurting product or process flexibility whereas the <u>system</u> assemblers feel less constrained by the standards. The case of the two MERIT companies that agreed that ISO 9000 led to a certain loss of flexibility (other benefits notwithstanding) is also noteworthy. They suggested that the response of the U.S. government and industry to ISO 9000 is significant. In general, the U.S. is moving more slowly to ISO 9000 quality standards than is Canada or Europe, and these two respondents both suggested product innovation constraints were a factor in this slower approach.

1. This is a very revealing finding. It suggests that Canadian firms could improve their processes and output by making better use of existing equipment. This is evidenced by the fact that worker re-training, improved management competence, etc., is at least as important in Canada as capital renewal (although evidently new technology is still important in light of some firms' decisions to invest in better, new machinery, even if not specifically linked to ISO 9000 standards).

On balance, it seems from these interviews that there may be some constraints on new product innovation by implementing ISO 9000 standards, but that adoption of the standards is not a significant obstacle to either the overall development of firms or in obtaining the benefits resulting from ISO 9000 status.

5.4 Drivers and Benefits of ISO 9000

In eight or perhaps nine (one company was not sure) of the companies interviewed in this project, the principal driving force behind the desire to achieve ISO 9000 status is the benefits that such status confers on the company. Among these eight or nine, the federal government's insistence on ISO 9000 was a significant, even if not overwhelming, factor for three of them in driving them to ISO 9000 standards. These three companies were in the CIRCLE (smaller firms) group. Yet, even within this group respondents provided evidence that their firms accepted the need for quality standards beyond merely the requirement to stay on the federal government's bidders list. Finally, in one or perhaps two cases, the federal government's insistence on ISO 9000 was the deciding and determining factor.

The interviews suggested that there were at least four reasons why firms wished to reach ISO 9000 quality standards. First, the major benefit of ISO 9000 that came out in all the interviews is that quality standards actually cut costs in the long run. While quality standards do involve extra costs to implement (and, of course, to obtain certification), the company gains because it will have lower rejection rates from defects, lower warranty costs, and superior customer satisfaction. It has become known by companies that it is always better and cheaper to get it right the first time, whatever the cost, rather than try to fix inferior goods later.

One respondent explained the benefits in these terms: a defect discovered in the R&D laboratory essentially costs $1 to fix; a defect discovered during assembly/manufacture costs $10 to fix; a defect discovered in the retail store costs $100 to fix; and finally, one discovered only on the customer premises costs $1,000 to fix. Each step along the production, sales and distribution chain raises remedial action costs by an order of magnitude. This particular set of numbers is for illustrative purposes but was not drawn out of the air. It followed from the results of a substantial costing study of different defect rates that the firm did internally, and these illustrative figures were shown in internal training programs promoting the need for quality standards.

Second, export market potential, especially in Europe, was commonly mentioned as a secondary benefit, but only by the larger firms (the MERIT and other-status companies). The smaller CIRCLE firms were well aware that ISO 9000 enhanced export prospects, particularly in Europe, but they generally felt they lacked the marketing and distribution networks that were required to achieve meaningful penetration. However, it was especially noteworthy that several representatives of the larger multinational firms singled out how their Canadian divisions' adoption of ISO 9000 was ahead of their U.S.

counterparts, and that this gave extra momentum to their search for world product mandates, by being able to sell to Europe.

Third, several firms ventured that their customers, like the federal government, insisted on ISO 9000. However, this was as likely to be private firms as to be the federal government. Northern Telecom was mentioned as an example no less than four times by both MERIT and CIRCLE firms as an illustration of the global marketplace's accelerating demand for quality.

Fourth, reaching ISO 9000 appeared in every case to have a significant and quite interesting psychological effect. It was tangible evidence of technical achievement - a noteworthy accomplishment in the eyes of many of the managers concerned. More than one company had explicit reference to their ISO 9000 success in the form of a plaque or other such notice hanging in their front lobby, where visitors could not help noticing them. Over and over again respondents would say "we are a better company for meeting ISO 9000".

5.5 Impact of Federal Government Strategies

There was clear agreement among an overwhelming majority of respondents - nine firms - that the federal insistence on ISO 9000 quality standards from its microcomputer suppliers is a wise policy. It is fully in harmony with emerging business trends, helps the federal government acquire useful tools for its own work, and provides a valuable incentive to both large and small Canadian microcomputer firms to improve the quality of their products.

However, when respondents were asked to compare federal government procurement strategies based on quality standards with strategies based on other criteria, such as Rules of Origin, tariff transformation classifications solely (i.e. without Canadian content) or so-called "solutions procurement", they were unable to compare the relative merits of these strategies. All the respondents agreed that the goal of each such strategy was simply too different, one from the other, to allow meaningful comparison. In other words, quality standards do indeed help Canadian industry, but not in the same way or with respect to the same goal as the other options. The strategies were not interchangeable.

Respondents agreed, however, that Rules of Origin were not a desirable strategy for differentiating suppliers. International trade in the components and subsystems going into any given computer was too complex and diverse to make Rules of Origin administratively consistent or even possible. Three respondents referred approvingly to the earlier Branham report for ISTC, illuminating various serious objections. In particular, this report noted the fact that since so much of the componentry was imported into Canada, the final differentiating decision would have to be based on only about 20% of the total price of the computer and this was too slim a margin to make just and reliable decisions.

One option that generated lively discussions was so-called "solutions procurement". On balance, the majority of respondents supported this approach. All the larger firms supported a total systems approach to an identified government need through a prime contractor, with the latter being in charge of arranging procurements of specialized subcontractors as required. Several respondents volunteered that Canada had substantial weakness at the total systems level, and that solutions procurement would be of major benefit in developing such talents domestically.

The smaller firms generally acquiesced in this assessment. Although they appreciated that they might have to sell through prime (systems) contractors rather than directly to the federal government, they recognized the force of "solutions procurement" as a practical business procedure. As one CIRCLE-status firm representative put it, "there's only so many technical solutions possible, and if our niche product is still a good one, we will get procurement orders even if it is in a more indirect procurement process".

Moreover, all the firms interviewed believed they had to appreciate fully their customers' needs (including the needs of the federal government) and respond to those needs (as opposed to simply meeting the formal specifications). Accordingly, they accepted as a matter of course in ordinary business dealings that their products had to provide solutions to customer problems. "Solutions procurement" is, of course, precisely this approach applied to the federal government's needs.

5.6 Are Information Technologies Special?

There remains the issue of whether information technologies (IT) are a strategic lever of a disproportionately great significance to Canada, and hence whether IT procurements justify special treatment of one kind or another. There was no consensus on this issue.

The government procurement officers interviewed for the project had mixed views on whether information technologies deserved differentiated treatment in the national interest. The government procurement officers acknowledged that procurement was a definite tool in industrial development, but they could not agree that computers of any sort were in some way more important than any other technology included in federal procurement. However, one procurement officer did feel that information technologies were indeed strategic in the sense that they had major impact on government processes. They were a vital management tool, and hence had much more importance than (say) office furniture.

Moreover, one government respondent (not the one who accepted IT as strategic) forcefully suggested that this lack of consensus was due more to a lack of investigative research than legitimate consensus. He expressed support for the notion that this issue should be explored further (for example, could this be investigated econometrically with some computer simulations? What statistical data exists to support debate one way or another?)

Among the private sector interviewees, there was more consensus that IT was, in some way, strategic. Generally, firms believed that, at some level of analysis, information technologies seems worthy of different procurement treatment than other items. There are two arguments from the interviews why this case can be made. First, that the integrity of government processes now depends on information technologies, and in turn these processes underpin a large number of follow-on dependencies, for example, cases ranging from national defence to individual income tax returns. Second, product lifecycles in information technologies' products continue to become shorter, thereby changing performance specifications at an accelerating rather than stable rate. In turn, this means that, in purely practical terms, government policy for procuring information technologies equipment has to accommodate on-going and increasing changes. This is indeed different from most other procurements. In other cases, e.g. office furniture, transport equipment, etc., there may still be product changes, but they are contained within stable life-cycles.

6.0 CONCLUSIONS

The overall conclusion from the interviews conducted for this project is that the federal government's policy of including ISO 9000 quality standards as a requirement in microcomputer procurement is a significant and useful step in encouraging and stimulating technological development and overall capability in the relevant Canadian industry. However, while this policy should definitely be continued, it is not sufficient by itself to provide all the industrial upgrading that the federal government would likely wish to see in this industry.

The central issue is that ISO 9000 standards address manufacturing processes and not the question of the practical usefulness of products, or how to encourage new product innovation. If any product is obsolete, it will stay obsolete despite being ISO 9000 compliant.

Conceivably, Canadian industry could solidly achieve ISO 9000 standards and still go out of business. This could come about, for example, in the case of innovative new products from off-shore suppliers whose cost and performance domestic suppliers cannot match. The new products, it should be noted, could themselves be produced in plants that were certified to ISO 9000 standards. They would not have a sufficient cost penalty - or even any cost penalty at all - so that Canadian suppliers (either MERIT-status or CIRCLE-status) would have any measure of protection on account of the quality standards. The issue would remain the firm's innovative product capability, which is not determined by ISO 9000.

Accordingly, ISO 9000 standards are a necessary but not sufficient condition for developing the technological capabilities of the Canadian microcomputer industry.

An alternative strategy for differentiating suppliers, and hence providing incentive for improving technological capability, needs to be put in place. Since Rules of Origin are universally disliked, according to these interviews, the federal government should investigate "solutions procurement" further .

7.0 NEW ISSUE - CERTIFICATION RECIPROCITY

In the course of this project, an important related new issue emerged, that of certification reciprocity.

From our interviews it was ascertained that government procurement officers believed international reciprocity in standards' acceptance was achieved. But both the CIRCLE company representatives and - significantly - the MERIT company representatives were much less sure. (One CIRCLE company representative was especially vocal on the topic.) The companies did not feel that Canadian standards, specifically certification to ISO 9000, were accepted reciprocally by other jurisdictions.

All of the CIRCLE companies had used a Canadian certification agency (i.e. either QMI or CGSB). One, or perhaps two, had superficially considered seeking ISO 9000 compliance through an off-shore certification agency (e.g. an European agency). The costs of going off-shore were found to be prohibitive, and the CIRCLE firms did not feel that the potential benefits were enough to justify the extra expense.

Interestingly, the MERIT company that had achieved ISO 9001 also used a Canadian certification agency, which helps explain the relatively low costs involved. Moreover, this company explicitly investigated whether or not a Canadian certification was accepted in European markets and was satisfied that it would be. A second MERIT company also used a Canadian certification agency - not the same as the first - and also appeared satisfied, but quoted considerably higher costs.

Interestingly, the other MERIT firms, and the other-status firm, used European certification agencies, and accepted the higher costs involved, because they "wanted to ensure they would be accepted to sell in European markets". They were not convinced that Canadian certification was acceptable. Accordingly, there is quite a split within this sample of firms on the international acceptance of Canadian certification.

The resolution of this issue is absolutely vital for any meaningful assessment of the future impact of ISO 9000. If it is true that foreign (and particularly European) jurisdictions will not accept Canadian certification of ISO 9000, then Canadian firms do not have any export advantages from meeting the benchmarks. Moreover, if Canadian federal authorities accept other (particularly Asian) ISO 9000 certifications, then fair reciprocity is not established. Canadian firms are at a competitive disadvantage. Two or three CIRCLE firm representatives hinted that a proportion of foreign (particularly Asian) ISO 9000 certifications were at best unreliable and at worst fraudulent.

APPENDIX A

LIST OF INTERVIEWEES

APPENDIX A: LIST OF INTERVIEWEES

Terry Cave
Senior Program Manager
Qualification and Certification Listing Branch
Canadian General Standards Branch

Noel Bhungara
Director General
Science and Professional Services Directorate
Supply and Services Canada

John Holinsky
Director
Science Branch
Science and Professional Services Directorate
Supply and Services Canada

Peter Sorensen
Director General
Office Automation, Services
and Information Systems (OASIS)
Supply and Services Canada

Sami Sourani
Manager
Economic and Statistical Analysis
Corporate Policy & Planning Service
Supply and Services Canada

William C. MacIver
President
CemTech

Dr. John de Mercado
Chairman and Chief Executive Officer
CemTech

Timothy A. Dummer
Procurement Engineer
International Procurement Office
Hewlett-Packard (Canada) Ltd.

Steve Bisbee
Product Safety and Reliability
Panacom Automation Division
Hewlett-Packard (Canada) Ltd.

Gord Van Koughnet
Vice President
Finance and Administration
Trillium Computer Resources

Ray Morier
Quality Manager/Service Supervisor
Primax Data Products

Larry Deverett
President
Primax Data Products

James U. Ludtke
Director
Quality Assurance
Engineering and Manufacturing
NCR Canada Ltd.

J.C. Bright
Vice President
Operations
Amdahl Canada Limited

Rick Maxwell
Manufacturing Technology Manager
Digital Equipment of Canada Ltd.

Mark Barook
Director
Quality Improvement
Apple Canada Inc.

5

NGL
Nordicity Group Ltd.
Le Groupe Nordicité ltée

VERSAILLES PROJECT ON ADVANCED MATERIALS AND STANDARDS (VAMAS)

A CASE STUDY

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FINAL REPORT

August 28, 1993

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1.0 INTRODUCTION

The Versailles Project on Advanced Materials and Standards (VAMAS) focuses on international collaboration on pre-standards measurement research, intercomparison of test results and the consolidation of existing information on priorities for standardization in the area of advanced materials. As such it provides a particularly good case study within the context of the mandate of the overall study on standards and technology diffusion for the following reasons:

- VAMAS deals with issues at the research and development (R&D) stage, a stage which is becoming increasingly important in the standards-setting process. Issues related to the transition from R&D results to standards can be better appreciated;
- there is a major focus on metrology which is an important basis for standards-setting;
- the international focus provides information on the dynamics of pre-standards collaborative research at the international level and on the linkages with international standardization bodies such as the International Organization for Standardization;
- Canadian participation in an international pre-standardization activity can be better appreciated; and
- the 10 year history of VAMAS, which was established in 1982, provides sufficient historical depth to study the evolution of the project.

2.0 THE HISTORY OF VAMAS

2.1 Developing the Program

VAMAS was launched at the Versailles Summit of the G-7 countries in June 1982. A program of research and development on advanced materials and standards was one of a number of science and technology proposals made at the Summit. The proposal was accepted and a Steering Committee was set up to prepare the VAMAS program. VAMAS is the only active remaining initiative originating from the Versailles Summit.

The framework for the program was based on the accepted proposal which envisaged the provision of R&D to underpin standards and codes of practice that would stimulate the acceptance of new materials and extend the utilization of existing materials. It was recognized that materials technology was an enabling technology that would have a major influence on the growth of mechanical, construction and electronic industries. The aim of the program was to provide the advanced measurement and data bases that would lead to the development of standards so as to increase industrial confidence in the application of such materials.

Program development culminated in the signing of a Memorandum of Understanding (MOU) among the G-7 countries and the Commission of the European Community (CEC) (see Appendix 1). This MOU set in place a five year research program which was launched on April 2, 1987, five years after the original decision to proceed.

The program was overseen by a Steering Committee composed of three representatives from each of the signatories to the MOU. As originally conceived, the Chairmanship and Secretariat of the Steering Committee alternate every three years between the U.K. and the U.S.A., and is currently in the U.S.A. at the National Institute of Standards and Technology. The Steering Committee meets at least once a year to review the work of Technical Working Areas (TWAs). The Secretariat is also responsible for publishing a semi-annual Bulletin on progress and VAMAS Technical Reports on TWA projects.

The Canadian representative on the Steering Committee is Dr. Jacques Martel, Director-General of NRC's Industrial Materials Institute (IMI).

2.2 The 1987-1992 Program

The initial work program centred on the activities of 14 TWAs in five thematic areas:

Thematic Areas		Technical Areas	
I	Metals and Metal Matrix Composites	TWA 11, TWA 13,	Creep Crack Growth (work completed) Low Cycle Fatigue
II	Polymers and Polymer Matrix Composites	TWA 4, TWA 5, TWA 12,	Polymer Blends Polymer Composites Efficient Test Procedures for Polymer Properties
III	Ceramics and Ceramic Matrix Composites	TWA 3,	Ceramics
IV	Test Techniques (non-material specific)	TWA 1, TWA 2, TWA 6, TWA 7, TWA 8, TWA 9,	Wear Test Methods Surface Chemical Analysis Superconducting & Cryogenic Structural Materials Bioengineering Materials Hot Salt Corrosion Resistance Weld Characteristics (work completed)
V	Materials Classification and Data	TWA 10, TWA 14,	Materials Databanks Unified Classification System for Advanced Ceramics

TWA 9 on weld characteristics completed its work in 1990, while TWA 11 on creep crack growth completed its activities in September 1992. Canada chairs TWA 4, Polymer Blends.

The results of this five year program can be measured in two ways; (1) scientific and technical achievements; and (2) influence on standardization.

The scientific and technical output of the program by each TWA is shown in Exhibit 2-1.

Exhibit 2-1
VAMAS TWA Publications
(as at May 1992)

TWA	Publications	Per cent
1	11	4.4
2	42	16.7
3	11	4.4
4	50	19.8
5	14	5.6
6	52	20.6
7	9	3.6
8	6	2.4
9	3	1.2
10	15	6.0
11	15	6.0
12	1	0.4
13	4	1.6
14	3	1.2
General	16	6.4
Total	252	100

Source: VAMAS Publication and Participants, May 1992

Examples of key areas where contributions were made include:

- the work done in wear metrology defining critical test parameters and methodology to obtain reproducible data;
- the development of accurate and traceable calibration methods based on fundamental understanding of electron spectroscopy techniques applied to surface analysis;
- an understanding of the properties and behaviour of complex polymer blends;
- the analysis of the mechanisms of delamination crack growth in polymer composites;
- the new knowledge of the fracture toughness of cryogenic steels and technical ceramics;
- an assessment of the effects of impurities in weld characteristics.

With regard to VAMAS achievements on the standards front, two national standards have been published on test methodology for wear of materials. In the surface chemical analysis area, a standard data transfer format has been developed and although it is not published by a Standards Body, the format has been accepted by the surface analysis community and is being used widely. Similarly, reference materials and guidelines for testing have been produced. Also, a standard on a test method for measurement of creep crack growth rates in metals was approved by the American Society for Testing Materials (ASTM) on February 15th, 1992. It is estimated that the technical basis has already been established from which another ten or so standards are at various stages of development.

No international standards have yet resulted from the work of VAMAS. However, closer ties have been established between VAMAS and the International Organization for Standardization (ISO). An ISO representative attends Steering Committee Meetings, and an agreement has been reached with ISO to publish joint Technology Trend Documents based on VAMAS research results. (see Appendix 3)

2.3 Evaluation of the 1987-1992 Program

An external review of VAMAS was undertaken in 1991 in preparation for a decision on whether or not to renew the program in 1992 for another five years. The conclusions and recommendations of that review[1] were as follows:

Conclusions

1. VAMAS has operated satisfactorily in accordance with the articles in the Memorandum of Understanding agreed by the Seven Economic Summit Nations and the Commission of the European Communities.

2. The signatory nations have participated strongly in VAMAS research activities. Four or more of them have contributed to each of the 14 technical work areas, and all eight have been involved in four areas.

3. VAMAS has made commendable progress since its inception in pursuing pre-standardization research on advanced materials. Several of the technical work areas have completed one or more objectives for their projects and transferred the technical basis to standards bodies.

4. The success of many of the activities is mainly attributable to the enthusiasm and technical competence of its participants and to adequate industry support.

5. The scientific and technical achievements, reflected in a considerable number of published papers, VAMAS Technical Reports and international conference presentations, are contributing to the development and utilization of advanced materials.

1 Glenny R.J.E., Blair J.A. and Tanaka R.: VAMAS, An Independent Report: VAMSC (91) 3; March 1991

6. The management of VAMAS has been effective at Steering Committee level. Management of the technical work areas has been generally satisfactory despite limitations such as lack of technical funding and lack of travel funding for some national activities, and discontinuities caused by changes in chairmanship and national co-ordinators.

7. VAMAS has enhanced co-operation between national research laboratories and national and international standards bodies, and has encouraged the involvement of industry ahead of strong market.

8. VAMAS is fulfilling its unique role in bringing to participants within and between nations the global knowledge and coverage of pre-standardization research that serves to avoid duplication and will lead to harmonized standards.

Recommendations

1. The Panel strongly recommends that VAMAS should be continued for at least another five years beyond 1992.

2. In noting the approved participation of non-Summit European nations in some VAMAS activities and requests for inclusion by some other nations, the Panel recommends that participation should continue to be subject to the unanimous agreement of all MOU signatories.

3. The Panel recommends that collaboration in VAMAS should continue to be on a work-sharing basis with no transfer of funds between the signatory nations.

4. The Panel recommends that the Steering Committee Chairman and the Secretariat should continue to change every three years but that the change should not be confined to the United Kingdom and the United States.

5. Additional effort should be made in the future toward conversion of technical results to international standards.

6. Closer collaboration between VAMAS and national and international standards bodies is recommended. The transfer of information from VAMAS should continue to be in accordance with Article VI of the MOU.

7. National governments should be encouraged to provide greater support for specific aspects of VAMAS such as travel funding and allowing the Secretariat to publicize VAMAS more effectively.

8. Industry representation on the Steering Committee and a strong industry presence in the Technical Working Parties should be sought in order to achieve greater financial support from the private sector.

9. The Panel recommends more formal organization of the modes of projection selection, technical publication and publicity.

10. The Panel suggests that the fifth to ninth recommendations above could be more effectively implemented by the inclusion of industry and ISO/IEC on the Steering Committee and by the formation of appropriate sub-committees.

11. In light of the above, the Panel recommends that the VAMAS Memorandum of Understanding should be extended by mutual agreement, i.e., without changes.

In sum, while there was a significant scientific output from VAMAS, the translation of that output into standards remained sketchy. There remains a need to establish closer relationships with standardization bodies and with industry.

All of the TWAs in the 1987-1992 program had participants from at least four of the VAMAS signatory nations. Eight other countries (Austria, Belgium, Denmark, Finland, Netherlands, Portugal, Sweden, Switzerland) have contributed to one or more projects. Moreover, more than 330 laboratories have participated in various tests.

The progress of each TWA varied depending on the technical and travel funding available, the stability of the membership as well as the direction given to the work program. The relative scientific outputs shown in Exhibit 2-1 give an indication of the relative dynamics of the TWAs.

3.0 DYNAMICS OF THE 1987-1992 PROGRAM

3.1 Overview

The VAMAS Steering Committee operates by consensus. It meets at least annually, and more often if agreed. It is composed of up to three representatives from each of the participating countries and the Commission of European Communities, which are signatories to the VAMAS MOU. The officers of the Steering Committee are a Chairman and a Secretary. The Secretary is designated by the Chairman and need not be a member of the Steering Committee.

Delegations from each participating country at Steering Committee meetings may include participants designated by the official representatives.

In practice, not all countries send their full slate of three representatives to these meetings. Exhibit 3-1 provides a "characterisation" of the Steering Committee membership. Japan, the United States, and Italy each have three designated members on the SC. Germany, the United Kingdom and the CEC each have two, and Canada and France each have one designated member.

Japan, the U.S. and the U.K. include members who are employed within standards-setting organizations. Most other members are employed within a science and technology/R&D type of agency. This is not to say that the latter representatives are not also active in standardization activities. For example, the Chairman and the

Secretary of VAMAS (from the U.S.), respectively, each chair an American standards technical committee.

Exhibit 3-1: Membership of VAMAS Steering Committee

	Designated Representatives (Total Number)	Representatives By Work Area: Standard-setting Organization	Representatives By Work Area: R&D Institution/ Science & Tech. Agency
Japan	3	1	2
United States	3	1	2
United Kingdom	2	1	1
Germany	2	0	2
Canada	1	0	1
Italy	3	0	2
France	1	0	1
CEC	2	0	2
TOTAL	17	4	13

The sole Canadian representative on the Steering Committee is Dr. Jacques Martel, Director-General of the Industrial Materials Institute at the National Research Council.

Generally, the nature of participation in VAMAS by the G-7 countries follows their style of involvement in other international standards or pre-standards forums. The Germans and the British take an active role in planning and technical activities. The Japanese come well prepared to the meetings, both at the SC and TWA levels, taking the initiative in identifying and proposing projects. France and the CEC have a high level of interest in VAMAS, but are mostly effective at the working group level rather than at the planning phases within SC. Similarly, Italy provides excellent technical contributions to the TWA activities, but contributes less to the planning and the establishment of a cohesive approach to the work.

The United States and Canada seem to benefit mainly from the TWAs which they chair. As originally conceived, VAMAS projects were to be financed as needed by interested participants and stakeholders (including private industry, laboratories, research institutions, standards development organizations, etc.). For the European members of VAMAS (U.K., Germany, France, Italy), the rationalization of funding activities of the Steering Committee and of the Technical Working Areas is provided under the framework of their common goal for normalizing European standards. Japanese financial contributions to VAMAS are seen as part of a broader strategy for proliferating its own technology and standards.[2] Rationalizing the financing of VAMAS participation by these countries is thus relatively easier than for the Americans or the Canadians, for whom there is no broad framework within which to identify or rationalize participation.

[2] Japan advanced $1 million in 1993 to support the future work program

Japan and the CEC members of VAMAS have formal budgets for VAMAS activity. All CEC members of VAMAS benefit from the Comité européen de normalisation's (CEN) mandate for harmonization standards in Europe. Japan benefits from its strategy for using international standards and pre-standardization organizations to promote its technologies. The U.S. and Canada benefit more by default rather than as a result of a strategic approach.

Neither the U.S. nor Canada have a consistent or planned mechanism for financing VAMAS participation. The U.S. and Canada have to identify volunteers and funding sources on a more ad hoc basis. However, the advantage that the U.S. has over Canada, in this matter, is that it has a greater base of potential sources of funding and interested parties. In addition, because one of the U.S. delegates to the Steering Committee is from ASTM and the other two are from the National Institute on Standards and Technology (NIST), this creates a climate of interest and cooperation, with respect to VAMAS activities, between these two U.S. organizations, both of which are directly involved in standards development activities.

3.2 Canadian Involvement

3.2.1 The Case of TWA 4 - Polymer Blends

Canada participated actively in the 1987-92 VAMAS program. Canada was involved in 7 of the 14 TWAs and NRC's Industrial Materials Institute (IMI) took responsibility for Technical Working Area 4 (TWA 4) - Polymer Blends - whose objective was "to provide the technical basis for drafting standard test procedures for new, high performance polymer alloys and blends in 5 complementary technical areas; melt flows, dynamic testing, thermal properties, morphology and mechanical properties". IMI devoted half a scientific person year (PY) and three-quarters of a technician PY to VAMAS activities during each year of the program.

As can be seen from Exhibit 2-1, the scientific output from TWA 4 as measured by the number of publications, was very high relative to most other groups. Ninety-five laboratories in Canada, France, Germany, Italy, Japan, U.K., U.S.A., Denmark and The Netherlands participated in the work of TWA 4.

However, difficulties arose when an attempt was made to translate some of the scientific information into standards. By 1988, work in the area of thermal characterization of polymer blends reached the stage where it could be translated into an international standard. The International Organization for Standardization (ISO) in Geneva, was the obvious place to go.

Dr. L. A. Utracki of IMI, the Chairman of TWA 4, prepared the necessary documentation and on August 23rd, 1988, forwarded the material to the Standards Council of Canada (SCC), Canada's accredited body to ISO, for transmittal to the appropriate ISO Committee for consideration.

The SCC passed on the material to ISO, and the item found its way to the ISO Technical Committee (TC) 61 which deals with plastics. To be accepted the item needed to receive a majority vote by member countries participating in TC 61 following ISO procedures. On July 15th, 1989, the result of the vote was issued; the proposed item had been accepted. However, Canada (i.e., the SCC) which had submitted the item did not vote. Subsequently, the item was declared "null and void" because there was no follow-up on the item by Canada.

Dr. Utracki's submission of August 23rd, 1988 was never acknowledged by the SCC. The SCC next contacted him on June 15th, 1991. However, Dr. Utracki had heard of the disposition of his item by TC61 previously through his VAMAS contacts.

This item "fell between two stools" for the following reasons:

- VAMAS TWA 4 felt that it had discharged its responsibilities after completing the technical work; as per its mandate of "providing the technical basis for drafting standard test procedures";

- SCC transmitted the proposed item to ISO without recognizing that VAMAS TWA 4 felt that its work was completed with the transmittal of the information to ISO.

VAMAS TWA 4 did not realize that it needed to "champion" the work item through the ISO process until it became a standard. This would have required significant resources which VAMAS or IMI did not have.

IMI did not obtain extra resources to participate in VAMAS. Moreover, IMI does not consider itself a standards development laboratory.

This impasse, which remains, was frustrating because TWA 4 had two other items ready to be transferred to ISO.

3.2.2 The Case of Surface Chemical Analysis: TWA 2 and ISO TC/201

This case is another example of the disjointedness of Canada's participation in VAMAS.

The ISO recently created a new Technical Committee (ISO/TC 201) on Surface Chemical Analysis in response to a proposal from Japan which also provides the Secretariat. As of January 1993, ten national standards bodies had indicated willingness to become participating members of ISO/TC 201 and fifteen national standards bodies had indicated willingness to become observer members. ISO/TC 201 will develop international standards and will consider standards and documents prepared by other groups as potential international standards.

This new ISO Technical Committee is a logical development that follows from the work of the VAMAS TWA 2. VAMAS will liaise with this Committee through national standards committees and links with the Secretariat.

What is interesting to note regarding this case, is that Canada was an active member of TWA 2, leading two of the 31 projects under this technical area, with seven experts participating in the activities.

Professor I.V. Mitchell of the University of Western Ontario and Dr. P.R. Underhill, then of Alcan (now Royal Military College, Kingston) were the two Canadian project leaders. They participated at the technical level within TWA 2 and had no contact with either the Canadian representative on the Steering Committee of VAMAS or the SCC. Because of the voluntary nature of their participation, and the lack of a budget for travel, their involvement was mainly through correspondence. Their reports were sent to the Chair of TWA 2 who in turn circulated them to other researchers involved. Their involvement in TWA 2 was not highly structured. Professor Mitchell will meet the Chair of TWA 2 for the first time, at a conference in the U.S. this fall. Dr. Underhill does not know what happened to his last report which was submitted when his work with TWA 2 ended.

In the follow up work involving ISO/TC 201, however, Canada is neither a participating nation nor has observer status![3] The Standards Council of Canada canvassed the five standards development organizations in Canada as to their interest in participating in this ISO Technical Committee. There was no interest.

3.3 From Scientific Results to Standards

These two cases illustrate the organizational and communications difficulties between the scientific and standards communities. On the one hand the scientists are focussed on technical issues within their peer groups (e.g., TWAs) with little understanding of the standardization process and contact with standards bodies. On the other hand, the standards community has difficulty dealing with the results coming out of VAMAS, in large part because this program is not formally tied to an accepted standardization body and hence lies outside well established standardization procedures.

The difficulty of translating scientific results into standards was not only a Canadian problem. The vast majority of TWAs indicated that there should be closer ties between VAMAS and national and international standardization bodies (reference 1).

The fact that an ISO representative was present at recent VAMAS Steering Committee meetings was taken as an indication that there will be closer ties between the two organizations.

[3] See listing of national standards bodies that are members of ISO/TC 201 in Feature Article in VAMAS Bulletin 16 (Draft - 1993), "ISO Technical Committee 201 on Surface Chemical Analysis", by C.J. Powell and R. Shimizu.

4.0 THE 1992-1997 PROGRAM

4.1 New Directions

The new Memorandum of Understanding (MOU) between the member nations, covering the period from 1992 to 1997 (Appendix 2), has been approved by six countries (U.K., U.S.A, Germany, Japan, Canada, and Italy) and the Commission of the European Communities (CEC). A formal response from France has not yet been received.

There are several changes that have evolved in the workings of VAMAS for 1992-1997:

Chairmanship: The Chairmanship is to be rotated among all the G-7 nations (not just the U.K. and U.S.A.). For the 1995-1997 round, a Chairman will be elected by the Steering Committee.

Relationship of SC with TWA Groups: There will be a new working relationship between the Steering Committee and the Technical Working Area Groups. Liaison between the SC and TWAs will be through a Steering Committee Co-ordinator, for each TWA. The implementation of this new "thematic/co-ordinator" system is intended to improve the administrative functions through delegation of certain authorities to reduce the delay for decisions between SC meetings:

> "Each Technical Working Area will have a Steering Committee member assigned as Co-ordinator. The Chairman of the Technical Working Area reports directly to the Co-ordinator. The Co-ordinator or their designee are responsible for tracking and reporting the activities and progress of the Technical Working Area at each Steering Committee meeting."

The Co-ordinators or their designees will have the responsibility to provide the communications interface between the TWA and the full Steering Committee.

Dissemination of VAMAS work: There will be an increased emphasis during 1992-1997 on liaison with national and international standardization organizations, and on dissemination/publication of VAMAS results. For example, an MOU has been signed between ISO and VAMAS on the dissemination of information (Appendix 3).

Proposals for new work areas: In the past, proposals of work areas usually came from the lead national members of the Steering Committee (SC). For the 1992-1997 round, proposals initiated from outside the SC will be encouraged. A draft copy of the VAMAS "Technical Working Area Project Initiation Form" is included in Appendix 4. Project initiation proposals will be considered based on the following themes: metals and MMC; polymers and PMC; ceramics and CMC; test techniques (non-materials specific); and materials classification and data.

A new criterion for selection of a TWA has been added to the requirements: "the extent of industrial and international participation". The other criteria that have in the past guided the selection process are:

- importance of the area in terms of potential for advancement of technology, growth, and employment;
- involvement of advanced materials technology;
- significance for standards;
- inability to proceed with standards development on the basis of existing technology or current programs to develop new technology;
- non-duplication of effort already under way in another organization; and
- the probability of implementation of the results.

Resource Requirements: The resource requirements for VAMAS projects will include the following: travel funds for participants; lab testing facilities -- a budget for at least two weeks in an industry or government lab; the price of purchasing specimens must also be covered, if the test involves materials.

The Content of the Program: A new technical working area (#15), "Metal Matrix Composites" has been added to the program for the 1992-1997 period. Other changes in the VAMAS program will evolve from the next Steering Committee meeting and workshops to be held with the chairs of the TWA groups (see next section).

Currently the most active of the technical working areas is TWA 6, "Superconducting and Cryogenic Structural Materials", which is led by the Japanese. VAMAS is playing a very pro-active role in this area. The Japanese have proposed an aggressive work program for the 1992-1997 period.

In addition, TWA 2, "Surface Chemical Analysis", now has liaison with the newly established ISO Technical Committee 201 on Surface Chemical Analysis. This liaison ensures full communication between these two activities so that the results of any VAMAS work may rapidly enter the TC/201 activity. It should be noted that the new ISO TC/201 was a logical development that followed from the work of the VAMAS TWA 2.

4.2 Next on the VAMAS Agenda

The Steering Committee will continue to work by consensus. Discussion proceeds until all participants accept the course of action to be taken by all participants or action to be taken by a subset of the participants.

The next meeting of the Steering Committee will be hosted by the Commission of European Communities -- probably around March-April 1994. The 1992-1997 program will be on the table for discussion at this time. Consideration will be given to proposed new TWAs, and terminating inactive TWAs and TWAs that have completed their work.

General action and policy issues will also be on the agenda (e.g., relations with international standardization bodies such as the ISO). The IEC has expressed interest in VAMAS activities, particularly in relation to TWA 6 (involving superconductivity). An MOU between the IEC and VAMAS may be in the making.

Prior to the next Steering Committee meeting, workshops will be held with TWA chairs to discuss the following areas: (1) current status of the work in progress; and (2) strategic workplan for the future, including recommendations for the next phase.

These workshops will be part of the on-going evaluation of the strategic importance of each work area, and the assessment of the impact of VAMAS (with particular emphasis on areas where there is technical representation and a high degree of pre-standardization interest).

4.3 Canada and the Renewal of the MOU

For Canada, renewal of the MOU created a dilemma. A survey undertaken by NRC to ascertain interest in VAMAS, prior to renewal, revealed that while participation in VAMAS was considered important to Canada (e.g., being part of the G-7 "club"; S&T intelligence on new materials) there was not much support from industry, supposedly the major beneficiary of VAMAS. Industry indicated that it did not have time to participate and the information could be obtained from other sources (e.g., the parent, if the firm is foreign-owned). Moreover, the fact that there is no dedicated funding for Canadian participation in VAMAS, resulted in a limited interest from university and government researchers.

While NRC is the appropriate focus for Canadian involvement in VAMAS, there is not a clear complementarity of interest between VAMAS and IMI, the NRC Institute which provides the Canadian interface with VAMAS. IMI does not consider pre-standard work to be part of its mission. Furthermore, IMI is increasingly pressed to undertake shorter term R&D on a cost-recovery basis.

This situation was raised at the 14th VAMAS Steering Committee meeting in Tokyo (19-20 December 1991). The Canadian representative outlined two possible options regarding the renewal of the VAMAS MOU. First option: Because of the lack of major interest in Canada on pre-standard research, Canada would not renew the agreement. Second option: If members were in agreement and in order to maintain a G-7 membership, Canada would renew the MOU with the understanding that in the present context NRC would not be an active partner.

The member countries indicated that if Canada would agree to make its best effort in the management of VAMAS activities, they would strongly urge Canada to sign the renewal.

NRC accepted to sign the renewal because it would keep Canada in a G-7 committee, reinforce NRC's international role and maintain NRC as the focal point of materials in Canada. However, NRC will not play as active a role in this new program as the one it had played in the previous program.

5.0 ISSUES

5.1 Difficulty of Translating Research Results into Standards

As noted in Section 3.2, there have been major difficulties in translating research results into standards. This can be attributed to a number of factors:

- the perceived mandate of researchers that the work is finished once the technical information is passed on;
- the general lack of understanding of the standardization process by researchers;
- the lack of appreciation of the mandate and the work of VAMAS and the role of IMI by the Standards Council of Canada;
- the lack of a "champion" and resources to ensure that the research results are translated into standards; and
- the fact that the Canadian representative to VAMAS, IMI, does not consider pre-standard work to be part of its mission.

Others have also experienced similar problems and have set in place mechanisms to overcome them. For example, research and development projects funded under the European Community's RACE (Research on Advanced Communication in Europe) have a standards dimension incorporated into them. The research results are reviewed by the RACE Industrial Consortium (RIC) for standardization implications. RIC, which is an accredited body to the European Telecommunications Standards Institute (ETSI), transmits the relevant RACE contributions to the various ETSI committees. In this way the early translation of research results into standards is assured.

Another example is the SYREN (la synergie recherche normalisation) program offered by l'Association française de normalisation (AFNOR) to French firms wishing to introduce their research results into European standardization processes. The principal focus of the support is to French firms participating in European R&D projects (e.g., Eureka; E.C.).

Both Canada and VAMAS need to explore possible mechanisms to bridge the gap between the research and standardization communities. Some steps are being taken, such as the MOU signed recently between VAMAS and ISO. However, at the Canadian level there remains a large gap between the research (i.e., IMI) and the standardization community (i.e., SCC).

5.2 Lack of Industry Interest

Canadian industry has not shown much support for the work of VAMAS, as noted earlier (Section 4.3). Subsidiaries of foreign-owned firms felt that standards work was the responsibility of the parent company. Canadian-owned firms felt that they could obtain the information elsewhere and many had no interest because they were not involved with advanced industrial materials.

Those few firms which participated (e.g., Dow Chemicals) did find the VAMAS activities useful, especially the networking and the intelligence obtained.

5.3 Lack of Government Support

The federal government was not particularly supportive of VAMAS and placed the onus of the final decision to participate on the NRC.

Participation in VAMAS does not appear to be linked to any policy development activity regarding advanced industrial materials (AIM). While there does not appear to be any firm policy direction on AIM there does exist a National Advisory Panel to the Minister of Industry and Science Canada on AIM. However, the Canadian representative to VAMAS, Dr. Jacques Martel, who is also Director-General of IMI, is not part of these discussions.

6.0 CONCLUSIONS

Canada's participation in VAMAS has highlighted a number of issues which include:

- the difficulty of establishing close ties between the research and standards community at a time when such links are considered important and are being established in other countries;
- the lack of industry support which reflects, at least in part, the structure of Canadian industry in the materials sector (e.g., foreign ownership, limited domestic technological development); and
- the lack of government policy and strategy in AIM that would give clearer directions to participation in initiatives such as VAMAS.

These issues illustrate that, generally, a much more coherent and strategic approach to technology and standards is needed.

7.0 RECOMMENDATION

The findings of this case study lead to the following generic recommendation:

- Canadian involvement in pre-standard research activities, at either the national or international level, should be undertaken within a strategic framework where funding, policy direction and the resulting benefits are made clear and the links between the agencies undertaking the research and those responsible for downstream standardization activities are established at the outset.

APPENDIX 1

ORIGINAL

MEMORANDUM OF UNDERSTANDING (MOU)

FOR COLLABORATION ON ADVANCED

MATERIALS AND STANDARDS

MEMORANDUM OF UNDERSTANDING
FOR COLLABORATION ON ADVANCED MATERIALS AND STANDARDS

THE UNDERSIGNED PARTIES

CONSIDERING

- the agreement of the Working Group on Technology, Growth and Employment established by the Economic Summit Meeting held in Versailles, 1982;
- the recommendations of the Working Group on collaborative research aimed to promote improvements in advanced materials and standards;
- the endorsement of the report of the Working Group by the Heads of Government at the Economic Summit Meeting in Williamsburg, in 1983;
- the spirit of the cooperation as it derives from the Summit Declaration namely, a common commitment to encourage the setting up of codes of practice and specifications on an internationally coordinated basis, as a contribution to removing technical barriers to, and promoting the development of trade in new technologies;

PROPOSE

collaboration between the parties to the Memorandum on research into Advanced Materials and Standards the arrangements for which are set out in the following articles.

Article I: SCOPE AND OBJECTIVES OF COOPERATION

The scope of the cooperation embraces work on enabling scientific and technological research in advanced engineering materials, the work having the clear aim of providing the technical basis for drafting Codes of Practice and Specifications in these materials.

Article II: SCOPE OF INVOLVEMENT

Each of the signatory parties will be free to enter into one or more of the individual work projects.

Article III: MODALITIES OF COOPERATION

The manner of collaboration will be on a work-sharing research basis, in which each participating member agrees to carry out a specific complementary component of a larger project and in turn obtain access to the total research output of that project.

A Steering Committee will be appointed having at most three delegates from each participating country appointed by his/her Government. This Committee will be responsible for setting up the appropriate technical structures for cooperative research. Each technical area will be managed by a Technical Working Group.

Article IV: FUNDING SOURCES

The activities carried out under this Memorandum will be subject to and dependent upon funds and manpower available to the parties. There will be no transfer of funds between countries unless such arrangements are made between the parties concerned.

Article V: PROGRAMME MONITORING

The Steering Committee, which should meet at least once a year, will review and report progress on all the activities carried out under this Memorandum; in addition, it should exchange views and act upon proposals for any future activities.

Article VI: RESEARCH OUTPUT

There will be free exchange of research output also among the participating parties in a specific technical area. Each party will be free to use the total information in order to help prepare standards or specifications directly with their national standards organisation. With the agreement of all the parties, draft standards will be recommended to the International Standards Organisation as a basis for standards having international status.

All parties will respect confidentiality in the research output unless or until agreed otherwise. Further specific conditions relating to the confidentiality of results may be imposed by agreement according to the particular project.

Article VII: PARTICIPATION BY OTHER COUNTRIES

With the unanimous agreement of all parties other countries may enter into this collaboration.

Article VIII: LIMITATION OF LIABILITY

No party to this Memorandum will accept a liability nor assert a claim against any other for damages arising from activities under this Memorandum.

Article IX: DURATION OF AGREEMENT

This Memorandum shall enter into force upon signature by all parties and remain in force for five years. It may be extended by mutual agreement.

Any party may terminate its participation under this Memorandum upon receipt by all other parties of six months' written notice of termination.

This Memorandum may be amended only by the unanimous agreement of all parties.

APPENDIX 2

VAMAS MEMORANDUM OF UNDERSTANDING

1992-1997

VM 01/85/4

VAMAS

VERSAILLES PROJECT ON ADVANCED MATERIALS AND STANDARDS

PROGRAMME DE VERSAILLES SUR LES MATÉRIAUX DE POINTE ET LES NORMES

VERSAILLER VORHABEN ÜBER FORTSCHRITTLICHE MATERIALIEN UND NORMEN

PROGETTO DI VERSAILLES SUI MATERIALI D'AVANGUARDIA E RELATIVE NORME

新材料及び標準に関するベルサイユ・プロジェクト

MEMORANDUM OF UNDERSTANDING
DÉCLARATION COMMUNE D'INTENTION
GEMEINSAME ABSICHTSERKLÄRUNG
DICHIARAZIONE D'INTENTI
覚　書

MEMORANDUM OF UNDERSTANDING
FOR COLLABORATION ON ADVANCED MATERIALS AND STANDARDS

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The Steering Committee, which should meet at least once a year, will review and report progress on all the activities carried out under this Memorandum; in addition, it should exchange views and act upon proposals for any future activities.

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This Memorandum may be amended only by the unanimous agreement of all parties.

VAMAS

VERSAILLES PROJECT ON ADVANCED MATERIALS
AND STANDARDS

PROGRAMME DE VERSAILLES SUR LES MATÉRIAUX DE POINTE
ET LES NORMES

VERSAILLER VORHABEN ÜBER FORTSCHRITTLICHE MATERIALIEN
UND NORMEN

PROGETTO DI VERSAILLES SUI MATERIALI D'AVANGUARDIA
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新材料及び標準に関するベルサイユ・プロジェクト

MEMORANDUM OF UNDERSTANDING

DÉCLARATION COMMUNE D'INTENTION

GEMEINSAME ABSICHTSERKLÄRUNG

DICHIARAZIONE D'INTENTI

覚　書

RENEWAL

MEMORANDUM EXTENSION, APRIL 1 1992-MARCH 31 1997

AGREEMENT ON BEHALF OF:

SIGNED:

POSITION:

DATED:

APPENDIX 3

ISO/VAMAS

MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING BETWEEN THE VERSAILLES PROJECT ON ADVANCED MATERIALS AND STANDARDS (VAMAS) AND THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

CONCERNING COOPERATION AT THE INTERNATIONAL LEVEL ON THE UTILIZATION OF THE RESULTS OF PRE-STANDARDIZATION RESEARCH ON ADVANCED MATERIALS IN THE DEVELOPMENT OF INTERNATIONAL STANDARDS

1. General considerations

1.1 Recognizing the role of the Versailles Project on Advanced Materials and Standards (hereinafter referred to as VAMAS) in promoting research on the properties and performance of advanced materials in laboratory and service conditions; and in promoting the development of unified test methods through international collaborative projects aimed at providing the technical basis for drafting codes of practice and specifications for advanced materials;

1.2 Recognizing the role of the International Organization for Standardization (hereinafter referred to as ISO) in the development and publication of International Standards;

1.3 The Chairman of the Steering Committee of VAMAS and the Secretary-General of ISO, on behalf of their respective organizations, agree to the following principles to govern cooperation between the two organizations in all areas where their functions and activities are complementary and mutually supportive.

2. Cooperation

2.1 VAMAS undertakes through its technical working areas to prepare guidelines to accelerate the establishment of standards on advanced materials through pre-standardization research permitting to identify those aspects most suitable to the characterization and testing of advanced materials. Guidelines ready for provisional application may be offered to ISO for publication.

2.2 When VAMAS guidelines are at a stage of development permitting their use as "prospective standards for provisional application" in a specific field of advanced materials, ISO will consider, through its approval mechanism, to publish them in its "Technology Trends Assessment" series of documents and disseminate them through its distribution channels.

ISO expresses a special interest to receive from VAMAS guidelines covering fields of advanced materials in which there is an urgent need for guidance on how standards should be used to meet an identified need. Those guidelines should be proposed for provisional application so that information and experience of their use in practice may be gathered.

2.3 ISO shall circulate comments received on "Technology Trends Assessment" documents to VAMAS, to ISO member bodies and to potentially interested ISO technical committees with a view either to continuation of the pre-standardization research or to their introduction into the formal process of International Standards development.

VAMAS

DRAFT *"new text in bold italics"*

VERSAILLES PROJECT ON ADVANCED MATERIALS AND STANDARDS

TECHNICAL WORKING AREA PROJECT INITIATION FORM

GUIDELINES

VAMAS

The Versailles Project on Advanced Materials and Standards (VAMAS) supports trade in high technology products through international collaborative projects aimed at providing the technical basis for drafting codes of practice and specifications for advanced materials. The scope of the collaboration embraces all agreed aspects of enabling science and technology - databases, test methods, design methods, and materials technology - which are required as a precursor to the drafting of standards for advanced materials. VAMAS activity emphasizes collaboration on pre-standards measurement research, intercomparison of test results, and consolidation of existing views on priorities for standardization action. Through this activity, VAMAS fosters the development of internationally acceptable standards for advanced materials by the various existing standards agencies.

PROJECT INITIATION

VAMAS is led by a Steering Committee (SC) which meets regularly to review activities such as new proposals, future strategy, publication and other policy issues. The SC operates by consensus and is composed of up to three national representatives from each participating summit country and the CEC. Projects are organized through Technical Working Areas (TWAs) which are grouped under Theme headings. ***Each TWA has a SC member assigned as Co-ordinator. The Co-ordinators provide the communication interface between the SC and the TWAs.***

VAMAS THEMES

I	Metals and MMC	IV	Test Techniques (Non-materials specific)
II	Polymers and PMC	V	Materials Classification and Data
III	Ceramics and CMC		

All proposals should be submitted to the ***appropriate Co-ordinator*** in accordance with the accompanying forms and no project should start until it has been given at least provisional approval by the Secretariat.

April 1993

VAMAS PROJECT INITIATION FORM

1 Theme

Indicate I - V as appropriate.

2 Title

Reasonably short.

3 Objectives

Make a clear concise statement of the technical problem or problems to be solved.

4 Deliverables

Define expected end products

5 Pre-standardization Needs

The aim is to determine the need for additional pre-standardization work and whether or not the results can be incorporated quickly into existing or planned standards. Please indicate:

- relevant existing standards or industrial codes of practice, if any;
- whether the measurement is to be used for quality control, materials specification or design;
- the range of industries using such measurements and the level of such usage;
- active or projected standardization committees, either national or international, and whether members of these committees are willing to participate in any VAMAS project.

6a Plan

Identify plan to achieve objectives and unique skills required.
Identify either joint leadership (specific names) or Chair and Vice-Chair.

6b Statistical Review of Testing Protocols in Interlaboratory Study

If plan proposes an interlaboratory study containing a testing component, the Advisory Group on Statistical Techniques for Advanced Materials Interlaboratory Studies should review the test protocols. Indicate if review results have been incorporated into test plan. If not, describe reason.

7 Timescales

Estimate target dates for objectives.

8 Funding

Concerted action is normal mode of operation, but indicate if there is agreement for specific financial support.

9 Industry and International Participation

List separately organizations who have formally agreed to participate, or are likely to participate.
Discuss form of industrial contribution, including in-kind assistance and financial support.

10 Dissemination

Identify routes, eg publications, standards bodies, codes of practice, guidelines, research procedures.

11 Identification of Proposal Source

Name, organization, address, telephone and Fax numbers, and date.

VAMAS

VERSAILLES PROJECT ON ADVANCED MATERIALS AND STANDARDS

TECHNICAL WORKING AREA PROJECT INITIATION FORM

RETURN FORM TO VAMAS SECRETARY

1 **Theme**

2 **Title**

3 **Objectives**

4 **Deliverables**

Versailles Project on Advanced Materials and Standards - UK, USA, Canada, Germany, France, Italy, Japan, CEC
VAMAS Chairman - Dr. H.L. Rook Secretary - Dr. J. G. Early
National Institute of Standards and Technology, B309/223, Gaithersburg, Maryland USA 20899
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CONTINUATION 1

VAMAS PROJECT INITIATION FORM

5 Pre-standardization Needs

6a Plan

6b Statistical Review of Testing Protocols in Interlaboratory Study

VAMAS

CONTINUATION 2

VAMAS PROJECT INITIATION FORM

7 Timescales

8 Funding

9 Industry and International Participation

CONTINUATION 3

VAMAS PROJECT INITIATION FORM

10 Dissemination

11 Identification of Proposal Source

Name :

Organization :

Address :

Telephone No. :

Fax No. :

6

Nordicity Group Ltd.
Le Groupe Nordicité ltée

TECHNICAL AREAS OF SHARED INTEREST BETWEEN THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) AND SECTOR BRANCHES OF INDUSTRY CANADA

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EXECUTIVE SUMMARY

There is a very strong correlation between the Sector Branches of Industry and Science Canada (ISC) [formerly ISTC] and the technical activities of the International Organization for Standardization (ISO). Some 67 per cent of the 180 Technical Committees and 72 per cent of the Sub-Committees and Working Groups of ISO operate in technical areas of direct interest to the Sector Branches.

However, ISC personnel do not appear to be much involved with ISO activities.[1]

With the globalization of industrial production, ISO is increasingly becoming the focal point for international standard-setting.

> **Note:** This study was based on an ISTC Organization Chart dated May 1993. While the department has undergone a reorganization since then, the main conclusion of this report, that there is a very strong correlation between the Sector Branches and the technical activities of ISO, still holds.

[1] Except for ex-DOC personnel who participate actively in JCT1 activities (see p20).

1.0 INTRODUCTION

The purpose of this document is to highlight technical areas of shared interest between the International Organization for Standardization (ISO) and the Sector Branches of Industry and Science Canada (ISC). Even though ISC is currently undergoing a reorganization, to form the new Department of Industry and Science, the material presented in this document remains relevant to Sector Branches, wherever they fit in the new organization.

With the globalization of the world economy, there is a growing focus on the development of international standards. ISO is the principal international body responsible for the development of international standards. In the period from 1946, when ISO was founded to 1982, ISO had published 4917 standards. By 1992, 8651 standards had been published, a near doubling in the 1982-1992 period. The average rate of publication of international standards was about 137 per year in the 1946-1982 period and 374 per year in the 1982-1992 period. This illustrates the rapid growth of international standards.

These international standards, which represent the state of technology at a given time, are set by consensus among the member countries which make up ISO. The discussions leading to a consensus on particular technical standards provide an important source of intelligence on emerging technologies and markets. These discussions are in themselves a source of technology diffusion. As such, firms seek to become involved in these discussions. For governments, these discussions, which provide information on emerging technologies, are grist to policy development.

For Industry and Science Canada, involvement in the activities of ISO can provide a valuable source of technological and market intelligence. The initial matching of ISO activities with the responsibilities of Sector Branches, in the pages which follow, is an attempt to show the richness of the ISO technological intelligence network.

2.0 HOW ISO WORKS

A first step in appreciating ISO activities is to describe how this organization works.

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies, at present comprising 92 members, one in each country. The object of ISO is to promote the development of standardization and related activities in the world with a view to facilitating international exchange of goods and services, and to developing co-operation in the spheres of intellectual, scientific, technological and economic activity. The results of ISO technical work are published as *International Standards.*

The scope of ISO covers standardization in all fields except electrical and electronic engineering standards, which are the responsibility of the International Electrotechnical Commission (IEC). ISO works closely with IEC.

ISO brings together the interests of producers, users (including consumers), governments and the scientific community, in the preparation of International Standards.

ISO work is carried out through some 2,709 technical bodies. More than 30,000 experts from all parts of the world participate each year in the ISO technical work which, to date, has resulted in the publication of 8,651 standards.

2.1 Origin

International standardization started in the electrotechnical field some 80 years ago. While some attempts were made in the 1930s to develop International Standards in other technical fields, it was not until ISO was created that an international standards organization devoted to standardization as a whole came into existence.

Following a meeting in London in 1946, delegates from 25 countries decided to create a new international organization "the object of which would be to facilitate the international co-ordination and unification of industrial standards". The new organization, ISO, began to function officially on 23 February 1947.

2.2 Members

A *member body* of ISO is the national body "most representative of standardization in its country". In Canada, it is the Standards Council of Canada (SCC). It follows that only one such body for each country is accepted for membership of ISO.

Member bodies are entitled to participate and exercise full voting rights on any technical committee of ISO, are eligible for Council membership and have seats in the General Assembly.

By January 1993, the number of member bodies was 71.

More than 70 per cent of the ISO member bodies are government institutions or organizations incorporated by public law. The remainder have close links with the public administration in their own countries.

A *correspondent member* is normally an organization in a developing country which does not yet have its own national standards body. Correspondent members do not take an active part in the technical work, but are entitled to be kept fully informed about the work of interest to them. They may attend the General Assembly as observers. Nearly all the present correspondent members are government institutions.

By January 1993, the number of correspondent members was 21.

ISO has recently established a third category, *subscriber membership,* for countries with very small economies. These subscriber members will pay reduced membership fees that nevertheless allow them to maintain contact with international standardization.

2.3 Technical Work

The technical work of ISO is carried out through *technical committees (TC)*. The decision to establish a technical committee is taken by the ISO Council and its scope is approved by the ISO Technical Board on behalf of Council. Within this scope, the committee determines its own programme of work.

Work in the field of information technology is carried out through a joint ISO/IEC technical committee, ISO/IEC JTC1 24 *Information technology,* established in 1987 by the ISO and IEC Councils.

Each technical committee may, in turn, establish *sub-committees (SC)* and *working groups (WG)* to cover different aspects of its work.

Each technical committee or sub-committee has a *secretariat,* assigned to an ISO member body: in the case of technical committees, by the Technical Board on behalf of Council, and in the case of sub-committees, by the parent committee. For each working group, a convener is appointed by the parent committee.

By the end of 1992, there were 179 technical committees, 620 sub-committees, 1,885 working groups and 25 ad hoc study groups. There is much competition among members to capture the Secretariats supporting the work of these committees.

A proposal to begin work in a new field of technical activity normally comes from within ISO itself, but it may also originate from some other international organization. Since the resources are limited, priorities must be considered. Therefore, all new proposals are submitted for consideration by the ISO member bodies. If accepted, either the new work will be referred to the appropriate existing technical committee or a new technical committee will be established.

To ensure co-ordination of work in all matters of common interest, liaisons are established between related technical committees.

Each member body interested in a subject for which a technical committee has been authorized has the right to be represented.

2.4 How an International Standard is Developed

An International Standard is the result of an agreement between the member bodies of ISO.

An International Standard may be used as such, or may be implemented through incorporation in national standards of different countries.

A first important step toward an International Standard is the *committee draft (CD)* - a document circulated for study within the technical committee or sub-committee.

This document must pass through a number of stages before it can be accepted as an International Standard. This procedure is designed to ensure that the final result is acceptable to as many countries as possible.

When agreement is finally reached within the committee, the committee draft is sent to the Central Secretariat for registration as a *draft International Standard (DIS)*; the DIS is then circulated to all member bodies for voting. If 75 per cent of the votes cast are in favour of the DIS, it is accepted for publication as an International Standard. Normally the fundamental technical issues are resolved at committee level; however, the member body voting procedure provides assurance that no important objections have been overlooked.

The greater part of the work is done by correspondence, and meetings are convened only when thoroughly justified. Each year some 10,000 working documents are circulated.

Most standards require periodic revision. Several factors combine to render a standard out of date: technological evolution, new methods and materials, new quality and safety requirements. To take account of these factors, ISO has established the general rule that all ISO standards should be reviewed at intervals of not more than five years. On occasion it is necessary to revise a standard earlier.

3.0 MATCHING ISO TECHNICAL COMMITTEES WITH ISC SECTOR BRANCHES

The following is a first attempt at matching the mandates of ISO Technical Committees (TC), Sub-Committees (SC) and Working Groups (WG) with those of ISC Sector Branches.

The methodology used was the following:

- the information on ISO activities was extracted from the latest annual report entitled "Memento 1993";
- the information on ISC Sector Branches was based on an organization chart provided by ISC (May 1993); and
- an initial judgement was made regarding the fit of ISO activities with those of ISC Sector Branches.

It must be emphasized that what follows is but an initial attempt at matching ISO activities with those of ISC to raise the level of awareness as to the potential that involvement with ISO could bring.

3.1 Environmental Affairs[2]

3.1.1 Regulatory Affairs

A. TC43 Acoustics

1) Secretariat - Denmark

2) Scope

Standardization in the field of acoustics, including methods of measuring acoustical phenomena, their generation, transmission and reception, and all aspects of their effects on man and his environment.

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[2] The headings and sub-headings relate directly to the titles of groups within the ISC Sector Branches. Relevant ISO TCs are listed under each heading.

Excluded:

- electro-acoustics and the implementation of specifications of the characteristics of measuring instruments for acoustic purposes.

3) SC/WG Canadian Secretariat[3]
   - WG 24 Sound propagation outdoors

4) Total number of SC/WGs = 34

B. TC 146 Air Quality

1) Secretariat: Germany

2) Scope

Standardization in the field of air quality, including definitions of terms, sampling of air, measurement and reporting of air characteristics.

Excluded:

- limits of acceptability for air quality

3) SC/WG Canadian Secretariat
   - WG 8 CO, CO2 and O2 automated methods
   - WG 8 Determination of ozone - UV method
   - WG 4 Performance characteristics of air quality measuring methods

4) Total number of SC/WGs = 35

C. TC 147 Water Quality

1) Secretariat: Germany

2) Scope

Standardization in the field of water quality, including definition of terms, sampling of waters, measurement and reporting of water characteristics

[3] These are Sub-Committees on Working Groups which are chaired by Canada and where Canada has the Secretariat.

Excluded:
- limits of acceptability for water quality

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 43

3.1.2 Environmental Industries

A. TC 200 Solid Wastes

1) Secretariat: USA

2) Scope

Standardization of equipment, facilities, and operations regarding the collection (pick up), handling (loading and unloading), containment, storage, processing and disposal of solid wastes.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 3

B. TC 207 Environment

1) Secretariat: Canada

2) Scope

Standardization in the field of environmental technologies (new committee).

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

3.2 Forest Industries Branch

3.2.1 Pulp and Paper

A. TC 6 Paper, Board and Pulps

1) Secretariat: Canada

2) Scope

Standardization:
- in the field of paper and board in respect of manufacture, methods of test, generalities, utilization and conversion;
- in the field of raw materials, in particular pulps (including dissolving pulps), in respect of manufacture, test methods and generalities

Excluded:
- matters falling within the scopes of particular technical committees (e.g. ISO/IEC JTC1, ISO/TC 10, 46, 68, 154) with which liaison should be maintained

3) SC/WG Canadian Secretariat
   - WG 5 Precision of test methods
   - WG 6 Revision and coordination of ISO terminology for paper
   - WG 24 Edgewise crush resistance
   - WG 17 Freeness

4) Total number of SC/WGs = 21

3.2.2 Wood Products

A. TC 55 Sawn Timber and Sawlogs

1) Secretariat: Russian Federation

2) Scope

Standardization of sawlogs, non-profiled sawn timber and test methods of mechanical properties of wood.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SCs = 5

B. TC 89 Wood-Based Panels

1) Secretariat: Germany

2) Scope

Standardization in the field of wood-based panels such as fibreboards, particle boards and plywood, including terminology, classification, dimensions, test methods and quality requirements.

3) SC/WG Canadian Secretariat
- WG 6 Specifications for structural plywood

4) Total number of SC/WGs = 22

C. TC 99 Semi-Manufactures of Timber

1) Secretariat: Russian Federation

2) Scope

Standardization in the field of semi- manufactured products of wood such as: framing strips, parquet flooring, staves and other semi- manufactured products, especially with respect to terminology, sampling, test methods and specifications.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 1

D. TC 165 Timber Structures

1) Secretariat: Canada

2) Scope

Standardization concerning the design of load bearing structures of timber, wood products and appropriate related lignocellulosic fibrous materials, comprising technical requirements for design, for materials and for the work of construction necessary to safeguard the design assumptions.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 3

3.3 Chemicals and Bio-Industries

3.3.1 Chemicals

A. TC 28 Petroleum Products and Lubricants

1) Secretariat: USA

2) Scope

Standardization of methods of measurement, sampling and test, terminology and specifications for petroleum, petroleum products and non-petroleum based lubricants and hydraulic fluids.

3) SC/WG Canadian Secretariat
- WG8 Alignment
- WG3 Joint TC 28-TC 131 WG: Classification and specifications of hydraulic fluids

4) Total number of SC/Wgs = 38

B. TC 35 Paints and Varnishes

1) Secretariat: Netherlands

2) Scope

Standardization in the field of paints, varnishes and related products, including raw materials.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 32

C. TC 45 Rubber and Rubber Products

1) Secretariat: United Kingdom

2) Scope

Standardization of terms and definitions, test methods and specifications for rubber in any form, rubber products (including their dimensional tolerances) and major rubber compounding ingredients.

By agreement with ISO/TC 61, coated fabrics, flexible cellular materials, footwear and hose, whether made of rubber or plastics, are also dealt with in ISO/TC 45. In the case of specialty hoses of strong user interest to other TCs, e.g. TCs 22, 44, 67, and 131, TC 45 will mutually agree with the user TC concerned on the appropriate method of establishing or revising the International Standards concerned.

Excluded:
- rubber belting (dealt with by ISO/TC 41);
- tyres (dealt with by ISO/TC 31);
- certain specialty products, specifically those dealt with by ISO/TC 20, ISO/TC 22, ISO/TC 121 and ISO/TC 157, as well as the rubber seals dealt with by ISO/TC 131

3) SC/WG Canadian Secretariat
   - SC 3 Raw materials (including latex) for use in the rubber industry

4) Total number of SC/WGs = 28

D. TC 47 Chemistry

1) Secretariat: Netherlands

2) Scope

Standardization in the field of the chemical industry in general, particularly the basic chemical products the use of which is current in widely different industries, and which have not been covered by any of the other technical committees of ISO.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 10

E. TC 54 Essential Oils

1) Secretariat: Portugal

2) Scope

Standardization of methods of analysis and specifications for essential oils.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 3

F. TC 81 Common Names for Pesticides and Other Agrochemicals

1) Secretariat: United Kingdom

2) Scope

Standardization of common names for pesticides and other agrochemicals.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 1

G. TC 91 Surface Active Agents

1) Secretariat: France

2) Scope

Standardization of classification, terminology, sampling, physical, chemical or other test methods, specifications, etc., of surface active agents and mixtures containing one or more surface active agents with or without other conventional components of soap and detergent formulations.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

H. TC 107 Metallic and Other Inorganic Coatings

1) Secretariat: Italy

2) Scope

- Standardization of the characteristics of protective and decorative metallic coating applied by electrolysis, fusion, vacuum or chemical means, mechanical deposition, ion plating.

- Standardization of the characteristics of protective and decorative non-metallic coatings (excluding paints and other organic coatings) on metal surface applied by electrolysis, fusion, vacuum or chemical means.

- Standardization of testing and inspection methods for such coatings.

- Standardization of the preparation of the substrates prior to the deposition of metallic and inorganic coatings.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 12

I. TC 134 Fertilizers and Soil Conditioners

1. Secretariat: Iran

2. Scope

Standardization in the field of fertilizers and soil conditioners, that is, materials whose addition is intended to ensure or improve the nourishment of cultivated plants and/or to improve the properties of soils.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 7

3.3.2 Health Care Products

A. TC 76 Transfusion, Infusion and Injection Equipment for Medical Use

1) Secretariat: Germany

2) Scope

Standardization of transfusion, infusion and injection equipment for medical use in different countries; terms and definitions for such equipment; specifications for quality and performance of materials.

Standardization of containers and other packaging components such as elastomeric closures and metal caps as accessories for the above defined areas.

Excluded:
- syringes and injection needles for medical use

Note: This committee is currently also dealing with blood-collecting tubes.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 5

B. TC 84 Medical Devices for Injections

1) Secretariat: France

2) Scope

Standardization of medical devices for injection, i.e. the chief characteristics of syringes, needles, intravascular catheters and pen-injectors to ensure fitness for purpose and safety of use.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 5

C. TC 106 Dentistry

1) Secretariat: United Kingdom

2) Scope

Standardization of terminology, methods of test and specifications applicable to materials, instruments, appliances and equipment used in all branches of dentistry.

3) SC/WG Canadian Secretariat
   - SC 1 Filling and restorative materials
   - WG 1 Dental operating light

4) Total number of SC/WGs = 45

D. TC 121 Anaesthetic and Respiratory Equipment

1) Secretariat: United Kingdom

2) Scope

Standardization of anaesthetic and respiratory equipment and supplies, related devices and supply systems.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 13

E. TC 150 Implants for Surgery

1) Secretariat: Germany

2) Scope

Standardization in the field of implants for surgery[1]

[1] Objects or devices which are surgically implanted in the body either temporarily or permanently for diagnostic or therapeutic purposes. </SFN> and their required instrumentation, covering terminology, specifications and methods of tests for all types of implants, and for the materials both basic and composite used in their manufacture and application.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 16

F. TC 157 Mechanical Contraceptives

1) Secretariat: Sweden

2) Scope

Standardization of Mechanical Contraceptives.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 3

G. TC 168 Prosthetics and Orthotics

1) Secretariat: Germany

2) Scope

Standardization in the field of prosthetics and orthotics, covering such aspects as performance, safety, environmental factors, interchangeability, etc.

Temporary and permanent procedures and devices are included.

Priority is given to standards on prostheses (artificial limbs and auxiliary equipment).

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 3

H. TC 170 Surgical Instruments

1) Secretariat: Germany

2) Scope

Standardization in the field of surgical instruments such as forceps, scissors, scalpels and retractors.

Excluded:
- specific instruments which are dealt with in ISO/TC 106 - Dentistry, and ISO/TC 150 - Implants for surgery.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

I. TC 172 Optics and Optical Instruments

1) Secretariat: Germany

2) Scope

Standardization in the field of optics including fundamentals, terminology, optical components, instruments and their accessories, auxiliary devices, quality requirements and test methods.

Excluded:

- standardization for specific items in the field of cinematography (ISO/TC 36), photography (ISO/TC 42), eye protectors (ISO/TC 94), micrographics (ISO/TC 171), fibre optics for telecommunication (IEC/TC 86), semiconductor devices and integrated circuits (IEC/TC 47) and lasers (IEC/TC 76).

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 35

J. TC 173 Technical Systems and Aids for Disabled or Handicapped Persons

1) Secretariat: Sweden

2) Scope

Standardization in the field of technical systems and aids for the physically or mentally disabled or handicapped persons.

Excluded:

- systems or aids that are dealt with by other technical committees such as access to means of transport (ISO TCs 8, 20, 22, 177), building construction (ISO/TC 59), furniture (ISO/TC 136), implants for surgery (ISO/TC 150), ergonomics (ISO/TC 159), prosthetics and orthotics (ISO/TC 168), ophthalmic optics (ISO/TC 172), electrical safety (IEC/TC 62) and hearing aids (IEC/TC 29).

3) SC/WG Canadian Secretariat
   - WG 6 Wheelchair restraint systems
   - SC 4 Aids and adaptations for communication
   - WG 1 Data transmission
   - WG 4 Software for technical aids

4) Total number of SC/WGS = 23

3.4 Information Technologies Industry

3.4.1 Computers & Emerging Technologies

A. JTC1[4] Information Technology

1) Secretariat: USA

2) Scope

Standardization in the field of information technology.

3) SC/WG Canadian Secretariat
   - WG 1 Advisory group for SC 1
   - WG 6 Hardware, services and operations
   - WG 1 Data link layer
   - SC 7 Software engineering
   - WG 3 Identification cards - Machine readable travel documents
   - WG 3 Database
   - SC 22 Programming languages, their environments and system software interfaces
   - WG 3 APL
   - WG4 Tools and Environment

4) Total number of SC/WGs = 97

[4] JTC1 is an ISO/IEC Joint Technical Committee

B. Micrographics and Optical Memories for Document and Image Recording, Storage and Use

1) Secretariat: France

2) Scope

Standardization of practices relative to the management of documents and images on microforms and other optical media, such as

- the format and quality characteristics of microforms, and the equipment required for producing and using them;
- input/output quality and the procedures by which documents and images on microforms and other optical media are recorded, stored and used;
- the terminology related thereto.

Excluded:
- cinematography, dimensions and labelling of rawstock film, and the methods of testing, rating, classifying and specifying the performance characteristics of processes, materials and devices applicable to photography and within the scope of ISO/TC 42;
- manufacturing, labelling and file structure of optical media within the scope of ISO/IEC JTC1.

3) SC/WG Canadian Secretariat
   - WG 3 Library and publishing applications, formats and consumable items

4) Total number of SC/WGs = 7

3.4.2 Software Products & Informatic Services

A. TC 46 Information and Documentation

1) Secretariat: Germany

2) Scope

Standardization of practices relating to libraries, documentation and information centres, indexing and abstracting services, archives, information science and publishing.

3) SC/WG Canadian Secretariat
- WG 6 Electronic publishing
- WG 7 Data elements

4) Total number of SC/WGs = 19

B. TC 68 Banking and Related Financial Services

1) Secretariat: United Kingdom

2) Scope

Standardization in the field of banking and related financial services.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 15

C. TC 204 Road Transport Informatics

1) Secretariat: USA

2) Scope

Standardization in the field of smart highways including Advanced traveller information services (ATIS), Advanced traffic management systems (ATMS), Advanced vehicle control systems (AVCS), Advanced public transportation systems (APTS), and Commercial vehicle operation (CVO).

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 0

3.5 Food Products

3.5.1 Primary Food Products

A. TC 34 Agricultural Food Products

1) Secretariat: Hungary

2) Scope

Standardization for products of agricultural origin used for human and animal feeding purposes as well as for animal and vegetable propagation materials with particular reference to terminology, sampling, methods of test and analysis, including also product specifications and requirements for packaging, storage and transportation.

Excluded:
- products covered by other ISO technical committees.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 22

B. TC 190 Soil Quality

1) Secretariat: Netherlands

2) Scope

Standardization in the field of soil quality, including classification, definition of terms, sampling of soils, measurement and reporting of soil characteristics.

Excluded:
- limits of acceptability for soil pollution;
- civil engineering aspects (as dealt with by ISO/TC 182)

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 35

3.6 Consumer Products

3.6.1 Textiles and Leather

A. TC 38 Textiles

1) Secretariat: United Kingdom

2) Scope

Standardization of:
- fibres, yarns, threads, cords, rope, cloth and other fabricated textile materials; and the methods of test, terminology and definitions relating thereto;
- textile industry raw materials, auxiliaries and chemical products required for processing and testing;
- specifications for textile products

3) SC/WG Canadian Secretariat
   - WG 3 Washing
   - WG 2 Yarn strength
   - WG 3 Test methods and criteria
   - WG 1 Terminology
   - WG 1 Liaison with CEN/TC 189

4) Total number of SC/WGs = 65

B. TC 120 Leather

1) Secretariat: India

2) Scope

Standardization (excluding methods of test) in the field of:
- raw hides and skins including pickled pelts;
- tanned hides and skins; and
- finished leather and leather products

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 3

C. TC 133 Sizing Systems and Designations for Clothes

1) Secretariat: South Africa

2) Scope

Standardization of a system of size designations resulting from the establishment of one or more sizing systems for clothes based on body measurements.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 0

3.6.2 Furniture, Household and Recreational Products

A. TC 83 Sports and Recreational Equipment

1) Secretariat: Germany

2) Scope

Standardization of terms, dimensions, tolerances and functional and safety requirements, as well as their testing, for sports and recreational equipment.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGS = 14

B. TC 114 Horology

1) Secretariat: Switzerland

2) Scope

Standardization in the field of instruments of small and large size intended for measuring time and time keeping:

- terminology
- technical definitions
- standardization of overall dimensions
- any other questions which may be proposed in the future

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 10

C. TC 116 Space Heating Appliances

1) Secretariat: New Zealand

2) Scope

Standardization of the methods of performance testing of space heating appliances, including related dimensional, construction and safety aspects.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 6

D. TC 136 Furniture

1) Secretariat: Sweden

2) Scope

Standardization in the field of furniture including:
- terms and definitions
- performance, safety and dimensional requirements
- requirements for specific components (such as hardware)
- test methods

By furniture is meant free-standing or built-in units which are used for storing, lying, sitting, working and eating.

Excluded:
- such units with corresponding functions that are dealt with by other ISO technical committees

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 20

E. TC 148 Sewing Machines

1) Secretariat: Germany

2) Scope

Standardization concerning classification, terminology, safety, performance and test methods for sewing machines.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 2

F. TC 161 Control and Safety Devices for Non Industrial Gas-Fired Appliances and Systems

1) Secretariat: USA

2) Scope

Standardization in the field of control and safety devices for non-industrial gas-fired appliances and systems, and forming part of different gas-fired appliances and systems, in order to maintain a safe and reliable operation.

Excluded:
- safety and reliability requirements of electrical controls

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 1

G. TC 166 Ceramic Ware, Glassware and Glass Ceramic Ware in Contact with Food

1) Secretariat: USA

2) Scope

Standardization in the field of ceramic ware, glassware and glass ceramic ware in contact with food.

Excluded:
- vitreous and porcelain enamel ware as dealt with by ISO/TC 107.

3) SC/WG Canadian Secretariat:
   - none

4) Total number of SC/WGs = 4

H. TC 181 Safety of Toys

1) Secretariat: Denmark

2) Scope

Standard of toys with respect to safety relating to their mechanical, physical, chemical and flammable properties.

Excluded:
- all electrical aspects which are dealt with by IEC.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

I. TC 186 Cutlery and Table and Decorative Metal Hollow-Ware

1) Secretariat: United Kingdom

2) Scope

Standardization in the field of cutlery, flat-ware and table and decorative metal hollow-ware.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

J. TC 188 Small Craft

1) Secretariat: Sweden

2) Scope

Standardization of equipment and construction details of recreational craft, and other small craft using similar equipment, less than 24 metres in overall length.

Excluded:
- lifeboats and lifesaving equipment covered by ISO/TC 8.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 26

3.6.3 Apparel & Footwear

A. TC 94 Personal Safety - Protective Clothing and Equipment

1) Secretariat: United Kingdom

2) Scope

Standardization of the quality and performance of clothing and personal equipment designed to safeguard persons against hazards other than those concerned with nuclear radiation.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGS = 21

B. TC 137 Sizing System, Designations and Marking for Boots and Shoes

1) Secretariat: South Africa

2) Scope

Standardization of a system of boot and shoe sizes based on the measurement of the foot, and the designation and marking of such sizes; standardization of sizing ranges (unit and intervals); standardization of a system of calibrating the last of equivalent equipment; terminology.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGS = 0

3.7 Materials

3.7.1 Primary Metals Directorate

A. TC 17 Steel

1) Secretariat: Japan

2) Scope

Standardization in the field of cast, wrought and cold-formed steel, including technical delivery conditions for steel tubes for pressure purposes.

Excluded:
- steel tubes within the scope of ISO/TC 5
- line pipe, cashing, tubing and drill pipe within the scope of ISO/TC 67
- methods of mechanical testing of metals within the scope of ISO/TC 164

3) SC/WG Canadian Secretariat
   - WG 3 Vinyl and other organic-coated steel sheet

4) Total number of SC/WGs = 48

B. TC 25 Cast Iron and Pig Iron

1) Secretariat: United Kingdom

2) Scope

Standardization in the field of all types of cast iron and all types of pig iron.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 5

C. TC 26 Copper and Copper Alloys

1) Secretariat: Germany

2) Scope

Standardization in the field of unwrought, wrought and cast products made from copper and copper alloys, including material specifications, dimensions and tolerances, and methods of testing peculiar for copper and copper alloys.

3) SC/WG Canadian Secretariat
   - SC 1 Chemical analysis

4) Total number of SC/WGs = 6

D. TC 33 Refractories

1) Secretariat: United Kingdom

2) Scope

Standardization of raw materials and products of the refractories industry and their properties.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 6

E. TC 65 Manganese and Chromium Ores

1) Secretariat: Russian Federation

2) Scope

Standardization of methods for sampling, chemical analysis and physical testing of manganese and chromium ores.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

F. TC 102 Iron Ores

1) Secretariat: Japan

2) Scope

Standardization in the field of iron ores, including terminology and methods of sampling, preparation of samples, moisture determination, size determination, chemical analysis and physical testing.

3) SC/WG Canadian Secretariat
   - WG 4 Guidelines for interpretation of ISO 9000 series within the iron ore industry
   - WG 5 Centralized data processing of test results
   - WG 34 Certified reference materials

4) Total number of SC/WGs = 31

G. TC 129 Aluminium Ores

1) Secretariat: France

2) Scope

Standardization in the field of aluminium ores and minerals used either for obtaining the metal aluminium and the intermediate aluminium compounds, or by other industries:

Excluded:
- those ores and minerals covered by ISO/TC 33
  - Refractories

3) SC/WG Canadian Secretariat
   - WG 4 Determination of calcium and magnesium content - Flame atomic absorption spectrometric method

4) Total number of SC/WGs = 7

H. TC 175 Fluorspar

1) Secretariat: South Africa

2) Scope

Standardization in the field of fluorspar.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

I. TC 183 Copper, Lead and Zinc Ores and Concentrates

1) Secretariat: Australia

2) Scope

Standardization in the field of copper, lead and zinc ores and concentrates, including sampling, chemical analysis and physical testing.

3) SC/WG Canadian Secretariat
   - WG 12 Weighing

4) Total number of SC/WGs = 13

J. TC 206 Fine Ceramics

1) Secretariat: Japan

2) Scope

Standardization in the field of fine ceramics powder, monolithic ceramics, fine ceramics based composite material, and fine ceramics coating.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

3.7.2 Advanced Materials and Construction Products Directorate

A. TC 79 Light Metals and Their Alloys

1) Secretariat: France

2) Scope

Standardization in the field of aluminium, magnesium, titanium and their alloys (i.e. alloys in which aluminium, magnesium or titanium is the principal element).

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 21

B. TC 92 Fire Tests on Building Materials, Components and Structures

1) Secretariat: United Kingdom

2) Scope

Standardization of tests for determining the behaviour and properties of building materials, components and structures in relation to the safety of life in and around buildings and to the protection of buildings in the event of building fires and for guidance on the application of these tests.

3) SC/WG Canadian Secretariat
   - WG 1 General requirements
   - WG 3 Fire spread beyond the compartment of origin

4) Total number of SC/WGs = 26

C. TC 119 Powder Metallurgy

1) Secretariat: Sweden

2) Scope

Standardization of powder metallurgical materials concerning terms and definitions , sampling, testing methods and materials specifications.

3) SC/WG Canadian Secretariat
- WG 11 Determination of transverse rupture strength (Revision of ISO 3325)

4) Total number of SC/WGs = 19

D. TC 132 Ferroalloys

1) Secretariat: Russian Federation

2) Scope

Standardization in the field of ferroalloys and other alloying additives used in iron- and steelmaking.

Excluded:
- standardization of ferronickels which devolves upon ISO/TC 155

E. TC 135 Non-Destructive Testing

1) Secretariat: Japan

2) Scope

Standardization covering non-destructive testing as applied generally to constructional materials, components and assemblies, by means of:
- glossary of terms
- methods of test
- performance specifications for testing equipment and ancillary apparatus

Excluded:

- quality levels
- specifications for electrical equipment and apparatus, which fall within the range of IEC Committees

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 13

F. TC 155 Nickel and Nickel Alloys

1) Secretariat: Canada

2) Scope

Standardization in the field of nickel and nickel alloys including terminology, specifications and methods of sampling, testing and analysis.

3) SC/WG Canadian Secretariat
   - WG 2 Refined nickel
   - WG 5 Application of plasma spectrometric methods
   - SC 4 Analysis of nickel alloys

4) Total number of SC/WGs = 12

G. TC 156 Corrosion of Metals and Alloys

1) Secretariat: Russian Federation

2) Scope

Standardization in the field of corrosion of metals and alloys including corrosion test methods and corrosion prevention methods. General coordination of activities in these fields within ISO.

3) SC/WG Canadian Secretariat
   - WG 9 Corrosion testing of materials for nuclear power generation

4) Total number of SC/WGs = 11

H. TC 160 Glass in Building

1) Secretariat: United Kingdom

2) Scope

Standardization in the field of glass in building, including terminology, performance requirements and methods of calculation and test, design and construction rules, classification and specification of materials, including dimensional properties.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 11

I. TC 163 Thermal Insulation

1) Secretariat: Sweden

2) Scope

Standardization in the field of thermal insulation covering terminology, test methods, calculation methods and specifications for thermal insulation materials, components, constructions and systems, including the effects of moisture and other agents on the thermal performance.

General review and coordination of work on thermal insulation within ISO.

Excluded:

- test methods which, after agreement with ISO/TC 163, are treated by other ISO technical committees.

3) SC/WG Canadian Secretariat
- WG 2 Joint TC 59/SC 3-TC 160-TC 162-TC 163 WG: Thermal transmission properties of windows
- WG 13 Infrared methods for industrial installations
- WG 4 Thermal insulation for foundation walls
- WG 5 Cellulose fibre loose fill insulation

4) Total number of SC/WGs = 26

J. TC 164 Mechanical Testing of Metals

1) Secretariat: Japan

2) Scope

Standardization of methods of mechanical testing of metallic materials.

Excluded:
- methods peculiar to a single metallic material and the responsibility for the application of a test method or the results to be obtained

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 6

K. TC 189 Ceramic Tile

1) Secretariat: USA

2) Scope

Standardization of ceramic tiles generally used for floor coverings and wall facings.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 2

L. TC 196 Natural Stone

1) Secretariat: Spain

2) Scope

Standardization in the field of natural stone including terminology, classification, requirements of blocks, slabs, semi-finished products, sampling methods, test methods, product assembly and installation requirements.

Excluded:

- aggregates for concrete which are the responsibility of ISO/TC 71 "Concrete, reinforced concrete and pre-stressed concrete".

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 3

3.7.3 Plastics and Polymers

A. TC 61 Plastics

1) Secretariat: USA

2) Scope

Standardization of nomenclature, methods of test, and specifications applicable to materials and products in the field of plastics.

Excluded:
- rubber, lac.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 77

B. TC 138 Plastics Pipes, Fittings and Valves for the Transport of Fluids

1) Secretariat: Netherlands

2) Scope

Standardization of pipes, fittings, valves and auxiliary equipments intended for the transport of fluids and made from all types of plastic materials, including all types of reinforced plastics.

Metal fittings used with plastics pipes are also included.

This standardization includes - for pipes, flanges, fittings, valves and auxiliary equipments - dimensions and their tolerances; requirements for chemical, mechanical and physical properties and appropriate test methods; requirements and test methods for other properties relevant to particular applications; temperature and pressure ratings.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 35

3.8 Space, Marine and Defence

3.8.1 Shipbuilding

A. TC 8 Shipbuilding and Marine Structures

1) Secretariat: Netherlands

2) Scope

Standardization of structural elements, outfitting parts, methods and technology used in shipbuilding and the operation of ships, comprising sea-going ships, vessels for inland navigation, shipborne barges, offshore structures, ship-to-shore interfaces and other marine structures.

Excluded:

- electrical and electronic equipment on board ships and marine structures (IEC/TC 18 and IEC/TC 80)
- internal combustion engines (ISO/TC 70)

- material and equipment for petroleum and natural gas industries (ISO/TC 67)
- steel and aluminium structures (ISO/TC 167)
- equipment and construction details of recreational craft and other small craft (not being lifeboats and lifesaving equipment) less than 24 metres in overall length (ISO/TC 188)
- sea bed mining
- equipment which is not specific for use on board ships and marine structures (e.g. pipes, steel wire ropes, etc.) and falling within the scope of particular ISO technical committees with which a regular mutual liaison must be maintained

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 27

3.9 Aeronautics Branch

3.9.1 <u>Propulsion & Aircraft Systems</u>

A. TC 192 Gas Turbines

1) Secretariat

2) Scope

Standardization in the field of all aspects of gas turbine design, application, installation, operation and maintenance, including simple turbine cycles, combined cycle systems, definitions, procurement, acceptance, performance, environment (on the gas turbine itself and the external environment) and methods of test.

ISO/TC 192 is responsible for preparing horizontal standards for all types of gas turbines. Work on aero gas turbine engines shall be undertaken in liaison with those technique committees having the primary responsibility.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 5

3.9.2 Aircraft Component Manufacturers

A. TC 20 Aircraft and Space Vehicles

1) Secretariat: USA

2) Scope

Standardization of materials, components and equipment for construction and operation of aircraft and space vehicles as well as equipment used in the servicing and maintenance of these vehicles.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 43

3.10 Service and Construction Industries

3.10.1 Construction Industry & Capital Projects

A. TC 59 Building Construction

1) Secretariat: Norway

2) Scope

Standardization of:

- general terminology for building and civil engineering
- organization of information in the processes of design, manufacture and construction
- general geometric requirements for building, building elements and components including modular coordination and its basic principles, general rules for joints, tolerances and fits
- general rules for other performance requirements for buildings and building elements including the coordination of these with performance requirements of building components to be used in building and civil engineering
- geometric and performance requirements for components that are not in the scope of separate ISO technical committees

Excluded:
- acoustic requirements (ISO/TC 43)
- fire tests on building materials, components and structures (ISO/TC 92)
- bases for design of structures (ISO/TC 98)
- calculation of thermal properties (ISO/TC 163)

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 22

B. TC 71 Concrete, Reinforced Concrete and Pre-Stressed Concrete

1) Secretariat: USA

2) Scope

Standardization of the technology of concrete, of the design and construction of concrete, reinforced concrete and pre-stressed concrete structures, so as to ensure progressive development both in quality and in price reduction; and of definitions and terms, as well as testing procedures, to facilitate international exchange of research work.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 10

C. TC 74 Cement and Lime

1) Secretariat: Belgium

2) Scope

Standardization - including definitions, methods of test and specifications - of various kinds of cement, and lime used in building construction and engineering, either for binding together the construction materials or as a constituent part of all kinds of paste, mortar and concrete.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

D. TC 77 Products in Fibre Reinforced Cement

1) Secretariat: Switzerland

2) Scope

Standardization in the field of products in fibre reinforced cement and calcium silicate containing essentially inorganic hydraulic binders, asbestos and other fibres; to include specifications, dimensions, test methods and specific values for acceptance and application requirements.

Standardization of test methods for asbestos and other fibres appropriate to their use in the manufacture of fibre reinforced cement products.

Excluded:
- products in concrete covered by ISO/TC 71
- products in gypsum covered by ISO/TC 152

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 4

E. TC 98 Bases for Design of Structure

1) Secretariat: Poland

2) Scope

Standardization of the bases for design of structures irrespective of the material of construction including especially terminology and symbols, load, forces and other actions and limitations of deformations. Consideration and coordination of basic safety requirements concerning the structures as a whole, including consideration of structures made of particular materials (steel, stone, concrete, wood, etc.) as far as is necessary for the preparation of common systems of safety, and in liaison with the relevant technical committees.

3) SC/WG Canadian Secretariat
   - WG 2 Vibration criteria for structures

4) Total number of SC/WGs = 15

F. TC 162 Doors and Windows

1) Secretariat: Norway

2) Scope

Standardization in the field of doors, doorsets and windows including hardware, manufactured from any suitable material covering the specific performance requirements, terminology, manufacturing sizes and dimensions, and methods of test.

Excluded:

- the responsibility for dimensional coordination with other parts of buildings and general performance requirements derived from buildings as a whole, which devolves upon ISO/TC 59

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 7

G. TC 167 Steel and Aluminium Structures

1) Secretariat: Norway

2) Scope

Standardization in the field of structural use of steel and alloys of aluminium as applied in building, civil engineering and related structures.

The standards shall comprise the requirements for the design, fabrication and erection of steel and aluminium structures, together with materials, structural components and connections.

3) SC/WG Canadian Secretariat
   - SC 3 Alloys of aluminium: Material and design
   - SC 4 Alloys of aluminium: Fabrication and erection

4) Total number of SC/WGs = 6

H. TC 179 Masonry

1) Secretariat: Germany

2) Scope

Standardization of rules for design and execution of unreinforced and reinforced masonry building constructions and appropriate test methods.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 12

I. TC 182 Geotechnics

1) Secretariat: Netherlands

2) Scope

Standardization of geotechnical aspects in the field of building and civil engineering, including (related) properties of soil and rock.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 9

J. TC 195 Building Construction Machinery and Equipment

1) Secretariat: Poland

2) Scope

Standardization of nomenclature, use classification, ratings, technical requirements and test methods, safety requirements, operation and maintenance manuals formats for machines and equipment used on building sites, including aggregate processing.

Excluded:
- standardization of earth-moving machinery (dealt with by ISO/TC 127) and cranes (dealt with by ISO/TC 96).

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 4

K. TC 205 Building Environmental Design

1) Secretariat: USA

2) Scope

Standardization in the design of new buildings and retrofit of existing buildings for acceptable thermal and visual comfort, indoor air quality, and energy conservation.

Excluded:
- methods of measurement of air pollutants and of thermal and lighting properties
- definition of ergonomic factors
- methods of testing for performance and rating of building environmental equipment
- thermal insulation

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

3.11 Automotive, Urban Transit and Rail

3.11.1 Components & Tires

A. TC 31 Tyres, Rims and Valves

1) Secretariat: USA

2) Scope

Standardization of classifications, size designations, dimensions and ratings of tyres, rims and valves.

3) SC/WG Canadian Secretariat
   - SC 6 Off-the-road tyres and rimes

4) Total number of SC/WGs = 38

3.11.2 Light Vehicles

A. TC 22 Road Vehicles

1) Secretariat: France

2) Scope

All questions of standardization concerning compatibility, interchangeability and safety, with particular reference to terminology and test procedures (including the characteristics of instrumentation) for evaluating the performance of the following types of road vehicles and their equipment as defined in the relevant items of Article 1 of the convention on Road Traffic, Vienna in 1968 concluded under the auspices of the United Nations:
- motor cycles (item n)
- motor vehicles (item p)
- trailers (item q)
- semi-trailers (item r)
- light trailers (item s)
- combination vehicles (item t)
- articulated vehicles (item u)

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 97

B. TC 23 Tractors and Machinery for Agriculture and Forestry

1) Secretariat: France

2) Scope

Standardization of tractors, machines and equipment used in agriculture and forestry.

3) SC/WG Canadian Secretariat
- WG 2 Snow throwers

4) Total number of SC/WGs = 44

C. TC 70 Internal Combustion Engines

1) Secretariat: United Kingdom

2) Scope

Standardization in the field of reciprocating and rotary displacement internal combustion engines, including definitions, performance/tests and special requirements, taking into account the relationship between engine and driven machinery and environment.

Excluded:
- reciprocating and rotary displacement engines used to propel road construction and earthmoving machines, agricultural tractors and machines for agriculture and forestry, industrial trucks, road vehicles and aircraft.

Note: In liaison with ISO/TC 70 application standards may be prepared by other technical committees for engines used in the particular area of responsibility of these technical committees. In this case, the standards of ISO/TC 70, including terminology standards and performance/test standards, shall be referenced.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 16

D. TC 110 Industrial Trucks

1) Secretariat: Germany

2) Scope

Standardization in the field of power-operated industrial trucks, hand-operated industrial trucks (including sack trucks, hand carts, trailers) wheels and castors for industrial trucks, comprising:
- terminology and definitions
- safety requirements related to:
  - design and construction
  - testing and inspection methods
  - operation and maintenance
- principal dimensions to facilitate interchangeability where essential to the interest of users and manufacturers

Excluded:
- vehicles designed primarily for earth-moving or road transport

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 7

E. TC 149 Cycles

1) Secretariat: India

2) Scope

Standardization in the field of cycles, their components and accessories with particular reference to terminology, testing methods and requirements for performance and safety, and interchangeability.

Excluded:
- chains and tooth profile
- tyres, rims and valves
- toy cycles

Note: The meaning hereby assigned to "cycle" is defined in item 1 of article 1 of the Convention on Road Traffic, Vienna, in 1968 concluded under the auspices of the United Nations:

1. "Cycle" means any vehicle which has at least two wheels and is propelled solely by the muscular energy of the persons on that vehicle, in particular by means of pedals or hand-cranks.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 12

F. TC 177 Caravans

1) Secretariat: United Kingdom

2) Scope

Standardization of aspects of caravans and motor caravans as habitations, dealing with construction, installation of services and general matters of safety.

Excluded:
- any road vehicle aspects of the caravan as dealt with by ISO/TC 22.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 6

3.11.3 Urban Transit & Rail

A. TC 104 Freight Containers

1) Secretariat: USA

2) Scope

Standardization of freight containers, having an external volume of one cubic meter (35.3 cubic feet) and greater, as regards terminology, classification, dimensions, specifications, test methods and marketing.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 12

3.12 Indus. & Elec. Equipment & Technology

3.12.1 Industrial Equipment

A. TC 11 Boilers and Pressure Vessels

1) Secretariat: USA

2) Scope

Standardization and securing international co-ordination of:
- design and construction of safe boilers (stationary) and pressure vessels
- methods of inspection and testing of such boilers and vessels
- material requirements for the component parts used in the construction of such boilers and vessels

Excluded:
- railway and marine boilers and gas cylinders

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 20

B. TC 14 Shafts for Machinery and Accessories

1) Secretariat: Germany

2) Scope

Standardization in the field of shafts for machines, their keys and keyways, splines and serrations and their accessories such as couplings, flanges, etc.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 5

C. TC 72 Textile Machinery and Allied Machinery and Accessories

1) Secretariat: Switzerland

2) Scope

Standardization of textile machinery, allied machinery, parts thereof, and accessories.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 14

D. TC 82 Mining

1) Secretariat: Germany

2) Scope

Standardization of:
- specifications relating to machinery and equipment used in opencast and underground mining for the extraction of solid mineral substances, but excluding the preparation and processing of the minerals
- recommended practice in the presentation of plans and drawings used in mine surveying
- methods of calculation of mineral reserves
- terminology

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 8

E. TC 96 Cranes

1) Secretariat: Australia

2) Scope

Standardization in the field of cranes and related equipment which suspend loads my means of a load handling device, particularly in respect of terminology, load rating, testing, safety, general design principles, maintenance and operation.

3) SC/WG Canadian Secretariat
- - none

4) Total number of SC/WGs = 13

F. TC 101 Continuous Mechanical Handling Equipment

1) Secretariat: Germany

2) Scope

Standardization in the field of continuous mechanical handling equipment for loose bulk materials or unit loads, comprising terminology, general design and construction, leading dimensions, safety requirements and testing and inspection methods.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 1

G. TC 111 Round Steel Link Chains, Lifting Hooks and Accessories

1) Secretariat: United Kingdom

2) Scope

Standardization in the field of:
- found steel link chains (excluding anchor chains and those used in mining)
- lifting hooks
- shackles, eyebolts, rings, joining links and terminal fittings for slings, swivels and other accessories

To deal with the following aspects of the above-mentioned items: terminology, material, dimensions and tolerances, screw threads, basic design criteria, proof loading, safe working load, destructive and non-destructive tests relating to recommended mechanical properties, inspection, certification and marking.

3) SC/WG Canadian Secretariat
  - - none

4) Total number of SC/WGs = 11

H. TC 115 Pumps

1) Secretariat: France

2) Scope

Standardization of test methods and conditions of acceptance for centrifugal, mixed flow and axialflow, reciprocating, rotary or semi-rotary pumps and pumps having special applications, for all liquids.

Standardization of methods for testing pumps on test stands, in their final installations, on models and at modified speeds.

Standardization of test methods for complete pumping installations.

Standardization of pump dimensions.

3) SC/WG Canadian Secretariat
  - none

4) Total number of SC/WGs = 10

I. TC 117 Industrial Fans

1) Secretariat: France

2) Scope

Standardization in the field of fans used for industrial purposes including the ventilation of buildings and mines.

Excluded:
- ceiling, pedestal and similar circulation types of fans such as those commonly used for non-industrial purposes.

3) SC/WG Canadian Secretariat
   - - none

4) Total number of SC/WGs = 8

J. TC 118 Compressors, Pneumatic Tools and Pneumatic Machines

1) Secretariat: Sweden

2) Scope

Standardization in the field of displacement and turbo compressions, pneumatic tools and pneumatic machines and accessories.

Excluded:
- pneumatic tool shanks and tool fitting dimensions, as they fall within the scope of ISO/TC 29.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 11

K. TC 127 Earth-moving Machinery

1) Secretariat: USA

2) Scope

Standardization of nomenclature, use classification, ratings, technical requirements and test methods, safety requirements, operation, maintenance manual format for earth-moving machinery that generally operates off-highway and which does not necessarily follow highway regulations.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 5

L. TC 153 Valves

1) Secretariat: USA

2) Scope

Standardization in the field of industrial valves and steam traps. The standardization to include parameters covering interchangeability, valve mathing details for actuator mounting, testing, marking, quality requirements, terminology and other relevant parameters.

Excluded:
- safety and relief valves and other pressure relief devices which are the responsibility of ISO/TC 185
- production valves for wellhead equipment and valves for cross country pipelines for the petroleum and natural gas industries which are the responsibility of ISO/TC 67
- valves forming the final control element used for industrial process control systems which are the responsibility of IEC/TC 65
- valves having an envelope predominantly made of plastics which are the responsibility of ISO/TC 138
- valves for sanitary use

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 7

M. TC 178 Lifts, Escalators, Passenger Conveyors

1) Secretariat: France

2) Scope

Standardization of all aspects, including safety, of lifts, service lifts, escalators, passenger conveyors and similar apparatus.

Excluded:
- continuous mechanical handling equipment and lifts in mines

3) SC/WG Canadian Secretariat
   - WG 4 Safety standards comparison

4) Total number of SC/WGs = 6

3.12.2 Electrical & Energy Equipment

A. TC 67 Materials and Equipment for Petroleum and Natural Gas Industries

1) Secretariat: USA

2) Scope

Standardization of the materials and equipment used in drilling, production, refining and the transport by pipelines of petroleum and natural gas.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 28

B. TC 180 Solar Energy

1) Secretariat: Australia

2) Scope

Standardization in the field of solar energy utilization in space and water heating, cooling, industrial process heating and air conditioning.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 5

C. TC 197 Hydrogen Energy Technologies

1) Secretariat: Switzerland

2) Scope

Standardization in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen for energy utilization.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 0

D. TC 203 Technical Energy Systems

1) Secretariat: Sweden

2) Scope

Standardization of basic concepts and methods used to define, describe, analyze and compare technical energy systems and of energyware balances.

3) SC/WG Canadian Secretariat
   - none

4) Total number of SC/WGs = 3

3.12.3 Advanced Manufacturing Technology

A. TC 60 Gears

1) Secretariat: Belgium

2) Scope

Standardization in the field of gears, including terminology, nominal dimensions, tolerances, and tools for manufacturing and control.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 8

B. TC 39 Machine Tools

1) Secretariat: Italy

2) Scope

Standardization of all machine tools for the working of metal, wood and plastics, operating by removal of material or by pressure.

3) SC/WG Canadian Secretariat
- none

4) Total number of SC/WGs = 18

C. TC 176 Quality Management and Quality Assurance

1) Secretariat: Canada

2) Scope

Standardization in the field of generic quality management, including quality systems, quality assurance, and generic supporting technologies, including standards which provide guidance on the selection and use of these standards.

3) SC/WG Canadian Secretariat
   - WG 2 Consistency of use of concepts, terms and definitions in ISO/TC 176 standards

4) Total number of SC/WGs = 18

D. TC 184 Industrial Automation Systems and Integration

1) Secretariat: France

2) Scope

Standardization in the field of industrial automation and integration concerning discrete part manufacturing and encompassing the application of multiple technologies, i.e. information systems, machines and equipment, and telecommunications.

Excluded:
- electrical and electronic equipment as dealt with by IEC/TC 44
- programmable logical controllers for general application dealt with by IEC/TC 65

3) SC/WG Canadian Secretariat
   - WG 4 Programming languages for automating controlled equipment
   - WG 4 Programming language environment

4) Total number of SC/WGs = 26

4.0 ANALYSIS

A summary of the findings layed out in Section 3.0 is presented in Exhibit 4-1.

A first observation is that it appears that some 67 per cent of current ISO Technical Committees (TCs) and 72 per cent of Sub-Committees (SCs) and Working Groups (WGs) can be correlated with the interests of ISC Sector Branches.

A second observation is that there is a concentration of interest in the following areas (i.e. 9 or more TCs):

- chemicals;
- health care products;
- furniture, household and recreational products;
- primary metals;
- advanced materials and construction products;
- construction industry and capital projects;
- industrial equipment.

Canada has responsibility for 6 TCs, five of which have a direct bearing on ISC:

- TC 6 - Paper, board and pulps;
- TC 155 - Nickel and nickel alloys;
- TC 165 - Timber Structures;
- TC 176 - Quality management and quality assurance; and
- TC 207 - Environment (new).

Up to the end of 1992, Canada had five TC Secretariats which places us in 9th place with Switzerland behind Germany (31), U.S.A. (23), U.K. (22), France (21), Sweden (13), Russian Federation (10), Netherlands (7) and Japan (6), among the 35 ISO member countries with Secretariats.[5] Canada also has 61 (2.4%) of the 2,505 SC/WG Secretariats.

[5] ISO Memento 1993.

Exhibit 4-1 Summary of Findings

ISTC Sectors	Number of Related ISO Committees			
	TCs	SCs and WGs		%
		Chaired by Canada	Total	
Environment Affairs				
- Regulatory Affairs	3	4	112	3.6
- Environmental Industries	2	0	3	0
Forest Industries Branch				
- Pulp and Paper	1	4	21	2.0
- Wood Products	4	1	31	3.2
Chemicals and Bio-Industries				
- Chemicals	9	3	131	2.3
- Health Care Products	12	6	148	4.0
Information Technologies Industry				
- Computers and Emerging Tech	2	10	104	8.6
- Software Products and Informatics	3	2	34	6.0
Food Products				
- Primary Food Products	2	0	57	0
Consumer Products				
- Textile and Leather	3	5	68	7.3
- Furniture, Household, Recreation	10	0	83	0
- Apparel and Footwear	2	0	21	0
Materials				
- Primary Metals Dir.	10	7	116	6.0
- Advanced Materials/Construction	12	11	144	8.0
- Plastics and Polymers	2	0	112	0
Space, Marine and Defence				
- Shipbuilding	1	0	27	0
Aeronautics Branch				
- Propulsion and Aircraft Systems	1	0	5	0
- Aircraft Component Manufacturers	1	0	43	0
Services and Construction Industries				
- Construction Ind/Capital Projects	11	3	89	33
Automotive, Urban Transit & Rail				
- Components and Tires	1	1	38	27
- Light Vehicles	6	0	182	0
- Urban Transit & Rail	1	0	12	0
Indus & Elec Equipment & Tech				
- Industrial Equipment	13	1	119	0.8
- Electrical & Energy Equip.	4	0	36	0
- Advanced Manu. Tech.	4	4	70	5.1
Total	120	62	1806	
Total No. of ISO Committees	180[6]		2505	
% of Committees that relate to ISC	67	2.4	72	

6 The TC on the Environment, created in 1993, was added because Canada obtained this Secretariat.

There is a lot of competition for these Secretariats because they are very influential in the standards development process. As can be seen from Exhibit 4-2, the Europeans have dominated the ISO. This is beginning to change as the U.S. and Japan become more involved. For example, the secretariat for JTC1 was awarded to the U.S.A. after an intense competition. As noted by a senior international standards executive:

> "A lot of money is being made available to support the secretariat of JTC1 in the U.S. and the secretariats of sub-committees in other countries. There was competition to get the secretariats because they are quite influential in the standards producing process in both the ISO and IEC system, particularly in JTC1".[7]

As noted in Section 3.4.1, JTC1 is a Committee where Canada is very much involved and manages 10 Sub-Committees (SCs) and Working Groups (WGs) secretariats. Like all TCs, there is a Canadian-based committee that oversees Canada's participation in JTC1. The names of the participants in that committee are given in the Appendix. As can be appreciated, while there are government representatives from Treasury Board, Secretary of State, National Research Council, Communications Canada,[8] there is no one from Industry and Science Canada (i.e. formerly ISTC) on this Committee which prepares Canada's positions for this ISO/IEC Committee. Participation in this Committee also provides insights on the views of the Canadian informatics industry, which is broadly represented. A few ISC staff are involved, along with 500 or so other Canadians, in the preparatory work for the various SCs and WGs related to JTC1. However, as a general observation, ISC personnel do not appear to be very active in ISO activities.

The Standards Council of Canada (SCC), a Crown Corporation, is the accredited organization to ISO. The SCC co-ordinates Canadian involvement in ISO and is the repository of information on ISO activities (e.g. Canadian participation, meeting reports). Under the new government reorganization, the SCC now reports to Parliament through ISC. Formerly it reported through the Department of Consumer and Corporate Affairs. Industry has long argued that the SCC should report to Parliament through ISC if it is to be an instrument to support international competitiveness.

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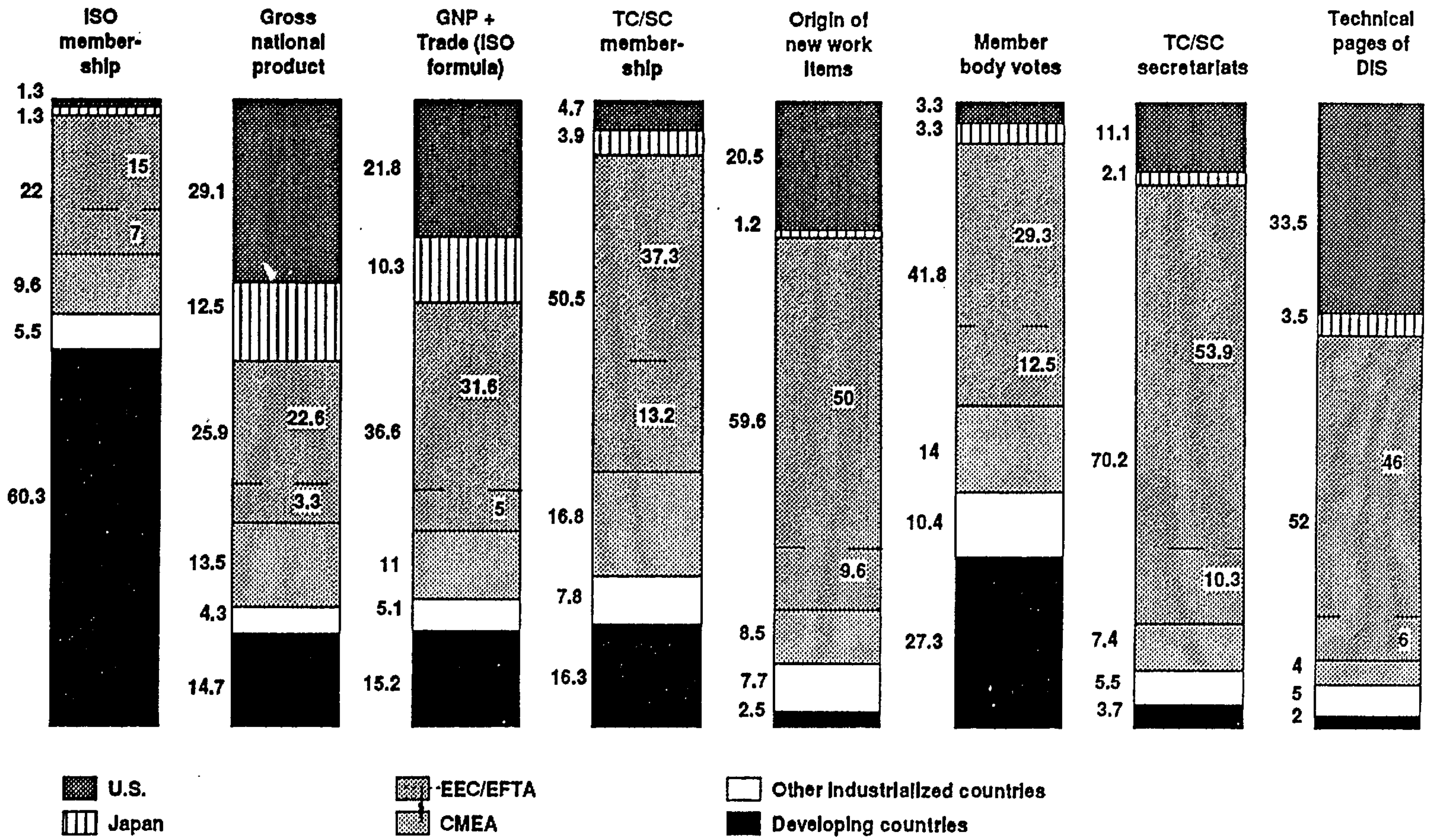
[7] L. Salter and R. Hawkins, The Standards Environment for Communications and Information Technologies (Vol. 1), prepared for the Department of Communications, March 1990, p. 38.

[8] Communications Canada is now part of Industry and Science Canada.

Exhibit 4-2
Participation in International Standards Work, International Organization for Standardization



KEY: DIS=Draft International Standards; EEC=European Economic Community; EFTA=European Free Trade Association ; SC=Subcommittee Chairman; TC=Tag Chairman.
SOURCE: International Organization for Standardization (ISO), 1988.

APPENDIX A

CANADIAN COMMITTEE FOR JTC1 - INFORMATION TECHNOLOGY

7

APPENDIX A
CANADIAN COMMITTEE FOR JTC1 - INFORMATION TECHNOLOGY

Mr. C. Allard
Associated Director, Inside Wire
and Cable Standards
Planning Standards Research
Stentor Resource Center Inc.

Mr. C.V. Ashford
Manager, OAM Protocol Standards
Bell-Northern Research Ltd.

Mr. E.R. Acheson (Chair)
Manager, Policy & Standards & Chair
Information Technology
Treasury Board of Canada

Mr. C. Bardell
Project Manager
Information Technology
Canadian Standards Association

Dr. S.D. Baxter
Consultant

Mr. D. Balmer
Protocols Standards and
Communications Inc.

Mr. J. Berube
IDEgenic Inc.

Mr. D. Bonyun
Bunberry, Filbert and Stokes Enterprises
Limited

Mr. P.G. Bowie

Mr. M.J. Bradley
Advisor, Operations
Operations Division
The Canadian Banker's Association

Mr. R.F. Brett
Manager
Bell-Northern Research Ltd.

Ms. H. Cormier
Chief
Direction Generale De La promotion
Des Langues Off
Secretariat D'Etat Du Canada

Dr. J.M. Costa
Manager, Standards Coordination
Bell-Northern Research Ltd.

Mr. H. Fournier
Manager
Telecommunications Standards
Teleglobe Canada Inc.

Mr. D.B. Forsyth
DBF Enterprises

Mr. P. Hanschke
GKS Product Manager
Prior Data Sciences Ltd.

Dr. W. Henneker
Research Officer
Electrical Engineering
National Research Council

Mr. M.D. Harrop
Administration Policy Branch
Treasury Board of Canada

Mr. B. Ho
Research & Development
Communications Canada

Mr. J. Hopkinson

Mr. J.D. Kelley
President
Keltech Advisory Group Inc.

Dr. J.V.TH Knoppers
President
Canaglobe International Inc.

Mr. V.C. MacDonald

Mr. D. MacKinnon
Managing Consultant
Open Systems Communication
Consulting

Mr. W.A. McCrum
Director
Systems Interconnection Research
Department of Communications

Mr. C. Mondello
Standards and Regulations Manager
Digital Equipment of Canada Ltd.

Mrs. S. Pavel
Terminologie et des Services
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Bell-Northern Research Ltd.

Mr. N. Psimenatos
Stentor Resource Center Inc.

Mr. D.A. Sheppard
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Communications Inc.

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Mr. R.L. Sunday
Consulting Systems Engineer
IBM Canada Ltd.

Mr. K. Torenvliet
Senior Advisor
CGA

Dr. V.S. Umamaheswaran
Advisory Engineering Representative
21/979/844
IBM Canada Ltd.

Mr. P. Voldner
Information Systems Advisor
Systems Technology

Mr. G. Warren
Dept. 31/123/844/TOR
IBM Canada Laboratory

Mr. J.D. Warner
Manager National Requirements
Telecommunications Relations
IBM Canada Ltd.

Nordicity Group Ltd.
Le Groupe Nordicité ltée

ISO 9000 FEASIBILITY STUDY FOR ELECTRONIC CHARTING IN THE CANADIAN HYDROGRAPHIC SERVICE

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EXECUTIVE SUMMARY

PURPOSE

The purpose of this study is to investigate for the Canadian Hydrographic Service (CHS) the feasibility of implementing a quality management system (QMS) for the electronic charting function.

This study is a CHS study jointly funded with Industry Canada. Industry Canada's interest in the study involves showing how ISO 9000 registration could help Canadian industry become more competitive and could provide opportunities for introducing international quality requirements in government contract procurement.

APPROACH

The study approach involved the following steps:

- *ISO 9000 awareness seminars for CHS staff in the regions and headquarters, and for a number of contractors involved in the electronic charting business;*
- *site visits and discussion groups to obtain feedback and data from participants in the electronic charting activities;*
- *assessment of electronic charting production activities against ISO 9000 requirements;*
- *identification of requirements for implementation of ISO 9000 in CHS.*

A number of issues were raised by regional staff and suppliers. These issues are discussed in the report. Generally, the response from regional staff and suppliers was very positive regarding the CHS ISO 9000 initiative.

The options for implementation that were considered involved the functional scope (electronic charting functions), the institutional scope (Headquarters, Regional Offices, Nautical Data International, and suppliers) and the selection of an ISO 9000 model (ISO 9001, 9002 or 9003).

RECOMMENDATION

The study team concluded that the CHS should:

Implement ISO 9001 for CHS electronic charting production, with a functional and institutional scope that covers electronic charting production processes across the board (i.e., covers Headquarters, Regional Offices, Nautical Data International and suppliers). The electronic charting quality management system, once in place, should be registered with an accredited Canadian registration organization.

ADVANTAGES

The advantages of introducing an ISO 9000 Quality Management System (QMS) include:

__Increased Efficiencies:__ The establishment of a QMS will provide the infrastructure for an improved organization which actively promotes efficiencies in the production processes; the process of documenting procedures opens opportunities for streamlining and integration.

__Customer Satisfaction:__ It assures clients that products are developed, produced and distributed using the best known management practices including standards of operation and quality checks.

__Litigation:__ It will be essential to have a QMS which ensures that state-of-the-art professional practices are in place at all stages of the ENC production process.

__Cost Savings:__ It is much cheaper to correct mistakes early in a process, rather than afterwards.

IMPLEMENTATION

The proposed implementation plan involves approximately 412 to 442 person days of CHS staff time, over an 18 month period.

The first year would be devoted to introducing and implementing the system. The second year is for proceeding with the registration process involved to get electronic charting production certified for ISO 9001.

A two year budget is required to start with. The first year is comprised mostly of training costs of $25,500. The second year represents an estimated registration fee of $47,700 for six sites (including Headquarters, four regional offices and Nautical Data International Inc.).

These cost figures do not include travel costs and expenses of auditors and trainers, and they do not include the costs of follow-up audits, in case of noncompliances discovered, or for surveillance purposes after registration (certification).

While it is preferable to require suppliers, especially software developers, to comply with ISO 9001, it would also be possible to control for quality, in supplier-CHS contractual situations involving electronic charting production, through the contract review and purchasing elements of a CHS ISO 9001 registration. Thus, the option of supplier registration could be made voluntary, if suppliers are not ready or able to commit to implementation within the same timeframe as CHS. However, for manufacturers (namely OSL) of the complete ECDIS product, as installed on ships, registration to ISO 9001 would clearly provide the necessary quality assurance needed to achieve market advantages and defence against litigation, and provide for after-sales servicing requirements.

I. INTRODUCTION

1.1 Purpose of the Study

The purpose of this study is to investigate for the Canadian Hydrographic Service (CHS) the feasibility of implementing a quality management system (QMS) for the electronic charting function.[1] To date, production and quality control processes have served the CHS well in the paper chart world, because they adhere to standard quality control practices and resemble what others in the international hydrographic community are doing. However, Canada is now on the threshold of a new era in hydrographic services, leading the way with its electronic charting technology. The adoption of formal process documentation and control is a necessity, to ensure accuracy, consistency and timeliness in production, and to achieve credibility in litigation cases associated with marine incidents.

The challenge for CHS is to clearly show that the "essence", or the quality basis, of navigational paper charts, is passed through to electronic navigational charts (ENC's) and onwards to the screen on the bridge (the complete ECDIS product). It is in the context of the ENC production process that this study examines the feasibility of implementing ISO 9000 requirements within CHS.[2]

The requirements for a quality management system, workable for ENC production, are contained in the International Organization for Standardization's ISO 9000 series. This series of standards represents the state-of-the-art worldwide, and it provides the elements of a QMS that are needed for organizing and controlling operations to achieve quality results.

---

[1] The expression "electronic charting" is an acceptable phrase to refer to Electronic Chart Display and Information Systems, or ECDIS, as well as to ENC's or Electronic Navigational Charts, which are installed in ECDIS as System Electronic Navigational Charts, or SENC's. The processes involved in producing ENC's are the main focus of this study.

[2] It should be noted here that the International Maritime Organization (IMO), together with the International Hydrographic Organization (IHO), has developed a draft performance standard for ECDIS which forms the basis of a resolution scheduled for passage by the IMO Assembly in 1995. The resolution concerns an amendment to the 1974 Safety of Life at Sea Convention whereby the carriage of ECDIS will be considered the legal equivalent of the present requirement that vessels from signatory countries carry up-to-date paper charts.

1.2 What is ISO 9000?

ISO 9000 international quality systems standards have all but replaced more parochial standards around the world. The term "ISO 9000" has become internationally synonymous with quality. The ISO 9000 quality systems standards, ISO 9001, 9002, and 9003, describe three distinct quality system models, each with a different level of emphasis and degree of stringency. Each of the models is appropriate to different expectations and organizational set-ups.

ISO 9003, Quality Systems -- Model for Quality Assurance in Final Inspection and Test, is of interest to those organizations in which the quality of the final product or service can be assessed purely by virtue of the final inspection and testing routines.

ISO 9002, Quality Systems - Model for Quality Assurance in Production and Installation, is the model most frequently required by private manufacturing firms. As its title indicates, it encompasses production and installation in addition to all the elements found in 9003. An organization that meets the requirements of ISO 9002 also satisfies ISO 9003.

ISO 9001, Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation and Servicing, is usually required of organizations in which design and product development is a substantial activity. This standard covers the production process as well as servicing requirements. An organization that meets the requirements of ISO 9001 also satisfies ISO 9002 and 9003.

1.3 Scope of Implementation

This study focuses on the level of effort required to implement an ISO 9000 quality management system standard within CHS, particularly in the context of electronic charting. The scope of the implementation is intended to cover all phases of the ENC production process. Options for implementation are discussed later in the report.

Although CHS plays a strong role in ECDIS development, it does not produce ECDIS. At the moment, Offshore Systems Ltd. (OSL), a company based in British Columbia, manufactures ECDIS. The Canadian Hydrographic Service "makes the data", or ENC's, that go into ECDIS. Supplier participation in ISO 9000 implementation (to include ENC and ECDIS) is also discussed later in the report.

II. STUDY APPROACH

This study is a CHS study jointly funded with Industry Canada. It involved an ISO 9000 consultant from Nordicity Group Ltd. (Rostum) and a CHS study team (Chapeskie, Holroyd and Casey). Digitizing contractors (The Eastcan Group and Terra Surveys Limited), regional offices, and Offshore Systems Ltd. were also included in the study process. Industry Canada's interest in the study involves showing how ISO 9000 registration could help Canadian industry become more competitive and could provide opportunities for introducing international quality requirements in government contract procurement.

2.1 ISO 9000 Awareness Seminars

The first step of the study process was to engender an awareness of ISO 9000, what it is and how it might apply to CHS. A series of seminars were held across the CHS organization, starting with Headquarters in Ottawa, followed by the regional offices. Seminars were held in the regional offices in the following order:

- Pacific Region, located at the Institute of Ocean Sciences in Sidney, B.C.

- Central and Arctic Region, based at the Canada Centre for Inland Waters in Burlington, Ont.

- Quebec Region, whose offices are in the Maurice-Lamontagne Institute in Mont-Joli, Quebec.

- Scotia-Fundy Region, based at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia.

ISO 9000 discussion groups were also conducted with staff of selected suppliers involved in ENC production, including Terra Surveys Limited, Offshore Systems Ltd. (OSL), and the Eastcan Group. Discussion between officials of CHS and Universal Systems Ltd. (USL) was also undertaken to explain the CHS ISO 9000 initiative.

The seminars and discussion groups in the regions focused on conveying the purposes of the study, the relevance of introducing a quality system to CHS electronic charting, the details about ISO 9000 standards, implementation requirements and the benefits of ISO 9000 registration.

The seminars and discussion groups lasted approximately three hours each, and included question-and-answer periods, which usually ended up in a two-way dialogue (between attendees and the study team) about ISO 9000 and its applicability within CHS. This two-way dialogue provided the study team with valuable input for the feasibility study.

2.2 Site Visits and Discussion Groups

Follow-up site visits involved more detailed discussion with core groups of staff at Headquarters, regional offices and suppliers involved in the electronic charting production process. Participants in these discussion groups involved all members within the electronic charting hierarchy. In addition, tours of the facilities of the participating organizations provided the study team with an opportunity to examine electronic charting production activities and to identify some of the elements for which a quality systems standard is required.

2.3 Assessment of Electronic Charting Production Activities Against ISO 9000 Requirements

Copies of existing documentation on procedures and feedback from interviews with study participants also provided input into the process of evaluating electronic charting production against the requirements of ISO 9000 elements. A checklist of ISO 9001 and 9002 elements was used as a guide to direct a number of specific questions at individuals directly involved in electronic charting production activities.

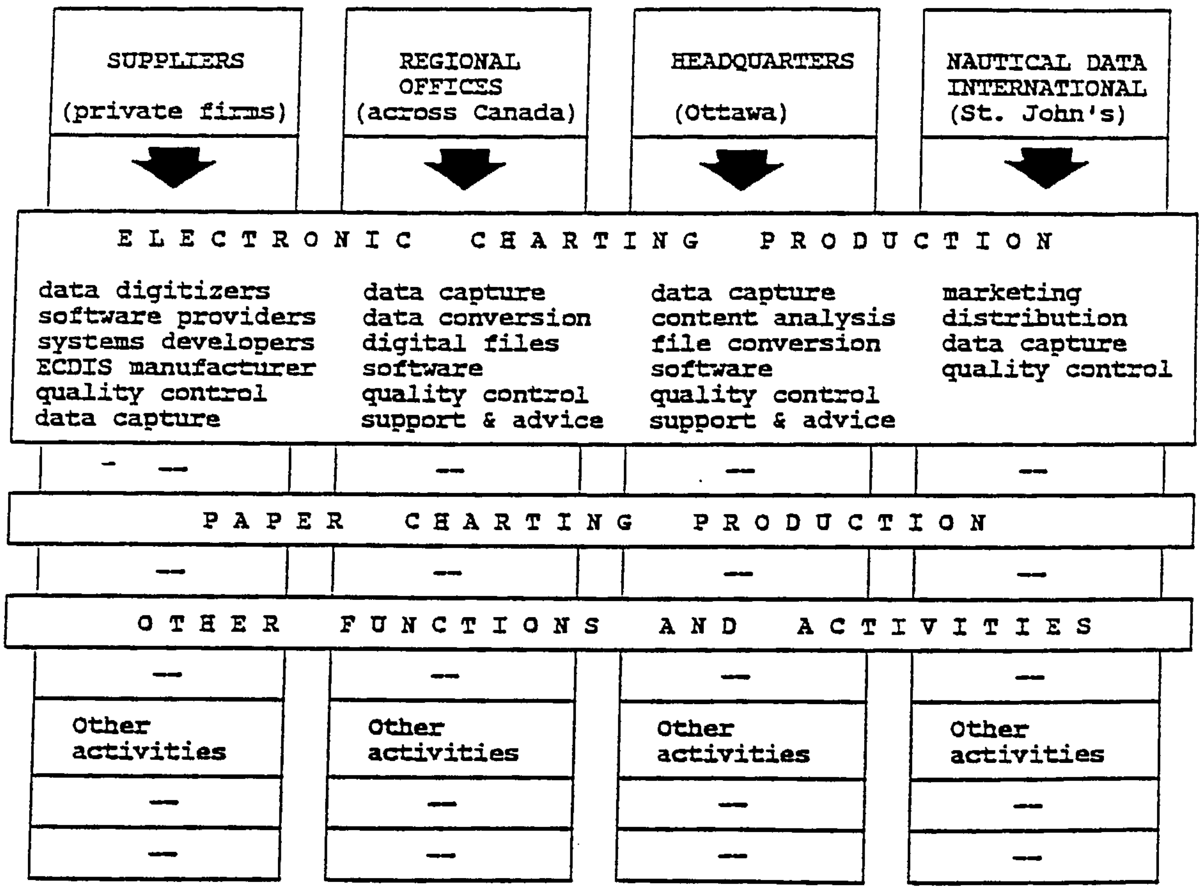
2.4 Identification of Requirements for Implementation

The conclusions regarding the level of effort needed and the requirements for ISO 9000 implementation provided in this report, are based primarily on feedback from the participants in the study. This includes a review of the results from the site visits and discussion groups, an examination of existing documentation on electronic charting procedures, and comparison of CHS practices against the checklist of ISO 9000 requirements.

III. PROFILE OF THE CHS ELECTRONIC CHARTING PRODUCTION PROCESS

Before discussing the issues and practicalities of implementing an ISO 9000 quality management system it is appropriate to describe the CHS ENC production process. This is necessary since the activities that make up the electronic charting business are spread over a number of organizational entities. Exhibit 3-1 shows the contributions of the different players in the electronic charting production process.

Exhibit 3-1: Participants in the Electronic Charting Production Process



What Exhibit 3-1 shows is that if an ISO 9000 QMS is introduced to CHS for electronic charting, it would need to envelope several organizations in order to cover the complete ENC production line, from design and development to distribution. The servicing and maintenance components are not shown in the matrix above, but these activities are likely to become an important part of the process as the electronic charting products (ENC's and ECDIS) become more and more commercialized. From our interviews and discussions across regions, it appears that servicing and maintenance activities are carried out on an ad hoc basis, by ECDIS manufacturers as well as Regional office staff.

Exhibit 3-2 depicts the interfaces between contractors (suppliers), the regional offices, Headquarters and the ECDIS manufacturer (OSL).

Exhibit 3-2: Interfaces Between the Players in the ENC Production Process

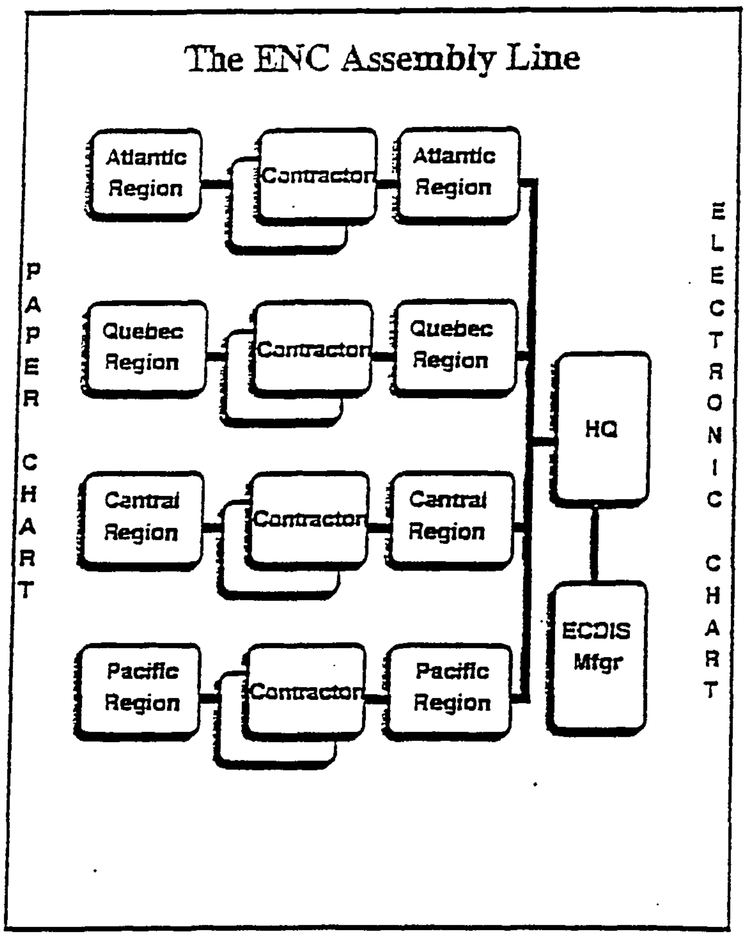


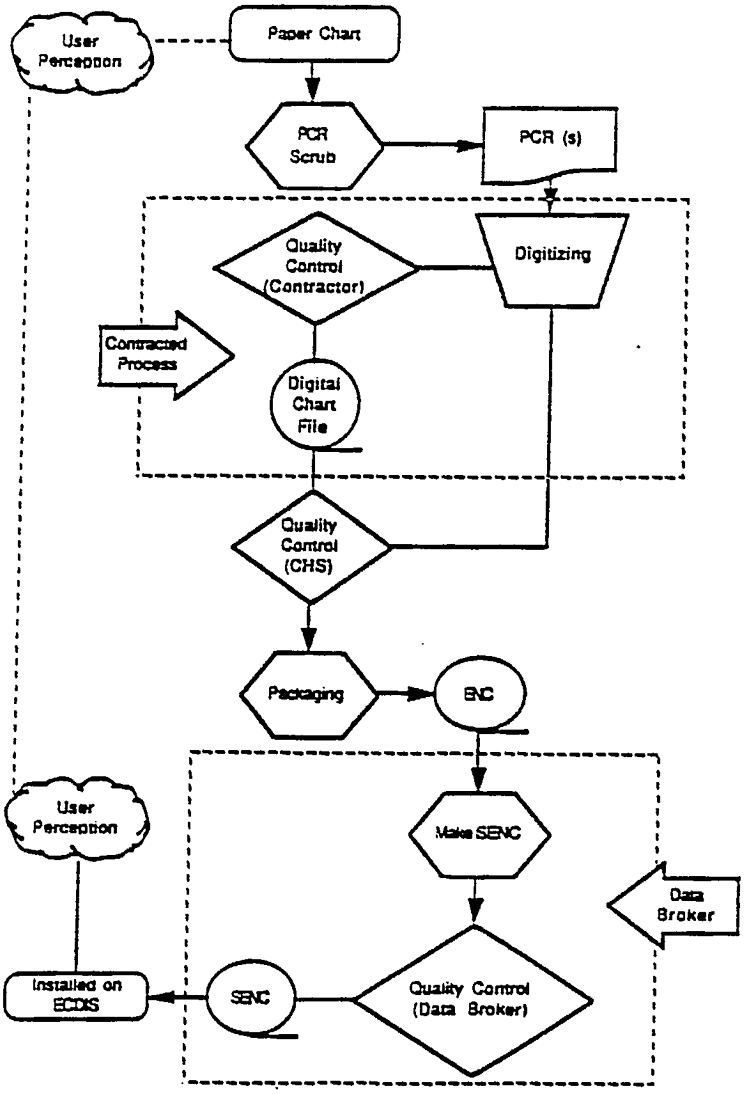
Exhibit 3-3 shows that the essence of the paper chart is not lost in the electronic chart production process. The paper chart is seen as the point of departure, the view on the ECDIS screen as the end point.

Key questions to ask related to introducing ISO 9000 to ENC production, as depicted in Exhibit 3-3, are:

- *What is the level of effort required to introduce a QMS to cover all the activities that go on between these two points?*
- *Does CHS have appropriate documentation for all the important procedures that impact on the quality of the final product?*
- *Does CHS have documented evidence that these procedures are in fact being followed?*

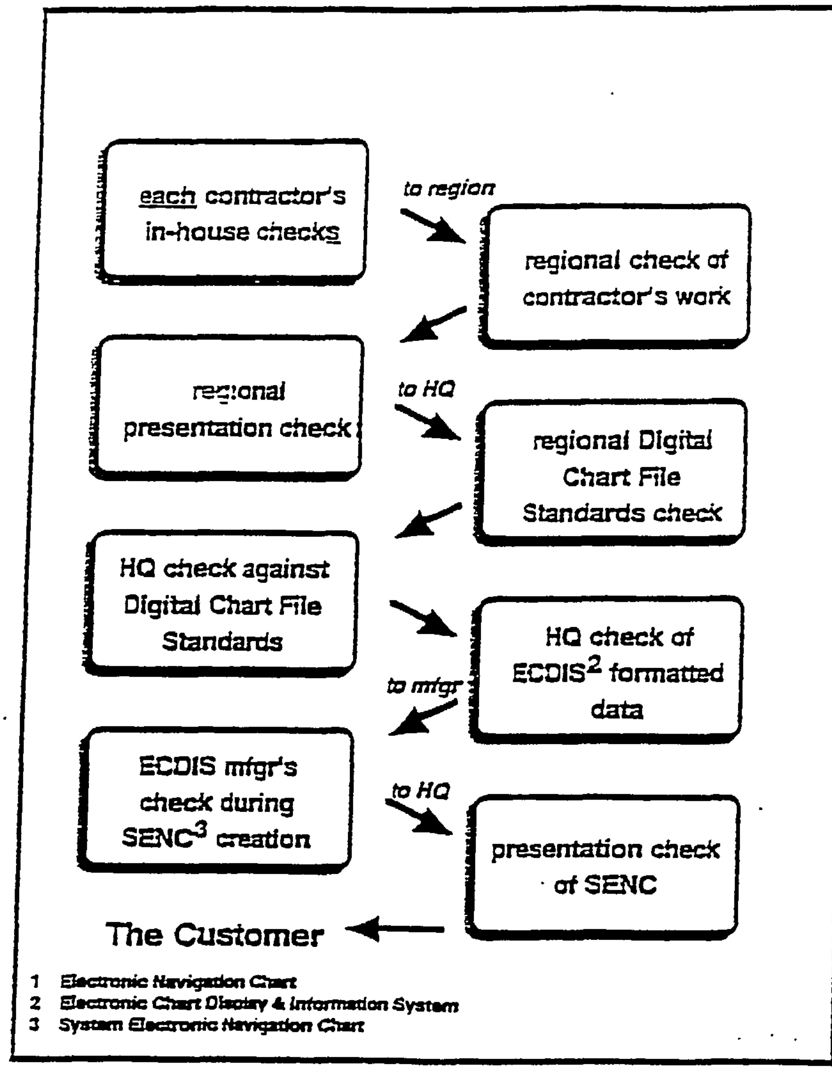
The goal of introducing an ISO 9000 QMS is to be able to respond positively to these questions.

Exhibit 3-3: ENC Production Flow Diagram



Finally, Exhibit 3-4 shows the existing quality control activity that is part of the ENC production process. This quality control activity would need to be incorporated into the ISO 9000 QMS system as part of the inspection and testing procedures that are needed to ensure accuracy and conformance of the charts to prescribed specifications and requirements.

Exhibit 3-4: Current ENC[1] Quality Control



IV. BENEFITS OF ISO 9000 IMPLEMENTATION

Lack of quality in electronic charting products could lead to disasters at sea, so quality is a prime consideration in CHS's operations. The electronic charting production process can benefit from implementation of a quality management system, such as that provided by ISO 9000, in several ways.

4.1 Conformance to International Standards

The two main international organizations dealing with hydrographic charts are the International Maritime Organization (IMO) and the International Hydrographic Organization (IHO). Both organizations develop and propose international standards which impact on electronic chart production. Standards are being developed which relate to data transmission and exchange formats, graphic on-screen presentation, the minimum function and content of an ECDIS and data models. Canada participates actively in the development and testing of these standards. Norway, another active country in the domain of electronic charting, also undertakes major research and development projects in this area.

Introducing an ISO 9000 QMS system will provide CHS with a means by which it can ensure conformance to IMO and IHO standards consistently and as appropriate throughout the different stages of ENC production. It should be noted that the Norwegian Hydrographic Service is also spearheading its own efforts at introducing ISO 9000 within its electronic charting production processes.

4.2 Litigation

ECDIS is an automated electronic navigational aid that combines digital chart data with the full range of on board sensors, including radar, a fathometer for depth sounding, and a global positioning system, which is a satellite-based technology used to track the precise locations of receiver-equipped objects. All information is incorporated into a single color graphic display.

The complexity of the ECDIS system, coupled with its use by vessels carrying passengers or hazardous cargoes, introduces questions of liability and risk which have legal consequences when things go wrong. It is imperative, therefore, to have a QMS in place which covers the ECDIS product, ensuring that state-of-the-art professional practices are in place at all stages of the ECDIS production process. This includes database development, and software and hardware requirements for ENC products.

In this respect, ISO 9000 could provide for an improved records keeping system at CHS which covers the ENC production process in case of litigation. It also means that procedures impacting on quality are documented, that specifications are clearly understood and responsibilities are identified. In addition, traceability to "root causes" of quality problems is ensured, to allow for speedy corrections and recovery.

4.3 Increased Efficiencies

Another advantage of introducing an ISO 9000 QMS is that it provides the infrastructure for an improved organization which promotes efficiency in the production process. This is brought about because conformance to ISO 9000 requirements would achieve the following for CHS:

- a clear definition of responsibilities and authorities;
- a job done right the first time;
- improved communications and completeness of information;
- improved utilization of resources;
- a formalized system in place which ensures consistent quality and punctual delivery;
- a documentation system in place which provides useful reference and training tools;
- errors rectified at the earliest opportunity and not repeated;
- a system in place which provides improved controls during periods of change or growth; and
- generally, a quality culture which is committed to continuous improvement.

4.4 Customer Satisfaction

ISO 9000 will not give the customer of electronic charting products a guarantee that everything will be perfect, but that the product is developed, produced and distributed using the best known management practices, applying adequate standards of operation and quality checks. In this respect, ISO 9000 guarantees that the customer of electronic charting products will get the best that can be produced given existing know-how and technology.

4.5 Benefits of Registration

Registering the ENC/ECDIS production process, under an ISO 9000 quality system, with an accredited Registration Organization,[1] would provide the following benefits:

- Registration of the QMS with an accredited Registration Organization demonstrates commitment to quality and can give direct competitive advantage to electronic chart producers.

- Registration enables the suppliers of electronic chart products to gain access to markets where accredited registration is recognized, or even mandatory, as in the European Economic Community.

- Registration is an essential part of demonstrating that contributors to the electronic chart production process are able to meet safety requirements and technical specifications.

- Registration gives confidence in the capability of the suppliers, including CHS, to deliver what is needed.

- Registration gives confidence that the suppliers, including CHS, operate in a professional manner with a demonstrated commitment to quality.

[1] "Registration" is a procedure by which an accredited third-party (i.e., an organization accredited by the Standards Council of Canada) registers the quality system of another organization to nationally or internationally recognized standards such as ISO 9000.

- Registration also frees purchasers of electronic chart systems from the need to carry out their own costly-audits of suppliers.

- Registration allows for the use of a recognized quality logo (of the registration organization) on stationery, advertisements, and literature regarding electronic chart products.

- Registration generally would provide for an improved quality image for the electronic chart products.

4.6 Cost Savings

Lastly, electronic chart producers could save money by introducing a QMS in the production process. It is much cheaper to correct mistakes early in a process, rather than afterwards. Fewer rejects and corrections means less repeated work and hence cost savings.

V. ISSUES AND RESPONSES TO THE ISO 9000 INITIATIVE

5.1 Scope of Implementation

An ISO 9000 conformant QMS is both customizable and configurable -- it can be whatever CHS wants it to be. There are at least five conceivable options regarding the scope of implementation which the study team considered. Four of these options are depicted in Exhibit 5-1 in a matrix format. These options will be discussed further in Section VII of this report, with a view of selecting the most feasible.

(1) The minimum approach: Selectively adopt ISO 9000 elements in the work process of electronic chart production, without necessarily seeking registration of the QMS by an accredited registration organization. This option allows for the introduction of some of the principles of documentation and the rigour of the ISO 9000 quality system, but does not provide the essential benefits of registration outlined above in section IV.

(2) The maximum approach: Apply the ISO 9000 QMS to the whole CHS organization, including HQ and each regional office, and including all charting products and services of CHS, and require compliance to ISO 9000 by all suppliers to CHS. This approach would be very ambitious and can certainly be characterized as an ideal to aim for on the long run.

(3) The electronic charting application: Apply the ISO 9000 QMS, under one strategic initiative, to electronic charting activities, simultaneously including activities carried out by HQ and the regional offices, and require compliance to ISO 9000 by all suppliers of ENC and ECDIS products. Also include marketing and distribution (Nautical Data International Inc.) and servicing activities.

(4) The incremental approach: Phase in the ISO 9000 QMS requirement by introducing it in the electronic charting production process, starting with HQ, or with one region, and then bringing in other members of CHS, respectively, and finally requiring compliance to ISO 9000 by suppliers and distributors.

(5) Only CHS required to adopt QMS standards: This option could be identical to (3) or (4), except supplier compliance is voluntary.

Exhibit 5-1: Scope of Implementation: Matrix of Options

■ = ISO 9000 coverage with registration

▒ = Implementation of ISO 9000 elements, without registration

REG (1, 2, 3, 4) = Regions (1, 2, 3, 4)
NDI = Nautical Data International Inc.
SUPPLIERS = e.g., OSL, Eastcan, Terra, USL

(1) THE MINIMUM APPROACH

	ORGANIZATIONS							
FUNCTIONS/ ACTIVITIES	CHS -HQ	REG 1	REG 2	REG 3	REG 4	NDI	SUPPLIERS ...	...
Paper charts								
Electronic charts	▒	▒	▒	▒	▒			
Other functions								

---								

(2) THE MAXIMUM APPROACH

	ORGANIZATIONS							
FUNCTIONS/ ACTIVITIES	CHS -HQ	REG 1	REG 2	REG 3	REG 4	NDI	SUPPLIERS ...	...
Paper charts	■	■	■	■	■	■	■	■
Electronic charts	■	■	■	■	■	■	■	■
Other functions	■	■	■	■	■	■	■	■
---	■	■	■	■	■	■	■	■
---	■	■	■	■	■	■	■	■

(3) THE ELECTRONIC CHARTING APPLICATION

	ORGANIZATIONS							
FUNCTIONS/ ACTIVITIES	CHS -HQ	REG 1	REG 2	REG 3	REG 4	NDI	SUPPLIERS ...	...
Paper charts								
Electronic charts	■	■	■	■	■	■	■	■
Other functions								

---								

(4) THE INCREMENTAL APPROACH (PHASING)

	ORGANIZATIONS							
FUNCTIONS/ ACTIVITIES	CHS -HQ	REG 1	REG 2	REG 3	REG 4	NDI	SUPPLIERS ...	...
Paper charts								
Electronic charts	■	▒	▒	░	...			
Other functions								

5.2 Response of Suppliers

The suppliers that we talked to, Eastcan, Terra Surveys, Offshore Systems Ltd., and USL, were all positive about adopting a QMS standard for their business applications, including their electronic charting services provided to CHS. To make it worth their while, however, all wanted to make sure that they benefit from qualifying for ISO 9000 -- vis-a-vis business opportunities (and preferential treatment for new contracts).

Eastcan Group are convinced that ISO 9000 could provide a positive contribution to their work. They have taken steps to look into the implications of adopting ISO 9000 for their company's business. They would likely commit to this QMS provided there was some assistance for implementation forthcoming from government sources. They have already looked into assistance from the Atlantic Canada Opportunities Agency Action Program (ACOA). Eastcan has its procedures for activities related to their electronic charting work well documented, and although it would require some effort to produce the kind of quality assurance system needed to conform to ISO 9000 practices, it appears that this would not be too arduous a task for Eastcan.

Offshore Systems Ltd. have already implemented a QMS (conforming to AQAP, the NATO quality management standards) in some of their hardware and software operations -- prompted by a sub-contractual commitment to another company which is contracted to the Department of National Defence. OSL is very interested in bringing in ISO 9000 and appears supportive of CHS's initiative. OSL is also in a relatively good position of preparedness to introduce ISO 9000 elements into their work process.

Terra Surveys would commit to adopting ISO 9000, not necessarily for electronic charting production purposes, but rather for some of its other business activities, particularly for overseas customers. Terra agree with the benefits of an ISO 9000 QMS, but see the costs of implementation not quite justified solely by the level of their contribution at this time to ENC products.

Universal Systems Ltd. has also responded positively to CHS's initiative to introduce ISO 9000. In the case of USL, it is worth noting that the application of ISO 9000 to software development is particularly pertinent, since a special option of the standards has been devoted to the software business. ISO 9000-3 was developed by the ISO technical committee working on the standards, to interpret ISO 9001 specifically for the software industry. Hundreds of software companies around the world have already adopted ISO

9001 and many more are now in the process of converting their QMS's for ISO 9001 compliance. In the United Kingdom, the British Standards Institute and the Department of Trade and Industry have co-sponsored a special program called TickIT, to introduce ISO 9001 to the software industry. Other countries including Sweden, France and Canada are looking at ways of introducing programs similar to TickIT.

ISO 9001 compliance for software developers is becoming a de facto requirement in contractual situations in Europe. In Canada and the United States many software companies have either become compliant or have implementation programs underway.

5.3 Responses from the Regional Offices

Many individuals within the CHS regional offices also expressed positive opinions about introducing ISO 9000 requirements. However, there are differences of opinion about the scope of implementation and the effects of an ISO 9000 quality management system on CHS. The main differences stem from the following concerns:

- Regions have different approaches and procedures for carrying out ENC activities -- how will ISO 9000 impact on these differences? Whose approach will become the standard?

- Resources for implementation of ISO 9000 are limited within the regions.

- Persons involved in ENC production processes are also involved in other unrelated activities -- how will this impact on the ISO 9000 QMS requirements?

- Organizationally, the ENC activities are spread over a number of separate organizational entities, functionally related but mainly tied together by good will and tradition (see Exhibit 3-1). This could make the introduction of a uniform implementation strategy for phasing in ISO 9000 somewhat tricky, although not necessarily problematic. Securing full commitment to the process by each player may not be straightforward. For example, commitment to specific test and checking procedures or software applications may require negotiation between regions and HQ, especially where these procedures or applications differ.

- The functions of ENC production are too intertwined with other functions, including paper chart production, such that the scope of ISO 9000 implementation needs to be broadened to include all navigational charting activities -- including data collection, transformation, packaging, updating, maintenance, distribution and servicing.

- The role of NDI (Nautical Data International Inc.) in marketing and distribution of the ENC and ECDIS products would need to be included in the scope of ISO 9000 implementation, for complete QMS coverage of electronic charting products.

- Finally, an issue arose as to the variability and changing nature of the electronic charting product. Electronic charting technology is likely to evolve over the next months and years significantly, enough to alter the processes of production and the electronic charting products themselves. This could have implications in terms of ISO 9000 implementation. For example, organizational restructuring, procedural changes, adjustment of responsibilities and authorities, etc., could significantly reorient the production process in the future, such that much of the work carried out during an ISO 9000 implementation phase might become obsolete.

All the above concerns are valid issues raised in the course of the study. Notwithstanding these issues, however, the ISO 9000 standards have been developed with these kinds of organizational dynamics in mind. The above issues are not uncommon amongst most organizations which encounter rapidly advancing technologies in an active R&D environment. The manner in which the above issues are addressed, however, will depend on a carefully structured ISO 9000 implementation strategy and appropriate scoping of registration.

5.4 <u>Software Applications</u>

The utilization of software packages for digitizing data, file transformation, data-base development and updating, editing and verification, and data transmission is so pervasive to the ENC production process, that it cannot be ignored as a key element that impacts on the quality of the product. It is, therefore, important to include software development and utilization as one of the areas to be covered within the ISO 9000 implementation loop.

For example, CARIS, the software package developed by USL which CHS uses in electronic charting activities, is utilized at many stages of the electronic charting production process. In addition, CHS does its own software development for purposes of ENC related activities. To the extent that this will continue to be a function of CHS's own electronic charting activities, consideration should be given to implementing ISO 9001, as provided for in the guidelines for software firms (ISO 9000-3). If the software applications development function is contracted out, however, this feature may be excluded from the CHS scope of implementation and passed onto the software developer.

- Edgar Gold, a legal expert in marine law, has raised an important issue related to software applications in electronic charting: What are the liability implications where software codes developed by CHS become embedded in software products which are produced and marketed by other manufacturers or organizations? In other words: Who is to blame and who pays when things go wrong? The situation is as follows: if most manufacturers of software are ISO 9000 certified, lack of CHS certification and compliance with appropriate procedures may give rise to an *inference* that the procedures actually adopted were not adequate, if they fail to meet ISO standards.

Increasingly, software developers around the world are moving towards ISO 9000 registration. There is also an active initiative under way in Canada by software companies to pursue registration.

5.5 Procedures

Many of the procedures required for ENC development (e.g., identification of charts from indexes, extracting chart data, scrubbing of plots, updates, data file reviews, editing, transformation of data, content analysis, etc.) have been documented on an ad hoc basis by participants in electronic charting activities in HQ and regional offices. The challenge for CHS is to amalgamate these documentation initiatives under one framework which allows for document control practices as advocated by the ISO 9000 standards.

5.6 Liability and Risk Context

In 1991, as part of the Green Plan, the CHS initiated the Electronic Chart Development Program to build the necessary infrastructure to support an electronic charting system. The objectives of this program are to reduce the risks of collision and grounding, thus reducing the likelihood of disasters affecting lives, property and the marine ecosystem.

An issue to consider in this context is as follows: Is it possible to avoid or reduce exposure to liability by adopting and implementing quality control standards, such as those which would result from ISO 9000 certification? Compliance to ISO 9000 requirements would not provide CHS with a complete defence against liability and litigation in court. However, registration and compliance to ISO 9000 standards is a good idea for protection against errors due to negligence. The ENC producers, and ECDIS manufacturers, by adopting and implementing stringent quality management standards in the development and manufacture of their products, will reduce the number of instances under which malfunction or failure may arise. This will also assist in ensuring that design defects and inaccuracies in information do not exist.

5.7 Cultural Implications

There is a current cultural mind-set which permeates the CHS and which governs the relationships of CHS with its suppliers and customers. It is a mind-set which is action-oriented, dynamic and highly adaptable to change. This is an asset which engenders a highly productive milieu for R&D and technological development. However, this same asset could also conceivably mean difficulty in establishing a structured, documented approach as required by ISO 9000. A cultural acceptance and adjustment to the practices required for achieving quality management systemization and standardization of procedures is required if CHS is to make the transition to ISO 9000. Experience in other organizations has shown that without a solid commitment by all key persons involved in the production process, it is very difficult to achieve the requirements of quality management systems such as ISO 9000.

5.8 Contractual Requirements

As discussed in previous sections of this report, suppliers (contractors) are important contributors to the electronic charting production process. Amongst other activities, they digitize data, edit and convert data files, develop software applications, and construct the ECDIS systems used on ships. The contractual requirements of CHS include feedback, reporting, verification of purchased products, assessment of contractor capabilities, approval of products and modifications, and so on.

These requirements are mostly covered by CHS offices, using existing Government Services contractual practices. However, the ISO 9000 contract review procedures provide some additional perspectives on the application of quality assurance to contractual situations.

Implementing ISO 9000 contract review requirements would provide CHS with assurance that suppliers have in place provisions for meeting quality specifications. Any quality related problems would be dealt with in relation to the procedures in place. Quality parameters on such aspects as functional performance, life, reliability and maintainability in addition to other technical information such as formats and protocols, which need to be adhered to by suppliers, will be included as part of the contract review requirements.

ISO 9000 contract review requirements provide for inclusion of procedures which ensure the following:

- all interested parties have an opportunity to review the contract;

- a check-list or documented guide is available for the reviewers to verify that they have understood the requirements of the contract;

- a method is available for the reviewers to question the terms of contract and have their concerns addressed;

- all the functional groups concerned are involved with the contract from the very beginning and help in developing a plan for the successful implementation of the contract;

- a method exists for reviewing quality requirements with CHS;

- there is provision for appropriate reviews should the contract or the quality requirements change.

If implemented, a formalized contract review procedure (following ISO 9000 requirements) could reduce or even avoid misunderstandings between suppliers and CHS. It could result in increased mutual confidence and reduce to a minimum the occasions for breech of product quality.

VI. EVALUATION OF CHS PREPAREDNESS

The definition of quality that is pertinent within the context of this study involves simply that the product meets the requirements of the users/customers, and that production is controlled in such a way to ensure reliability and consistency of the product. This implies that requirements and procedures to meet quality specifications for electronic charts are appropriately documented and followed. In this case, inspecting and testing the final product before delivery is not sufficient.

In order to ensure that a complete and reliable quality management system is in place it is necessary to have quality procedures built into every critical stage of the production process. Whenever something goes wrong, it is necessary to be able to easily identify where in the process corrections are needed. Each step must be defined and quality checks must be built into each stage. Individuals involved in electronic charting activities must have a clear understanding of what they are supposed to do and how to correct mistakes when they occur.

The following pages provide an assessment of the state of preparedness of CHS in relation to the twenty elements of the ISO 9001 standard (shown in Exhibit 6-1). This assessment is based primarily on the feedback obtained during the course of this feasibility study, and from a review of current electronic charting procedures documentation.

Exhibit 6-1: The Twenty Elements of ISO 9001

1. Management responsibility
2. Quality System
3. Contract Review
4. Design control
5. Document Control
6. Purchasing
7. Purchaser supplied products
8. Product identification and traceability
9. Process control
10. Inspection and testing
11. Inspection, Measuring & Test Equipment
12. Inspection and Test Status
13. Control of non-conforming products
14. Corrective Action
15. Handling, storage, packaging & delivery
16. Quality records
17. Internal quality audits
18. Training
19. Servicing
20. Statistical Techniques

6.1 Management Responsibility

The management of the quality system at CHS will require a clear statement of management commitment to the implementation process and its continuous maintenance. Eventually, once a quality management system has been put in place for electronic charting, this will only signify the beginning. The quality system is intended to be a dynamic, continuous process which becomes part of the day-to-day operations of staff. Management will need to define and document its policy and objectives, and commitments to, quality so it can be understood throughout the organization.

A complete organization structure of the ENC production process is required showing the duties, responsibilities and authority of all staff who manage, verify or perform work affecting quality of electronic charting products.

A management representative would need to be nominated who will be responsible for all matters affecting the quality system. Although this person would act as the focal point for quality matters, the whole workforce would need to contribute to the overall quality of ENC's.

6.2 Quality System

The overall quality system will need to be documented as it applies to ENC products. Documentation could take the form of three levels of concern: policy, procedures, and work instructions. The documented quality system needs to be appropriate, practical, up to date, correspond to what really happens and be effectively implemented.

At CHS, there is currently a considerable amount of documentation at the procedures and work instructions levels. This documentation, however, is probably best characterized as "grass roots". The challenge for CHS is to amalgamate the "grass roots" developments of procedures into a more formalized quality system.

6.3 Contract Review

Currently, the regions and HQ generally follow Government Services procedures for contracting out. In some cases, as well, regional offices have indicated that they do have procedures covering contract reviews on an individual contract basis concerning requirements, contractual obligations and capability to meet them. However, control of matters related to modifications of products, validation against requirements/specifications and verification of completeness are usually done on an ad hoc basis rather than following specific, prearranged contract review procedures.

6.4 Design Control

This particular feature of the ISO 9001 standard is relevant in cases when the control of design functions are needed. In the case of customized software applications by CHS, such as CARIS, it is necessary to have design control in order to obtain ISO 9001 compliance.

Organizational and technical interfaces that take place during the design phase of electronic charting technology development, hardware and software, need to be part of the quality system loop.

This requirement for design control, however, is relevant if the electronic charting product line is going to undergo significant changes and improvements over the next 1-3 years. To the extent, for example, that embedded software will be modified and the product revamped then ISO 9001 becomes more appropriate, to provide the right quality controls over product changes.

6.5 Document Control

In the area of document control, some regions have already begun to produce work instructions and procedural documents that conform to ISO 9001 requirements. The ISO 9001 quality manual should include procedures that CHS adopts to govern the approval and issuance of these documents and for their change and modification. The current CHS efforts at document control can be characterized, again, as "grass roots". In the interest of consistency across the board, for electronic charting production, these initiatives at document control should be coordinated to ensure that similar versions and similar specifications and requirements are being utilized in different sites involved in electronic charting activities.

For example, only up to date copies of procedural documents should be available on site and obsolete copies withdrawn. During the course of this study there was one instance discovered that one regional office and a supplier were working with two different versions of a specifications document.

6.6 Purchasing

It is important to ensure that purchased equipment, materials and services are to specified requirements. How these requirements are identified and included in contractual arrangements is based on a case by case basis at CHS. There is some flexibility and perhaps too high a degree of tolerance when incoming material does not conform to specified requirements. The ISO 9001 standard stipulates that incoming materials may not be used or processed until they have been inspected or verified as conforming to specified requirements. CHS specifications need to be clearly written so that the supplier knows exactly what is required. In the instances we examined in the course of this study, for ENC related contracts, this has been the general practice. Where the system seems to be more tolerant, however, is in enforcement, but this is largely due to products being accepted on the basis of good past performance by suppliers. ISO 9001 would require that evidence be available to substantiate this past performance levels of suppliers.

6.7 Purchaser Supplied Products

Conformance to elements of this particular part of ISO 9001 seems to be carried out by CHS on a case by case basis. Quality control procedures do take place to check whether a purchased product, e.g. digitized data, is received in complete form.

6.8 Product Identification and Traceability

The question of product identification and traceability is important for ENC, because when errors occur along the production line, it would be useful to be able to identify exactly where the errors occurred, so corrections can be made in a timely fashion. Most of the time, the electronic charting activities are being undertaken against stringent deadlines in contractual situations. If errors can be detected and traced back to their origin quickly this will streamline the process and result in cost savings for CHS. There are a number of quality control checks that currently take place within CHS and by suppliers (Exhibit 3-4). Report cards are issued and action required and taken, on an item by item basis, is duly recorded. Procedures for tracing errors to their source are in many cases dependent on the creativity of experienced individuals working on ENC functions, using both visual and non-visual techniques, but not all these procedures have been fully documented.

6.9 Process Control

While staff working on ENC products have in the past conformed to high quality standards, the ISO 9001 requirements stipulate that criteria and standards for workmanship need to be established to ensure uniform evaluation and to provide an objective basis for acceptance and rejection of interim and final products. Many of these criteria are already included in various documents provided by regional offices and suppliers. CHS would need to formalize these within the work instructions documents and develop suitable monitoring procedures.

6.10 Inspection and Testing

There are a number of opportunities for inspection and testing that could take place in the electronic charting assembly line. The interim and final ENC products received from suppliers, and passed on to regional offices, to headquarters and to the ECDIS manufacturer should be examined and validated against specified requirements (content, completeness, format, software version, etc.). No item should be used until it has passed the incoming inspection and test procedure for conformance to specifications.

Procedures for final inspection of the ECDIS system which is installed on ships should be documented and consistent for all installations. Variations in the installation requirements also need to be documented, based on specific or customized applications. This part of the electronic charting production line is the responsibility of the system manufacturers (namely, OSL).

Appropriate records of inspection and test results need to be kept to establish objective evidence that these have occurred.

6.11 Inspection, Measuring and Test Equipment

Written procedures for inspecting and testing essential machinery and equipment, used in the ENC production line, need to be available for compliance with ISO 9001. The basis (specifications/standards) used for testing equipment should be documented (e.g., calibration of digitizing tables). If specific hardware contains bugs that have not been identified, major errors could occur.

6.12 Inspection and Test Status

The quality system introduced should also have built into it procedures that ensure that at all times it is possible to know the status of interim products (data files, software, systems): i.e., whether they have been not inspected, inspected and accepted or not accepted, as appropriate.

6.13 Control of Non-conforming Products

The identification of items that do not conform to specifications is obviously important, to ensure that these items are not mixed up with conforming items -- e.g., "good" data files (edited) with "bad" data files (not edited). Presently this is done within the ENC/ECDIS production process, and regions and suppliers are developing their own identification procedures which try to ensure that no "mix-ups" occur.

6.14 Corrective Action

Records are kept on file of problem areas where rework was required, but this again is ad hoc and dependent on the initiative of individuals working on ENC processes, rather than on a formalized record keeping procedure regarding corrective actions. The format and content of these records are not uniform across regions, headquarters, and suppliers.

6.15 Handling, Storage, Packaging and Delivery

This area of the standard is particularly relevant to the final ECDIS product that is to be delivered to ships. Documented procedures need to be established and enforced for the handling, packaging and storage of the product(s) through the entire operation to the point of installation. This too is an element that would be relevant to NDI.

In addition, for interim ENC products, procedures for back-ups and electronic delivery of data files need to be documented.

6.16 Quality Records

In order to demonstrate achievement of quality in ENC production, effective operation of the quality system in place and performance of each player (contractors, regions, headquarters, NDI), records need to be kept in such a manner that these records are readily accessible and stored for a defined period secure from loss or damage.

6.17 Internal Quality Audits

ISO 9001 requires that the quality system in place be maintained. This means that, to ensure that the system is effective, an internal auditing procedure should be in operation. Currently, there is no such procedure in place for ENC.

6.18 Training

CHS's career review program is currently considered to be very effective in assessing training needs and in determining future professional and skills requirements for various CHS initiatives. Training needs are assessed as part of personnel evaluations. In addition, training priorities and plans are determined at the regional level and headquarters, and appropriate budgeting is accordingly allocated. ENC training requirements for utilization of necessary tools (e.g., CARIS) is ongoing on an as needed basis.

6.19 Servicing

A regular servicing plan for installed ECDIS systems should be part of the quality management system. Who does it, when, and how it is done should be documented. This applies particularly where servicing is specified as part of a purchasing contract. Procedures need to be established for carrying out and checking that servicing meets specified requirements. This matter is primarily the responsibility of the ECDIS system manufacturer.

6.20 Statistical Techniques

When documentation is developed for ENC production, as part of the compliance requirements for ISO 9001, any statistical techniques used for verifying the acceptability of any of the ENC process capabilities (e.g., techniques to measure complexity or length of time required to digitize charts) or product characteristics (e.g., content analysis) should be identified.

VII. OPTIONS AND RECOMMENDATION

The objective is to build a system within CHS which identifies what the ENC production activities are, how they are done and by whom, how each step of the process is checked and what is done when something is found to be wrong.

The options that were considered by the study team for implementing ISO 9000 standards at CHS were presented in Section V, and were summarized in a matrix format (Exhibit 5-1). These options were summarized as follows:

(1) the minimum approach;
(2) the maximum approach;
(3) the electronic charting application;
(4) the incremental approach;
(5) same as 3 or 4, but only CHS required to adopt a QMS standard (supplier compliance is voluntary).

Selecting one of these options depends on the intended scope of implementation. There are three dimensions to the scope: (i) institutional scope, (ii) functional scope, and (iii) choice of ISO 9000 model (i.e., 9001, 9002, or 9003). Permutations for scope are shown in Exhibit 7-1.

7.1 Institutional and Functional Options

These options were discussed in the course of the study with study participants. The project team, based on feedback obtained from participants, have concluded that the most appropriate and practical option is 3 ("the electronic charting application"). However, option 3 could also involve voluntary compliance by suppliers (i.e., option 5). Option 3 (or option 5) potentially provides the electronic charting business (ENC and ECDIS production) with all the benefits, discussed in Section IV, of introducing an ISO 9000 quality management system.

The incremental approach, option 4, was rejected because it was concluded that the electronic charting production activities, and the players involved, are intertwined and dependent on each others functional contributions,

Exhibit 7-1: Scope of ISO 9000 Implementation Options

(i) <u>Institutional scope of implementation of standard</u>:

Options:
-- HQ only
-- HQ + Regions
-- HQ + Regions + Suppliers
-- HQ + Regions + Suppliers + NDI
(Either require supplier registration or supplier registration is made voluntary).

(ii) Functional scope of implementation of standard:

Options:
-- Electronic charting production
-- Electronic charting production + other CHS activities

(iii) Level of implementation of standard:

Options:
-- no implementation
-- implement elements of ISO 9000 requirements without registration
-- implement ISO 9001 -- with registration
-- implement ISO 9002 -- with registration
-- phased approach -- ISO 9002 and then ISO 9001
-- implement ISO 9003

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including digitizing data, conversion, editing, file transformation, quality control, content analysis, database packaging, systems development and distribution of the electronic chart products. It is not really appropriate to apply ISO 9000 elements to any one, or combination, of these functions without considering it for the other functions at the same time. The phased (incremental) approach is feasible, but is not functionally suitable. Each of the activities performed by the different players is an important component contributing to the overall quality of the electronic chart products, and hence should be included in any quality management system introduced for electronic charting.

A wholesale approach as that identified in option 2 (the maximum approach) could impose too much rigidity and stringent requirements which are not practical within the current CHS environment, and given the evolving ENC and ECDIS technology. Option 3 (or 5), on the other hand, would delineate the electronic charting activities into a unique production line, shared between CHS and its suppliers, which is likely to retain for the conceivable future all the key functional stages of production -- from design and development to distribution to ships at sea. This production line is consistent with the requirements for applying an ISO 9000 model of quality management.[1]

7.2 ISO 9000 Model Selection

ISO 9001 is the quality management system model which is deemed most comprehensive in treating the issues discussed in Section V, and which is applicable to the total production process of electronic charting, from design and development to production and distribution. To achieve the full benefits of ISO 9000 practices, as outlined in Section IV, it will be appropriate to aim for registration of the system with an accredited Canadian Registration Organization (such as the Canadian General Standards Board or QMI, a division of the Canadian Standards Association).

The choice of ISO 9002 as an interim option is also a conceivable alternative for CHS. However, this would not provide the necessary requirements for a complete software development assurance system, and it would not provide the same comprehensive prevention package against errors and negligence,

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[1] Informal discussions with representatives from an accredited registration organization regarding the feasibility of introducing ISO 9000 conformance, within the electronic charting production process, also confirmed the study teams conclusions as indicated in this section.

nor would it provide as strong a defence against liability if things go wrong with ECDIS.

In addition, ISO 9002 excludes quality aspects of after-sales servicing. Including after-sales servicing in the ENC and ECDIS quality management package would be a competitive marketing advantage for this type of technology and should be considered as a benefit of ISO 9001 registration. Also, servicing is required to maintain the system and to keep it up to date, make changes as the technology evolves, introduce add-ons (e.g., new information or embedded software) if necessary and appropriate, and generally respond to the needs of mariners in terms of the day-to-day upkeep and running of the system.

It will, however, be more difficult to implement ISO 9001 because it includes design and development elements and is more stringent in some of the standard QMS elements which were outlined in Section VI.

ISO 9003 was deemed too limited in scope for the electronic charting business. The scope of ISO 9003 is focussed primarily on the final inspection and testing of products. It does not include the full complement of the work in process quality assurance coverage as provided in ISO 9001, which is required to achieve all the benefits discussed in Section IV of this report.

7.3 Recommended Option

Implement ISO 9001 for CHS electronic charting production, with a functional and institutional scope that covers electronic charting production processes across the board (i.e., covers HQ, Regional Offices, NDI, and suppliers). The electronic charting quality management system, once in place, should be registered with an accredited Canadian registration organization.

While it is preferable to require suppliers, especially software developers, to comply with ISO 9001, it would also be possible to control for quality, in supplier-CHS contractual situations involving electronic charting production, through the contract review and purchasing elements of a CHS ISO 9001 registration. Thus, the option of supplier registration could be made voluntary, if suppliers are not ready or able to commit to implementation within the same timeframe as CHS. However, for manufacturers (namely OSL) of the complete ECDIS product, as installed on ships, registration to ISO 9001 would clearly provide the necessary quality controls needed to achieve market advantages and defence against litigation, and provide for after-sales servicing requirements.

VIII. IMPLEMENTATION PROGRAM, LEVEL OF EFFORT AND COSTS

8.1 Implementation Program

For CHS to introduce the ISO 9001 quality management system approach, an implementation program and two-year budget will need to be approved by senior management. The elements of this implementation program are outlined in Exhibit 8-1.

Exhibit 8-1: Elements of an ISO 9000 Implementation Program at CHS

Canadian Hydrographic Service Implementation Program

Year One

1. Appoint an implementation team (headquarters, regions, suppliers, NDI)
2. Prepare a plan and schedule for implementation
3. Identify procedures and work instructions which need to be documented
4. Prepare quality documents
5. Training -- program staff
6. Select registration organization
7. Assessment of documentation against ISO 9001 requirements
8. Correct documentation
9. Pre-registration meeting with registrar
10. Implement procedures and conduct an internal audit
11. Corrective actions

Year Two

12. Apply for registration
13. Actual ISO 9001 audit
14. Corrective actions
15. Registration (certification)
16. Quality system maintenance plan

Industry Program (in parallel with the CHS Program)

1-6 Months

Inform the industry of CHS intentions and invite cooperation as partner with CHS

Investigate sources of financial assistance for industry
-- Industry Canada, Energy Mines and Resources, Provinces, regional industrial development programs (ACOA, Western Diversification, FORD-Q, etc.)

7th Month

Begin industry ISO 9000 implementation program.

8.2 Level of Effort Needed and Implementation Schedule

8.2.1 Appoint an implementation team (headquarters, regions, suppliers, NDI)

An implementation team needs to be appointed to coordinate and spearhead the ISO 9000 initiative. This team should have representatives from each region, headquarters, and NDI. Suppliers may also participate on an ad hoc basis -- depending on the extent of their willingness to participate in the initiative.

8.2.2 Prepare a plan and schedule for implementation

The first task of the implementation team would be to formalize an implementation plan and schedule, to be approved by CHS senior management. This implementation plan and schedule would be a more detailed version of that presented in this report, assigning responsibilities to specific individuals, and identifying expectations and operational matters.

Senior management should also approve the scope of implementation and the proposed budget.

8.2.3 Identify procedures and work instructions which need to be documented

The implementation team, in cooperation with the ENC workforce, would then need to identify exactly which procedures and work instructions need to be standardized and documented. This will involve discussions between HQ, regional staff and suppliers, to determine the critical procedures and tasks that impact on quality of the interim and final products of electronic charting.

8.2.4 Prepare documents

The preparation of the quality documentation should be done with utmost care and should cover the input of all groups and persons directly concerned with quality-related activities. The quality documentation should be based on the practices and systems existing within the electronic charting production line. Some of these practices may include traditional procedures and current informal unwritten habits.

In many cases the process of documenting the existing procedures may result in modifications after thorough discussions with personnel concerned and their supervisors. Before modifications are finalized, their practicability on a continuing basis must be ascertained.

The documentation exercise is not intended to lock CHS into specific procedures/work instructions regarding electronic charting. Initially, it would represent a "snapshot" of existing activities and procedures, but this "snapshot" should be considered as a starting point from which modifications and additions would continuously be made. For this reason, all documents which collectively make up the quality system, need to be controlled with sign-offs, dates, version numbers, etc., to ensure that procedures are uniform and specifications are applied consistently throughout the ENC assembly line.

A good start for the implementation team is to study the ISO 9000 "Guidelines for developing quality manuals" (ISO/DIS 10013). The implementation team should also closely involve, in the documentation process, all key personnel involved in the electronic charting activities .

This particular task towards implementing ISO 9000 at CHS will be the most time consuming and will be the greatest challenge for the implementation team and CHS as a whole.

Many quality control processes and specifications for verification and validation procedures are already well documented for electronic charting activities. Consistency in application and control over these existing documents needs to be established for ISO 9000 compliance. Examples of such documents which are currently in use are <u>Data Management Procedures Manual</u>, December 2, 1993, developed by Scotia-Fundy Region; the <u>Canadian Hydrographic Service Contractors Guide to Digital Data Formats for CHS/CARIS Version 4.2</u>, February 14, 1992, a document intended for contractors wishing to exchange digital cartographic data with CHS; and <u>Normes et procédures pour les superviseurs</u>, Quebec Region. Revamping of these documents, and others, to conform to ISO 9000 requirements would need to be carried out as part of the ISO 9000 initiative at CHS.

8.2.5 Training -- program staff

Some training has already been done across CHS. Several headquarters and regional staff have attended ISO 9000 courses and seminars. In addition, part of this study involved carrying out several ISO 9000 awareness sessions across CHS. Most electronic charting staff have attended these sessions.

The next stage of training should focus on the documentation preparation phase. Guidelines for developing the quality documentation need to be established by the implementation team, and these guidelines need to be the subject for in-house training for all personnel involved in the documentation exercise. An ISO 9000 expert could be hired to conduct on-site documentation workshops and to coach staff and review drafts during the documentation process

8.2.6 Select Registration Organization (RO)

This step needs to be taken at an early stage in the process to obtain the appropriate feedback from the RO, regarding conformance to ISO 9000 requirements.

The tasks involved for this milestone are:

- CHS requests information from several registration organizations, including: information on their auditing program, list of companies registered, costs, and checklists against which to pre-assess the quality system that will be put in place;

- CHS invites quotations from two or three registration organizations;

- discussion and agreement of the scope, service and cost with the registration organization.

Finally, CHS selects the proposal from the RO with the best value for money.

8.2.7 Assessment of documentation against ISO 9001 requirements

A final check of the quality documentation against the checklist of the selected RO is required by the implementation team and an ISO 9000 expert.

8.2.8 Correct documentation

Any discrepancies/nonconformities need to be corrected before the pre-registration meeting with the registrar.

8.2.9 Pre-registration meeting with registrar

At this point, CHS requests a pre-registration review of its quality management system by auditor(s) of the RO. CHS will need to determine whether one registration for the entire electronic charting production line is required, or separate registrations for each organization (HQ, regions, NDI, suppliers) is best. This is a matter to discuss with the RO at this phase of the implementation program.

8.2.10 Implement procedures and conduct an internal audit

Procedures that have been documented should be in place before an internal audit is carried out. CHS staff should be trained to carry out an informal internal audit, to make a final check on the system's operation, and to examine the objective evidence that documented procedures are indeed being followed as specified.

8.2.11 Corrective actions

Any corrective actions required in actual practices against the stated procedures need to be done before bringing in the RO for a formal ISO 9000 audit.

8.2.12 Apply for registration

At this stage, formal application to the selected RO is submitted by CHS. The RO evaluates the electronic charting documentation and recommends changes/additions as appropriate.

8.2.13 Actual ISO 9001 audit

Preparation for the audit would include the following:

- ensuring everyone to be involved in the process is aware of what is involved;
- reviewing all activities and groups, within the scope of the registration, prior to the audit;
- preparing a list of all projects currently under way, particularly those that fit within the scope of the registration; and
- ensuring that the requirements of the auditor (e.g., room, lunch) are met.

The audit itself would involve the following:

- an on-site start-up meeting with senior staff in ENC production;
- an escort for the auditor(s) to be provided throughout the assessment;
- an in-depth appraisal of the organizations procedures and overall management structure;
- examination of objective evidence for a representative sample of ENC activities/functions;
- final meeting where the auditor(s) present their recommendations for registration or the corrective actions needed.

The above would happen at each site (e.g., HQ, regions, NDI, suppliers) involved in the ISO 9000 registration.

8.2.14 Corrective actions

If, after the audit, major or several minor nonconformances are detected, an appropriate period for corrective actions will be allowed, after which the RO will revisit to establish whether the corrective actions have indeed been taken.

8.2.15 Registration (certification)

The final stage of the implementation program is the successful registration of the electronic charting production line with an accredited Registration Organization. This would entitle CHS to identify ENC/ECDIS production as compliant with ISO 9001.

8.2.16 Maintenance plan

Built into the implementation phase should be the development of a quality system maintenance plan. The implementation team, once registration is achieved, would need to ensure that this plan is acted upon. This would involve assigning a person(s) to be responsible for ensuring that ISO 9001 requirements and practices continue to be adhered to within ENC/ECDIS production. It would also mean that a post-registration internal auditing schedule be developed and carried out. The RO will likely do surveillance audits, once a year for three years subsequent to registration. Internal audits could be scheduled at 2-3 months prior to the RO surveillance audits, to allow for sufficient time for any needed corrective actions.

Failing the first audit is not the worst thing that could happen to an ISO 9000 aspiring organization (the failure rate generally in North America is over 50 percent). What is bad, however, is succeeding in the first audit and subsequently losing the ISO 9000 designation because of major non-compliances in follow-up audits. Putting a maintenance plan in place will help avoid such a result.

Exhibit 8-2 shows the estimated level of effort for each task in the implementation plan. These estimates are based on the assessment of current preparedness of CHS in terms of conformance to ISO 9001 requirements.

Exhibit 8-3 is a proposed schedule for implementation.

Exhibit 8-2: Estimated Level of Effort (Person Days) for Each Task in the Implementation Plan

	Task	Persons (number)	Person Days (each)	Total PDs
1.	Implementation team:			
	HQ	2	15	30
	regions	4	15	60
	NDI	1	15	15
2.	Prepare a plan and schedule for implementation	(included in Task 1)		
3.	Identify procedures and work instructions which need to be documented	(included in Task 1)		
4.	Prepare quality documents			
	HQ	several		20-25
	regions	several		60-80
	NDI	several		20-25
5.	Training -- ISO 9000 course			
	HQ	1	5	5
	regions	4	5	20
	NDI	1	5	5
	Training -- documentation/coaching			
	HQ	2	2	4
	regions	4	2	8
	NDI	1	2	2
6.	Select registration organization			
	HQ	2	0.5	1
	regions	4	0.5	2
	NDI	1	0.5	0.5
7.	Assessment of documentation against ISO 9001 requirements			
	HQ	2	2	4
	regions	4	2	8
	NDI	1	2	2
8.	Correct documentation			
	HQ	2	2	4
	regions	4	2	8
	NDI	1	2	2
9.	Pre-registration meeting with registrar			
	HQ	2	1	2
	regions	4	1	4
	NDI	1	1	1
10.	Internal audit			
	HQ	1	3	3
	regions	4	3	12
	NDI	1	3	3
11.	Corrective actions			
	HQ	2	5	10
	regions	4	5	20
	NDI	1	5	5

(continued)

Exhibit 8-2: (Continued)

	Task	Persons (number)	Person Days (each)	Total PDs
Year Two				
12.	Apply for registration	---	---	2
13.	ISO 9001 audit			
	HQ	2	3	6
	regions	4	3	12
	NDI	1	3	3
14.	Corrective actions			
	HQ	2	5	10
	regions	4	5	20
	NDI	1	5	5
15.	Registration (certification)	---		
16.	Develop quality system maintenance plan			
	HQ	2	2	4
	regions	4	2	8
	NDI	1	2	2
TOTAL ESTIMATED EFFORT (ROUNDED)				412 - 442 PDs

Exhibit 8-3: CHS Implementation Schedule for ISO 9001[1]

TASK	MONTH																			
<u>Year One</u>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Appoint implementation team	■																			
2. Prepare implementation plan and schedule	■																			
3. Identify procedures and work instructions to be documented		■																		
4. Prepare quality documents			■	■	■	■	■	■	■											
5. Training -- ISO 9000 course		■																		
Training -- documentation		■																		
6. Select registration organization				■																
7. Assessment of documentation against ISO 9001 requirements									■											
8. Correct documentation										■										
9. Pre-registration meeting with registrar					■															
10. Implement procedures & conduct an internal audit											■									
11. Corrective actions												■								
<u>Year Two</u>																				
12. Apply for registration													■							
13. Assessment of system by RO and ISO 9001 audit														■	■					
14. Corrective actions																■				
15. Registration (certification)																	■			
16. Develop quality system maintenance plan																		■		

[1]Note that the above estimates represent elapsed time and assume that individuals working on implementing ISO 9001 will, at the same time, be carrying out their normal day-to-day duties. Elapsed time, therefore, depends very much on the organizations priorities and the workload of staff.

8.3 Costs

The following cost figures do not include the salaries of CHS staff during the implementation phase (as calculated from the level of effort and person days indicated in section 8.2). The CHS internal activities/tasks required to bring about a quality management system into the electronic charting business is what CHS should consider as part of its regular mandate anyway. Thus factoring out salaries as an item in ISO 9000 implementation costs would be misleading.

8.3.1 Training Budget (Total $25,500 -- Year 1 of Implementation)

ISO 9000 Courses ($10,000)

As was mentioned earlier, several HQ and regional (Scotia-Fundy, Quebec) staff have already gone to ISO 9000 courses and seminars. A training budget to send additional staff from other regions, particularly implementation team members, to ISO 9000 courses is recommended. These courses range from approximately $1,000 to $2,500 in fees. A training budget of approximately $10,000 is required to send about five additional persons to ISO 9000 courses.

Documentation Training and Coaching ($15,500):

In addition, a training budget for quality documentation preparation is required. This could be contracted out for a one-day workshop in each region and HQ. Suppliers and NDI staff could attend the regional sessions.

At approximately $750 per diem for an ISO 9000 expert for 5 sessions across Canada (5 days), plus 5 days preparation and customization of quality documentation workshop materials for the electronic charting context, this would total approximately $7,500 fees, not including travel and accommodation expenses.

In addition, another approximately $8,000 for an ISO 9000 expert to provide documentation coaching assistance during the process, and to review draft quality manuals, would be required.

8.3.2 Registration Costs ($47,700 -- Year 2 of Implementation)

The following registration costs assume 2 auditors for 3 days per site (HQ, regions, and NDI) at $825 per diem per auditor. The costs also assume that each site is registered separately. These estimates are based on typical prices as listed by the current eight registration organizations in Canada. Actual costs are to be negotiated with RO's by the CHS ISO 9000 implementation team. Travel and accommodation expenses are not included in the estimates below.

Exhibit 8-4: Estimated Registration Costs

ITEM	COST
1. Application fee ($500 per site separately)	$ 3,000
2. Assessment of documentation	$ 6,000
3. Pre-registration fee for all sites	$ 6,000
4. Audits -- 6 sites	$ 29,700
5. License fee ($500 per site separately)	$ 3,000
TOTAL	$ 47,700

These costs do not include the price of any follow-up audit required to assess corrective actions, should the CHS fail to become registered after the first audit. These costs fall in year 2 of the implementation budget, and are subject to revision based on prices of registration organizations at that time.

8.3.3 ISO 9000 Implementation Budget (Total -- $73,200)

The estimated total implementation budget for introducing an ISO 9001 quality management system for electronic charting, based on the above estimates, is approximately $73,200 (including $25,500 for training plus $47,700 registration costs). This estimate does not include travel and accommodation costs of auditors and trainers.

These costs do not include the price of any follow-up audit required to assess corrective actions, should the CHS fail to become registered after the first audit.

These costs also do not include the annual surveillance follow-up audit costs, which could be an additional $2,500 to $4,000 (fees) per site each year. Thus a post-registration budget of between approximately $15,000 to $28,000 fees (for HQ, four regions and NDI) per year for surveillance is needed. Any travel and accommodation expenses are extra. These latter fees are subject to negotiation with the registration organization and could vary, in part, depending on how many changes have occurred in the organization (staff, new procedures, documentation, etc.) in the interim, which could affect the quality management system.

8

Nordicity Group Ltd.
Le Groupe Nordicité ltée

THE LINK BETWEEN THE CANADIAN TECHNOLOGY NETWORK (CTN) AND A FIRM LEVEL STANDARDS IMPACT TEST (SIT)

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TABLE OF CONTENTS

1.0 INTRODUCTION

Small and medium-sized enterprises (SMEs) are usually in a responsive mode vis-à-vis standards, with all the volatility that that entails. SMEs have asked for better intelligence regarding standards which led to the following recommendation:

> "Mechanisms to acquire, evaluate and disseminate sectoral and firm level standards intelligence be identified and established in collaboration with various government departments and agencies."[1]

The proposed Canadian Technology Network (CTN) is to provide a standards intelligence service. This service would provide the basic information that firms have requested. However, this information could also be used to illustrate how standards would impact on the performance of firms. Such a Standards Impact Test (SIT) could be a value-added service provided through the CTN. The clients for this service would be firms and government agencies interested in evaluating the impact of standards on industrial performance.

Industry Canada has developed, in cooperation with the Canadian Manufacturers Association and Treasury Board, a Business Impact Test (BIT) which shows how regulations impact on the performance of firms. A similar approach could be used to develop a SIT.

The purpose of this study is to show, **conceptually** how a standards impact test (SIT) could be structured and how it would be delivered to firms, especially small and medium-sized enterprises (SMEs) through the proposed Canadian Technology Network (CTN).

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1 NGL Nordicity Group Ltd.; The Effects of Standards on Technology Diffusion (Synthesis Report); Prepared for a Consortium of Federal departments/agencies; September 1993.

2.0 DEVELOPING A STANDARDS IMPACT TEST (SIT)

2.1 The Business Impact Test (BIT)

The Business Impact Test (BIT) is an interactive, software-based consultative tool, designed to help understand and assess how government regulations will impact on specific firms (a hard copy can be found in Appendix A). It allows firms to provide input early in the process of developing regulations as well as to provide information on regulations already in place. BIT is designed to show, in detail, the **costs/benefits of regulations** at the level of the firm.

The business impact test is based on a model of how regulations impact on business, that was developed and refined with extensive input from business. The model focuses on how businesses innovate and compete successfully in the marketplace. This model forms the foundation for the design of the software and helps improve both the quality and breadth of information that can be collected in the test.

The model links competitiveness to a wide range of factors, both measurable and "intangible".

- The first set of factors deals with direct costs and benefits to the firm -- such as the cost of labour, energy, etc.

- The second set describes the impacts of regulation on the general business environment in which a firm operates. Such factors as marketplace conditions faced by a firm and impacts on market opportunities are included. These factors, while outside the control of the firm, often set the climate and boundaries for its business.

- The third set describes impacts that are much harder to quantify. These factors affect the way a firm organizes, operates, innovates and responds to challenge. They include the flexibility and responsiveness of a firm to change and the inclination of the firm to move forward.

With minor modifications, BIT could be used to illustrate the costs/benefits of standards to the firm (i.e. basically change the word "regulations" to the word "standards" along with appropriate changes reflecting the differences in setting regulations and standards. The elements relating to internal costs or benefits to the firm would remain largely unchanged.)

2.2 Towards a Standards Impact Test (SIT)

In contrast with government regulations, which are by and large imposed, technical standards are set by voluntary consensus through standards development organizations or by the forces of the marketplace. With globalization of economic activity and deregulation, voluntary or consensus standards, especially international standards, are gaining more prominence. In fact, BIT and SIT could work hand-in-hand as alternatives to regulations, such as consensus standards, i.e. a high negative impact regulation, identified through BIT, could lead to exploring the impact of a standard as an alternative through SIT.

By definition, a consensus standard takes time to develop. Each stage of development provides intelligence that could be of value to firms. A new item proposed for consideration provides an "early warning" to a firm of possible impacts on its product line, while an approved standard sets the framework for product development. This means that SIT would have to be designed to incorporate intelligence on standards in development as well as approved standards. In turn this means that the standards intelligence service to be delivered by the CTN would have to provide standards intelligence on the full range of standardization activities (see Section 3.1).

Following the logic flow of BIT (see the introductory section of Appendix A), the initial standards information to be included in SIT would have to be the following:

- What is the problem being addressed?
- What is the standard proposed? (Is it a new proposal, work in progress or an approved standard?)
- Which is the lead agency developing the standard (e.g. Canadian Standards Association, International Organization for Standardization, etc.)?
- What are the anticipated effects and benefits of this standard on the firm and industry?

As can be seen from the example in Appendix B, the above questions can be readily answered. This new work item proposal to a Working Group of the International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) Joint Committee on Information Technology (JTCI) lays out clearly the scope, the purpose and the benefits of proceeding with the development of a standard in this area.

From this initial information, SIT would have to be designed to show the impact of a proposed or approved standard on a firm's product line and hence how its position in the marketplace would be affected. The type of questions that would be asked in SIT would include:

- Would this standard directly affect demand for your products or services;
    - in Canada?
    - abroad?

- Would this standard affect the ability of your firm to:
    - introduce new/improved products or services?
    - adopt new/improved technologies or business practices?

- Would this standard place your firm in a <u>more</u> or <u>less</u> advantageous position in relation to your competition:
    - in Canada?
    - abroad?

Such questions would lead to other questions such as:

- How could the standard be modified to meet your product development requirements?

- If the standard cannot be modified, how would you adapt to the situation?

The full development of the SIT, based on questions such as those above, would have to be done in consultation with industry.

The major benefits of using SIT would be to:

- raise **awareness** by giving a firm an indication how its market/technology position would be affected by a proposed or approved standard;

- **encourage** the firm to participate in the development of the standard affecting it (if the standard has not yet been approved); and to

- give the Canadian standards community including government, a **structured basis by which to evaluate** the impacts of proposed standards on Canadian industry. This would make it easier to arrive at a clear position to guide Canadian representatives at international standards development activities, for example.

In this way, SIT would be an **awareness raising** and **advocacy** tool which would complement BIT which is an **efficacy** tool. SIT and BIT (as adopted to standards) would then be complementary tools. A firm would initially undertake a SIT to determine how it would be affected in the **external** market/technology environment. Once the firm has "bought-into" the process, it could take the BIT to help determine the **internal** costs/benefits to the firm of the standard under review.

3.0 LINKING SIT TO CTN

3.1 Standards Intelligence Service

Industry Canada is in the process of designing the Canadian Technology Network (CTN) announced by the Government[2] and referred to in the Budget of February 22nd, 1994.

The CTN concept was described in a Discussion Paper for a series of workshops held in January 1994.[3]

As shown in Exhibit 3-1, the proposed CTN is to be made up of a number of electronically connected nodes in municipalities across the country which will interact directly with firms in that community. These nodes are to be located in organizations that are competent with technology or the business aspects of technology, such as IRAP, provincial research organizations, technology centres, economic development offices, business information centres, colleges, universities, government laboratories, trade associations and so on. Collectively, the nodes form a national network.

The nodes are to be staffed by business/technology advisers who will provide a personalized service to clients. These advisers have access to common information resources such as those listed in Exhibit 3-1.

As noted, standards information is one of the information resources. This means that the Standards Council of Canada (SCC), the Canadian Standards Association and other standards development organizations will have to be involved in the development of this resource.

In fact, a proposal for the development of a National Standards Network has been made to the SCC, by representatives of the Canadian standards community (see Exhibit 3-2). This proposal has triggered the SCC review Committee to recommend "the establishment by Council of a team responsible for the development of an electronic standards information network strategy which shall include all stakeholders".[4] Industry Canada has recently, on behalf of the Telecommunications Standards Advisory Council of Canada (TSACC), contracted with the SCC the undertaking of a field trial designed to provide

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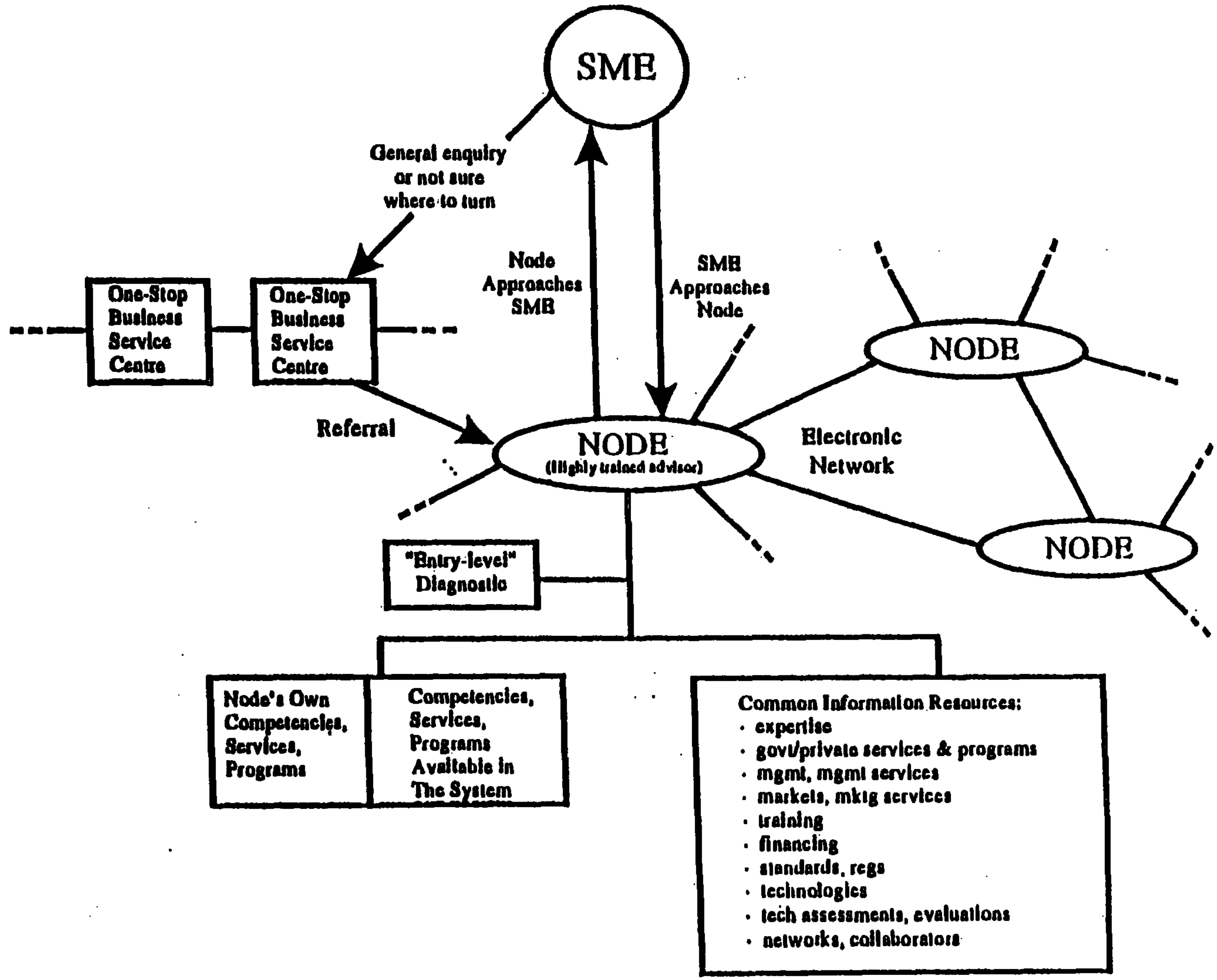
[2] Creating Opportunity; A Liberal Plan for Canada; 1993, p. 51.

[3] Discussion Paper; Establishing a Canadian Technology Network, January 1994.

[4] Standards Council of Canada; Advisory Committee on Standards; Decision of Meeting held November 4, 1993.

Exhibit 3-1
Canadian Technology Network



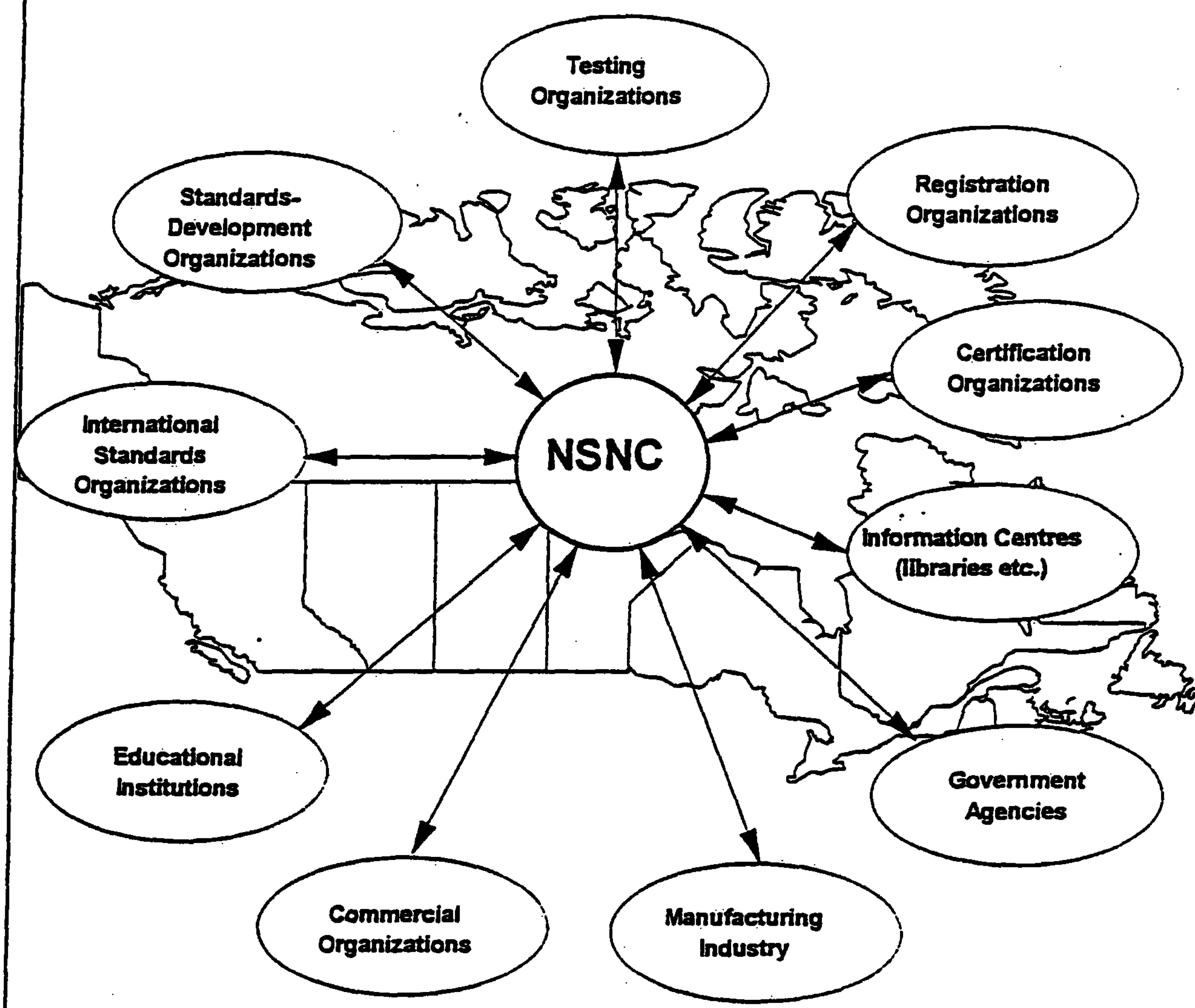
Source: Discussion Paper; Establishing a Canadian Technology Network; January, 1994

Exhibit 3-2
Proposal for the National Standards Network Canada

Proposal for the

National Standards Network Canada

(NSNC)



timely telecommunications information to industry. The findings of this field trial will be valuable in shaping the CTN standards information resource. There should, therefore, be a link between the designers of the CTN and the SCC regarding the standards information resource.

Because SMEs do not have the resources to keep abreast of Canadian and international standards development, the onus will be on the business/technology advisers to make firms aware of the implications of standards and to take the SIT.

3.2 Delivery of the SIT Service

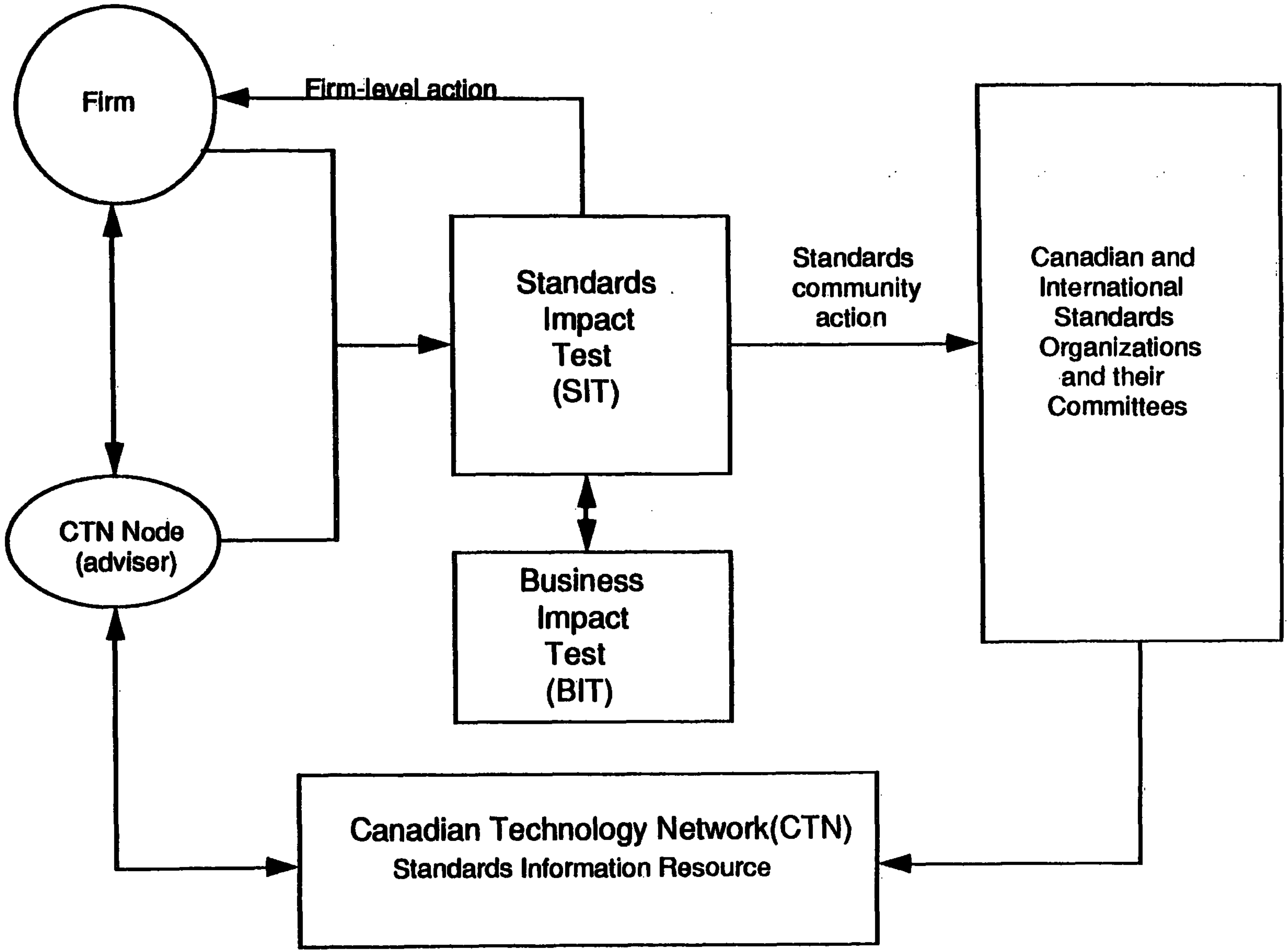
As shown in Exhibit 3-1, the SIT service would be delivered from the local nodes across the country. Some of these proposed nodes, such as some of the provincial research organizations, already provide a basic standards information service.

The delivery process would then be as shown in Exhibit 3-3. Because SMEs are often not aware of the implications of standards for their firms, the adviser within a node would have to continually scan the CTN standards information resource service for up-coming standards that could impact on his/her clients. It is assumed that the adviser knows his/her clients very well within the local community. Once a standard is spotted, the adviser would alert the firm and suggest that it proceed with the SIT (with the advisor's assistance). The firm could also approach the adviser with an inquiry about the standards implication of its current product development activities.

The adviser and a representative of the firm would complete the SIT and analyze the possible impacts. The firm then takes appropriate action (e.g. adjust product design). The adviser informs the appropriate standards development organization of the implications of the standard for the firm involved, and possibly for that industrial sector. In the latter situation the adviser would inform the appropriate Sector Branch of Industry Canada. The representative of the firm may wish to participate in the relevant standards development committee. As well, the firm may wish to take the BIT which would be administered by a node adviser.

The standards development organizations would be tasked to provide the relevant standards information (e.g. new work items, emerging standards, meeting reports, names of participants, draft and approved standards) to the CTN standards information resource service. This information has to be continually up-dated. For example, an important source of information is the 14,000 Canadians who participate in various standardization activities. Up-to-date information on these people and what committees they participate in is very important, if the adviser and/or the firm are to be able to consult the appropriate people regarding the status of a particular standard or standardization activity in preparing a SIT.

Exhibit 3-3; Linking the SIT to the CTN



4.0 CONCLUSION AND RECOMMENDATIONS

Conceptually it is possible to envision a **value-added service** (i.e. SIT and BIT) linked to the provision of standards intelligence through the CTN.

It is recommended that:

- the designers of the CTN involve the Canadian standards development organizations in shaping the proposed standards information resource;
- a SIT be developed through consultations with industry; and,
- the BIT be modified to deal with standards.

By moving in this way, both firms and government will gain a much better appreciation of the impact of standards development on industrial competitiveness.

Appendix A

The Business Impact Test
(The BIT)

Regulations and their Impact on Business

Today, governments are searching for ways to avoid the unintended and unnecessary economic burdens imposed by regulations of the past. Consequently, governments worldwide are seeking new ways to regulate, and alternatives to regulation, that interfere less with the way businesses operate.

Business people have a pivotal role to play in the pursuit of better approaches. Only they have the practical experience and knowledge of the consequences of poorly designed regulations. The detrimental effects of poorly designed regulations are often quite unintentional. Government analysts working in isolation cannot possibly be expected to take them all into account. Thus the importance of obtaining greater involvement of the private sector in the search for better approaches to regulation can not be emphasized enough.

What is the Business Impact Test?

- It is an interactive, software-based tool for consultation designed to help governments understand and assess how regulations will impact on the private sector by obtaining the observations of business.

- It identifies direct costs to firms from regulations as well as how regulations impact on the way frims operate, organize and innovate.

- It will assist in developing a deeper understanding of how proposed regulatory actions will impact on business.

- It allows business to provide input early in the process of developing regulations (or alternative ways of achieving public interest objectives).

This test focuses attention at the firm level, and it can be used in a number of different ways in the search for less disruptive and more efficient approaches to regulation:

- As a consultative and analytical tool, it will serve as a preliminary screen to identify potential impacts that require more detailed analysis.

- By providing a consistent, structured way to take into account the concerns of businesses, the test should increase the efficiency and effectiveness of consultations with industry. Its use should clarify areas of agreement and disagreement, and it will ensure that, to the greatest extent possible, government and industry are speaking the same language.

- The test will assist regulators in identifying less burdensome alternatives that are equally effective in satisfying the government's objectives.

What it is not!

The business impact test is not intended to replace benefit/cost analysis. It is a tool to simplify one component of the analysis -- the impact of regulations on the competitiveness of businesses. Analysis and protection of the "public interest" should in no way be compromised. Indeed, where there appear to be conflicts between "competitiveness" and "public interest" considerations, this test will serve to highlight the relevant issues and help to identify ways of meeting the public objectives without creating unnecessary impacts on businesses.

The software system will complement, not take the place of current consultation mechanisms nor dictate how one should consult with stakeholders. It can be useful in focusing and, in some cases, simplifying consultation efforts.

Why use it?

- Benefits to government

  The test can be a powerful tool. It can provide a wealth of information on the impacts of proposed regulations on the competitiveness of businesses (information which has been difficult to obtain through traditional consultation). Also, it can save resources by narrowing the requirements for in-depth analysis to those areas that have significant impacts from the perspective of business.

- Benefits to firms

  The test will give businesses a more effective and influential way of participating in the design of regulations. The business impact test will bring businesses "into the loop" of regulatory design at an early stage.

- Benefits to the public

  The competitiveness of businesses has important implications for the "public interest". Regulations can introduce inefficiencies into the economy. The intent of this test is to identify how regulation can be done in the least burdensome way.

Foundation of the Test

The business impact test is based on a model of how regulations impact on business that was developed and refined with extensive input from business. The model focuses on how businesses innovate and compete successfully in the market place. This model forms the foundation for the design of the software and helps improve both the quality and breadth of information that can be collected in the test.

The model links competitiveness to a wide range of factors, both measurable and "intangible."

- The first set of factors deals with direct costs and benefits to the firm -- such as the cost of labour, energy, etc.

- The second set describes the impacts of regulation on the general business environment in which a firm operates. Such factors as marketplace conditions faced by a firm and impacts on market opportunities are included. These factors, while outside the control of the firm, often set the climate and boundaries for its business.

- The third set describes impacts that are much harder to quantify. These factors affect the way a firm organizes, operates, innovates and responds to challenge. They include the flexibility and responsiveness of a firm to change and the inclination of the firm to move forward.

Ultimately the test captures the priorities of business that were expressed in the extensive consultations that were used to refine and validate the model.

How was it Developed?

Business has played a prominent role in setting priorities for what is included in the test and in the actual test design. The Canadian Manufacturers' Association, along with Industry and Science Canada and Treasury Board of Canada Secretariat worked with a full spectrum of the community and their associations in developing and validating the test. Five focus groups provided multi-sectoral input of the business community. Approximately 50 senior executives from industry participated in these meetings. As well, federal departments with major regulatory responsibilities were consulted to define the analytical requirements for regulatory bodies.

How do I get it?

The Business Impact Test will be available from:

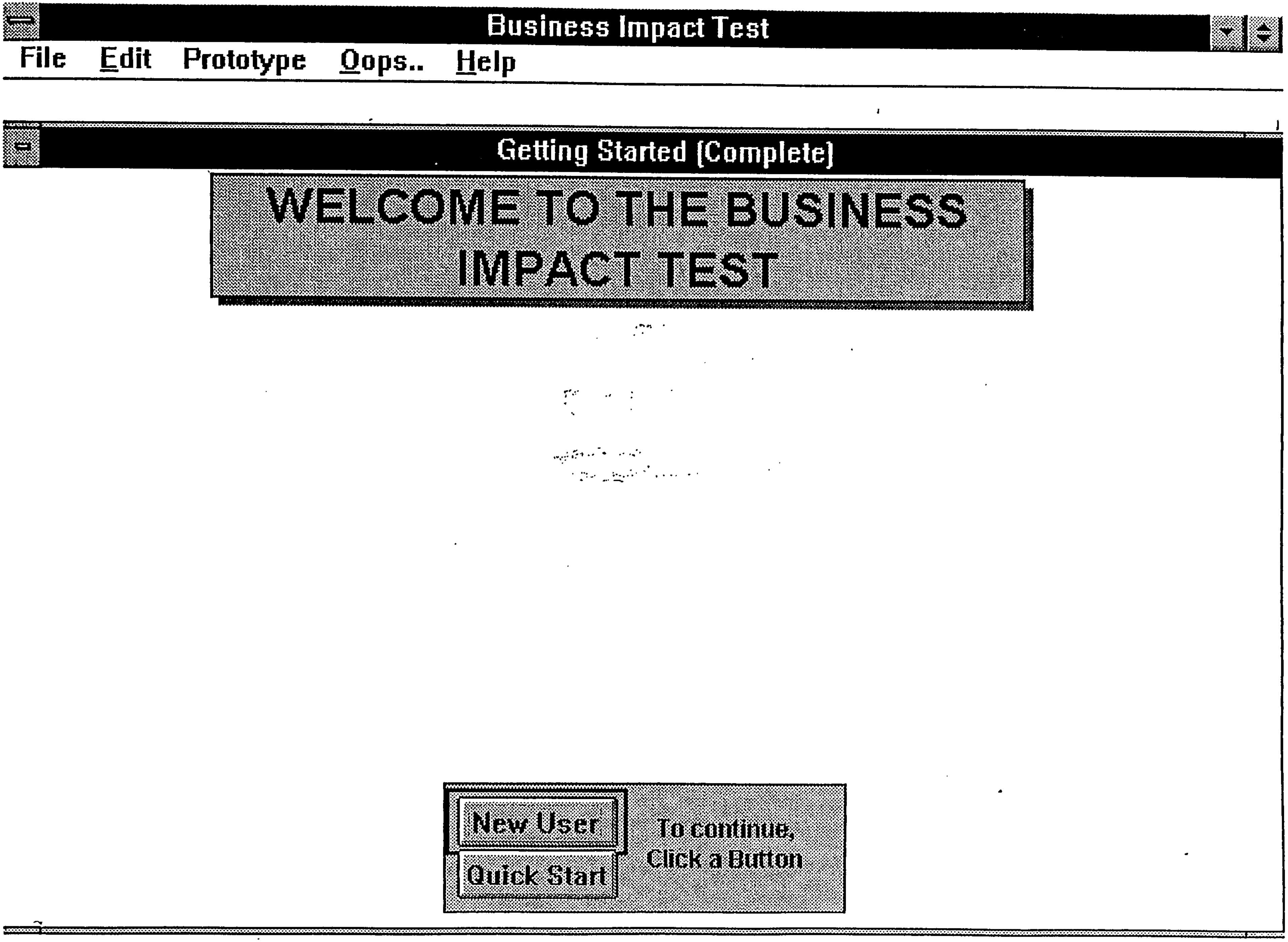
CMA Quality Software
75 International Blvd.
4th Floor
Etobicoke, Ontario.
M9W 9Z9
Tel: (416) 798-8000 (ext 241)
Fax: (416) 798-8050

Contacts

Doug Blair
Policy Coordinator
Regulatory Affairs
Treasury Board of Canada Secretariat
Phone: (613) 952-3463

Russell Roberts
Special Advisor
Science and Technology Policy
Industry Canada
Phone: (613) 941-0610

Jayson Myers
Chief Economist
Canadian Manufacturers' Association
Phone: (416) 798-8000, ext. 237


Business Impact Test
File Edit Prototype Oops.. Help
Getting Started (Complete)
WELCOME TO THE BUSINESS IMPACT TEST
New User
Quick Start
To continue, Click a Button

Business Impact Test

File Edit Prototype Oops.. Help

Getting Started (Complete)

Large or small, be heard using the BIT!

To preserve and enhance the productivity and profitability of business, governments must be committed to avoiding unneeded regulations and improving needed ones.

As a business person, you're in the ideal position to recognize the potential impact of regulation on a firm.

This test is your opportunity to find out if a proposed regulation will hinder your business and to influence governments' regulation-making process.

Where to Get Help

The Business Impact Test Workbook provides you with a step by step explanation of how to use this software. Please read through the Workbook carefully, especially if you are a first time user. You can get assistance by using the HELP function that appears on each screen throughout the software system.

IMPORTANT!!

The organization administering this test is responsible for ensuring that the information you provide then in this test is treated in commercial confidence and not divulged under any circumstances to a third party, unless express written consent has been provided by your company.

Business Impact Test

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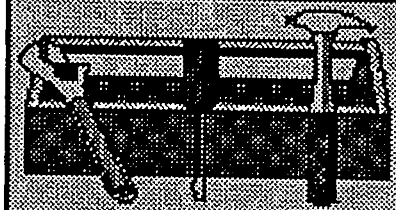
Getting Started (Complete)



Before you get started...

Here are some tools to help you complete the test quickly. Try them out!

Help

By clicking on the HELP button below you will enter a Windows based help system. This Help system will allow you to obtain information about each screen in the software and/or definitions and explanation of the terms used on each screen in the system.

Glossary

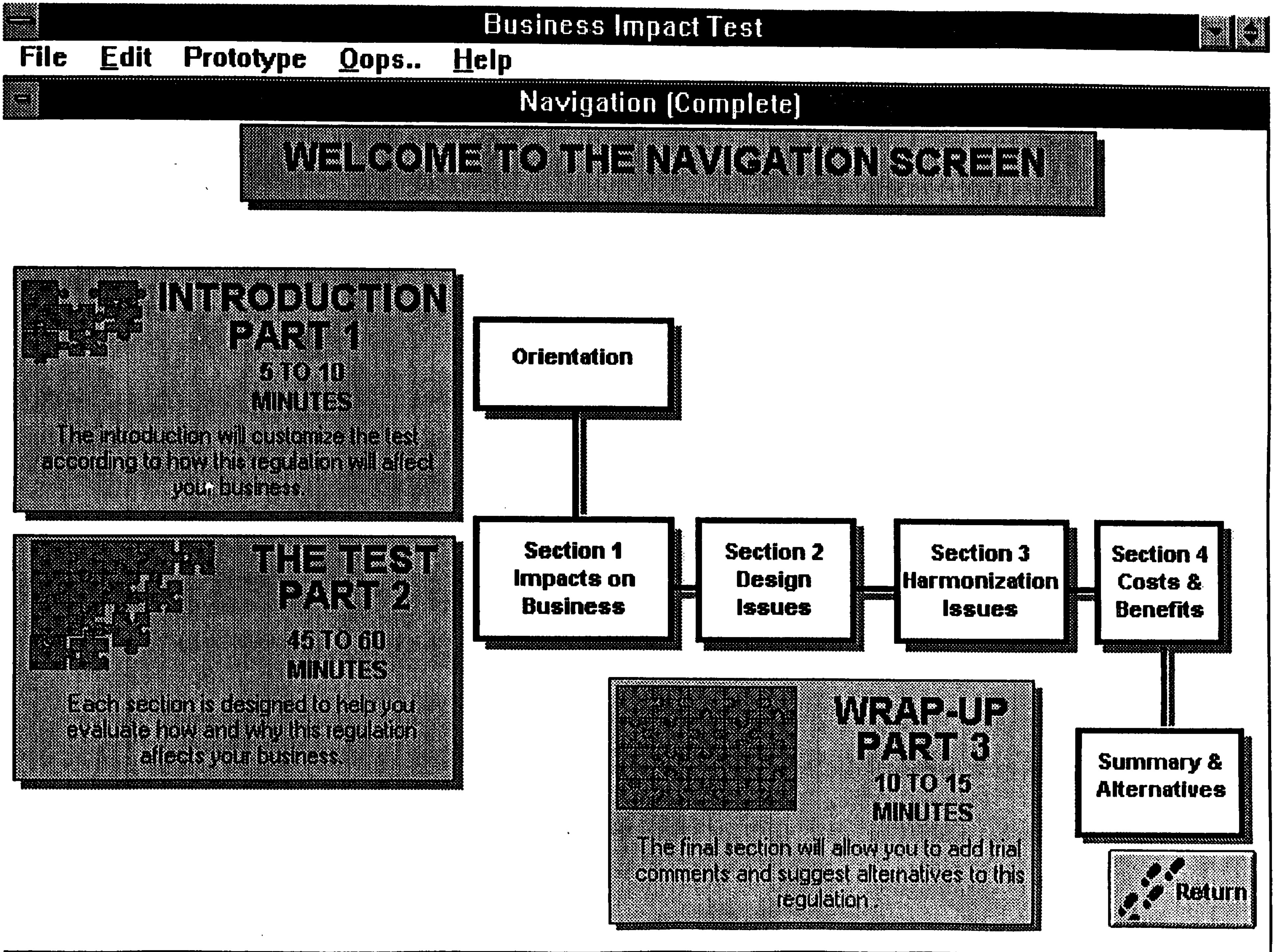
Throughout the test you will find certain words, phrases or sentences highlighted. It is important to be familiar with these terms as you complete the test -- please look them up in the Definitions section of HELP.

Navigation

This button invokes the ROAD MAP screen which follows this screen. You can use it to orient yourself within the Survey.

Help

Navigation Screen



Business Impact Test
File Edit Prototype Oops.. Help
Navigation (Complete)
WELCOME TO THE NAVIGATION SCREEN
INTRODUCTION PART 1
5 TO 10 MINUTES
The introduction will customize the test according to how this regulation will affect your business.
THE TEST PART 2
45 TO 60 MINUTES
Each section is designed to help you evaluate how and why this regulation affects your business.
Orientation
Section 1 Impacts on Business
Section 2 Design Issues
Section 3 Harmonization Issues
Section 4 Costs & Benefits
WRAP-UP PART 3
10 TO 15 MINUTES
The final section will allow you to add trial comments and suggest alternatives to this regulation.
Summary & Alternatives
Return

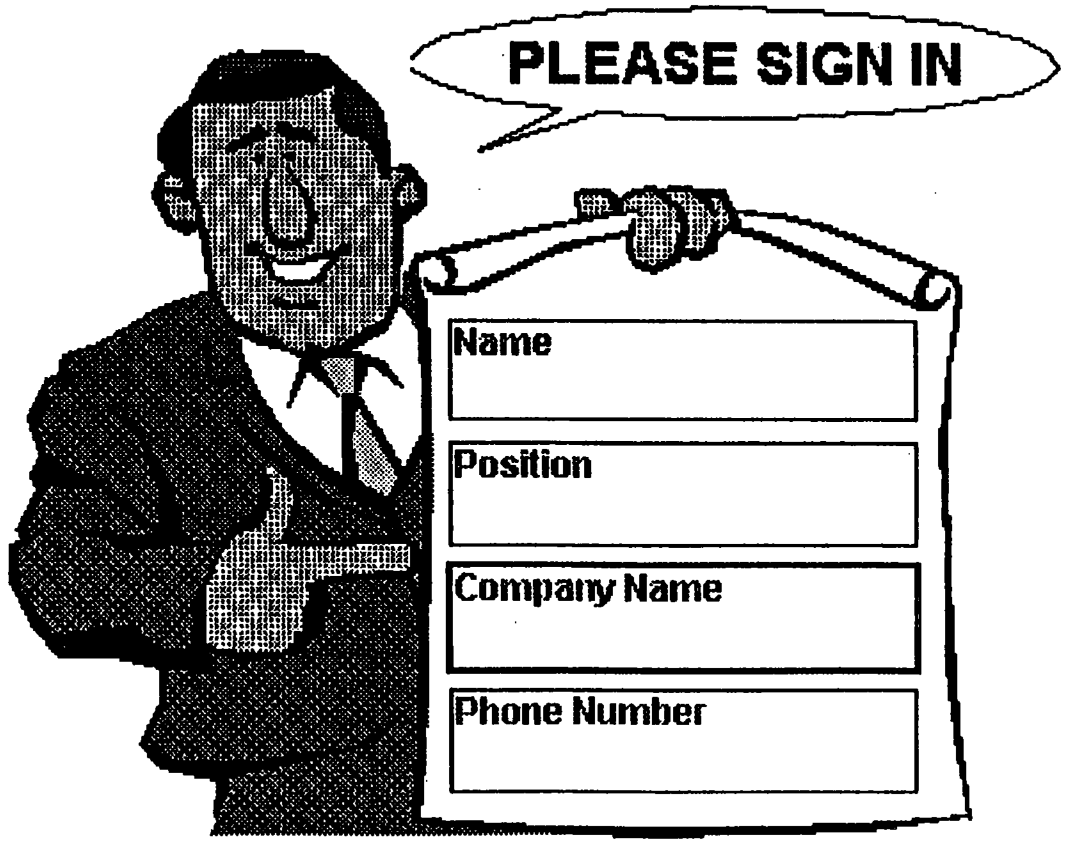
Business Impact Test

File Edit Prototype Oops.. Help

Getting Started (Goal)

YOU ARE ABOUT TO START THE TEST

ANYTHING YOU INPUT IN EACH SCREEN WILL BE SAVED, SO DON'T WORRY ABOUT LOSING YOUR WORK!



Help

If you want more than one person in your company to complete the test, click the HELP button to find out how.

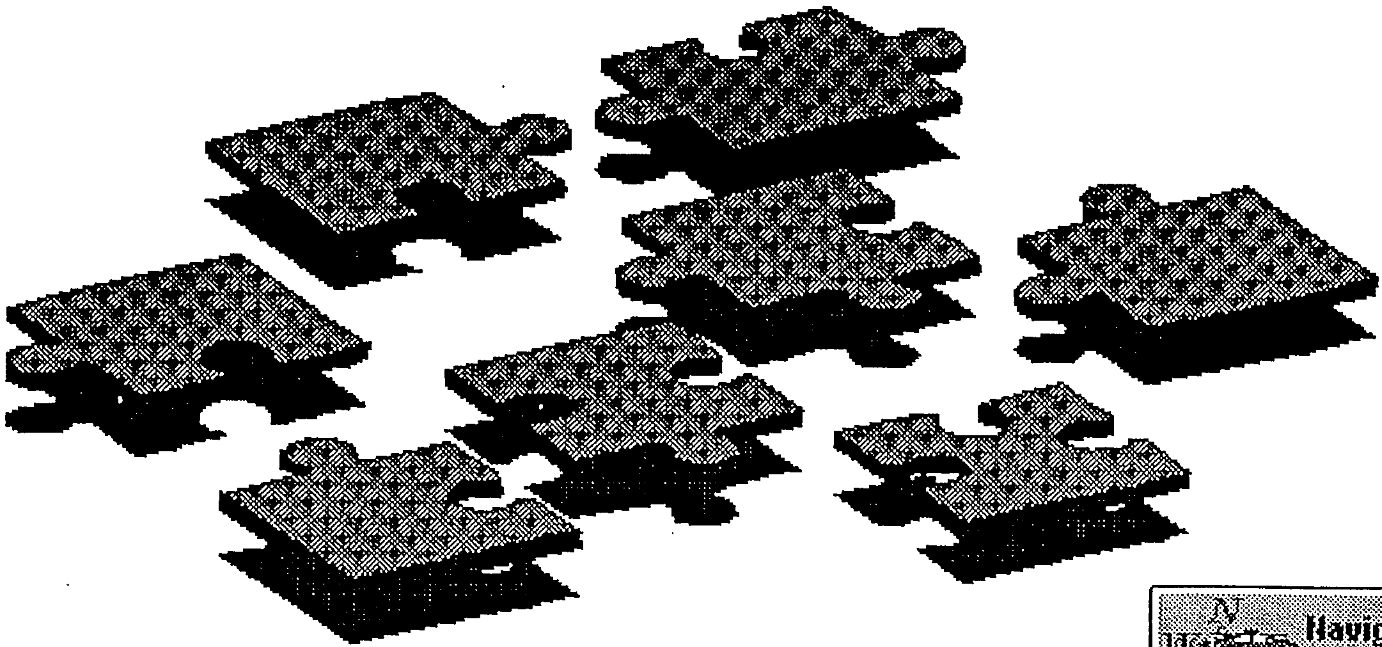
Navigation Screen

Business Impact Test

File Edit Prototype Oops.. Help

Getting Started (Complete)

THIS ELECTRONIC FORMAT PROVIDES A BRIEF SUMMARY OF THE KEY ELEMENTS OF THE REGULATORY INITIATIVE UNDER DISCUSSION. HOWEVER, BECAUSE THESE REGULATORY CHANGES COULD SIGNIFICANTLY AFFECT THE OPERATION AND / OR PROFITABILITY OF YOUR BUSINESS, IT IS STRONGLY RECOMMENDED THAT YOU READ THE HARD COPY OF THE PROPOSED REGULATION ENCLOSED WITH THE TEST REGULATION NOW.



Navigation Screen

Business Impact Test

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Getting Started (Goal)

THE FOLLOWING DESCRIBES WHAT GOVERNMENT IS PROPOSING:

Title	
Department	
Contact	
What problem is being addressed?	
Why is government considering this action?	
Objectives(s) (What is government trying to achieve?)	

Help

Business Impact Test

File Edit Prototype Oops.. Help

Getting Started (Goal)

THE FOLLOWING SUMMARIZES THE GOVERNMENT'S ANALYSIS OF WHAT YOU WILL BE REQUIRED TO DO:

Compliance Standard(s) for you to meet.	
Approval/Documentation/ Reporting & Monitoring Requirements placed on you.	
Enforcement Procedures government will follow.	
Anticipated Impacts of this Action on Business.	

Business Impact Test

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Getting Started (Goal)

BASED ON YOUR READING OF THE PROPOSED REGULATION:

		If No, Please Explain:
Has the problem been described accurately?	☐ Yes ☐ No	
Should government take action to rectify the problem?	☐ Yes ☐ No	
Has government adequately described the requirements that will be imposed on your firm?	☐ Yes ☐ No	

You can refer to the REGULATION SUMMARY information at any time. Click on this button to Remind Yourself of the Regulation.

Help | Regulation Summary | Navigation Screen

Business Impact Test

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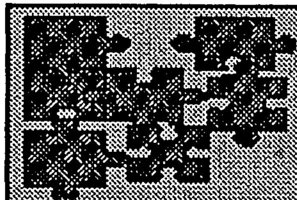
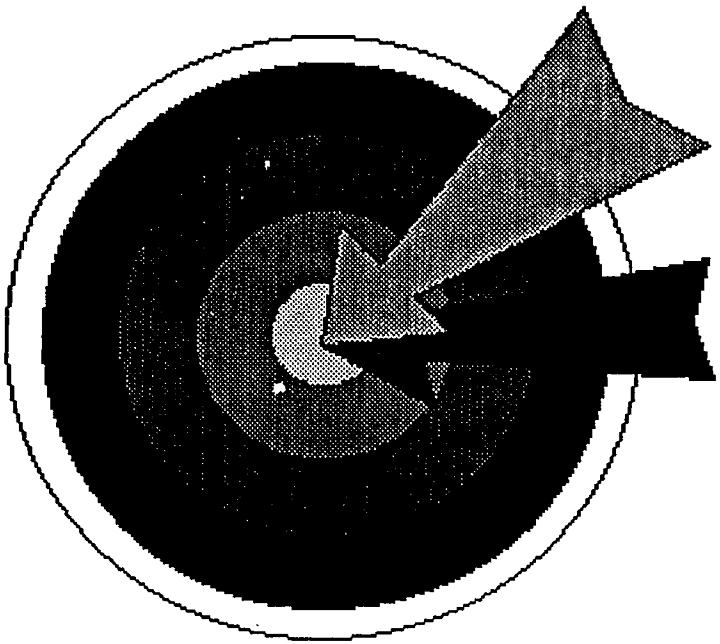
Introduction (Complete)



WELCOME TO PART 1 OF THE TEST

YOUR ANSWERS IN THIS PART WILL FOCUS THE TEST ON SPECIFIC IMPACTS ON YOUR BUSINESS.



The test is designed to obtain detailed comments on where you anticipate specific impacts to occur in your company and why.

The questions on the following screens will help you focus the test, on the areas of greatest concern to your company.

Answering "No" to any question will omit further questions related to that type of impact.

Navigation Screen

Business Impact Test

File Edit Prototype Oops.. Help

Introduction (Complete)

PLEASE ANSWER THE FOLLOWING QUESTIONS TO SELECT ISSUES FOR FURTHER ANALYSIS.

Is this regulation likely to have a significant IMPACT on YOUR BUSINESS?			
	☐ Yes	☐ No	☒ Don't Know
Would this regulation directly affect:			
- demand for your products or services?	☐ Yes	☐ No	☒ Don't Know
- labour, goods or services used by your firm?	☐ Yes	☐ No	☒ Don't Know
- general business conditions affecting your firm?	☐ Yes	☐ No	☒ Don't Know
Would you have to make operational changes if this regulation were implemented?			
	☐ Yes	☐ No	☒ Don't Know
Would this regulation affect the ability of your firm to:			
- introduce new/improved products or services?	☐ Yes	☐ No	☒ Don't Know
- adopt new/improved technologies or business practices?	☐ Yes	☐ No	☒ Don't Know
Would this regulation result in costs or benefits to your firm?			
	☐ Yes	☐ No	☒ Don't Know

Help | Regulation Summary | Navigation Screen

Business Impact Test

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Introduction (Complete)

IDENTIFY THE ACTIVITIES OR COST CENTRES IN YOUR COMPANY THAT THE REGULATION WOULD AFFECT.

ACTIVITY	ANTICIPATED IMPACTS	EXAMPLES
General Administration	None / Pos / Neg / Prohibitive	* Strategic Management / Shareholder Relations * Information Systems * Regulatory & Legal Affairs * Contracting / Leasing
Budgeting / Control	None	* Accounting / Auditing * Payments * Cash Flow Management / Budgeting * Inventory Management
Financing / Investment / Taxation	Pos	* Banking / Financing * Investment * Acquisition / Divestment of Assets * Taxation
Human Resources Management	None	* Wages / Benefits / Pensions * Recruitment / Training & Skills Development * Personnel Management / Labour Relations * Employment / Labour Conditions
Delivery / Distribution / Sales	None	* Product / Service Delivery * Product / Service Distribution * Sales * Pricing

Help | Regulation Summary | Define Scale | Navigation Screen

Business Impact Test

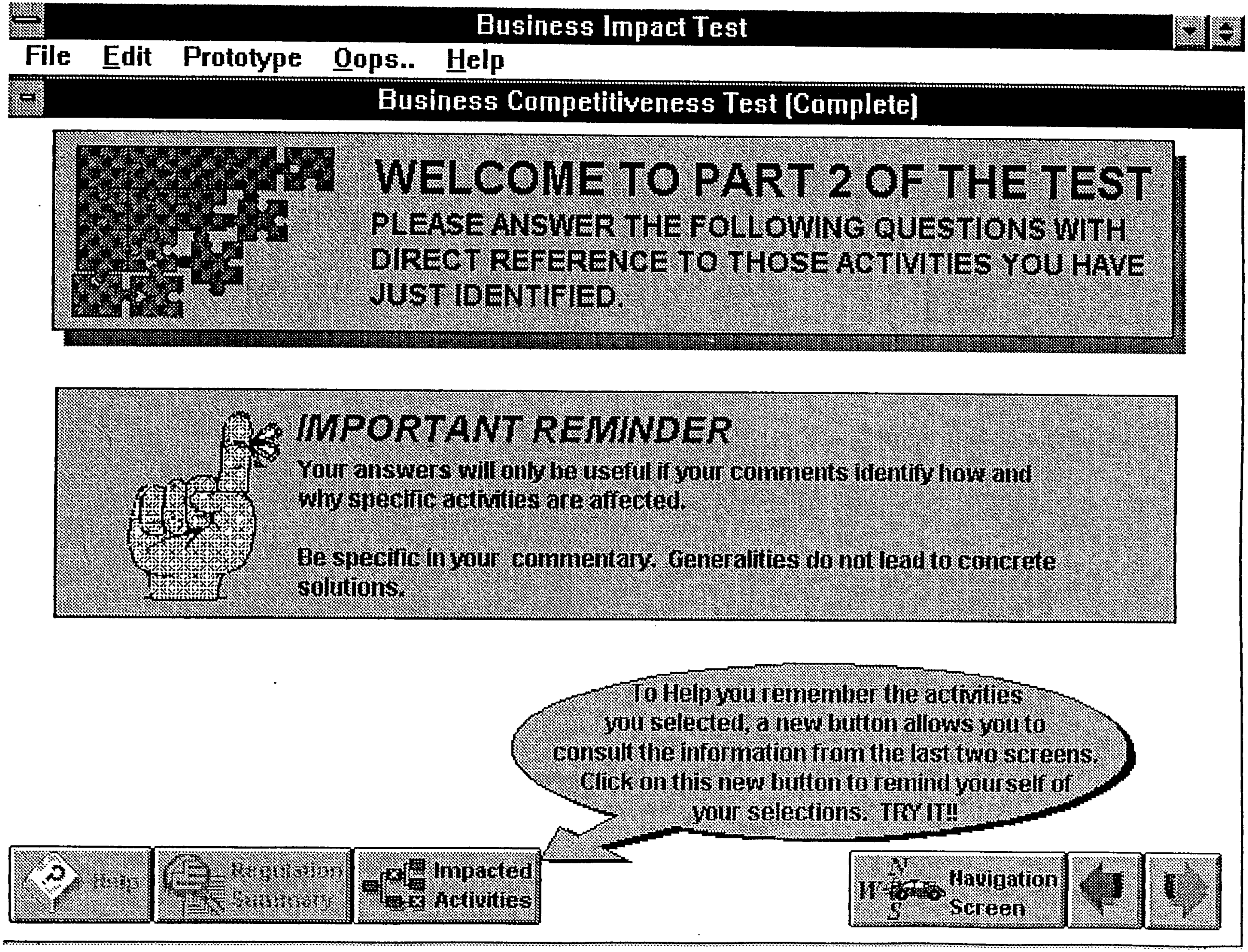
File Edit Prototype Oops.. Help

Introduction (Complete)

IDENTIFY THE ACTIVITIES OR COST CENTRES IN YOUR COMPANY THAT THE REGULATION WOULD AFFECT.

ACTIVITY	ANTICIPATED IMPACTS	EXAMPLES
Development of Products/Services	None Pos Neg Prohibitive	* Research / Design / Engineering * Product / Process / Service Development * Acquisition of Intellectual Property * Development of Facilities
Supply Management	None	* Sourcing * Purchasing * Relations with Suppliers * Accessing Infrastructure
Marketing	None	* Market Research / Analysis * Marketing * Advertising * Other Promotional Activities
Production	None	* Production / Provision of Goods / Services * Quality Control * Packaging / Labeling * Health / Safety / Environmental Control
Customer/Client Services	None	* Customer / Client Relations * After-Sales Service * Customer / Client Support * Warranty / Guarantees

Help Regulation Summary Define Scale Navigation Screen


Business Impact Test
File Edit Prototype Oops.. Help
Business Competitiveness Test (Complete)
WELCOME TO PART 2 OF THE TEST
PLEASE ANSWER THE FOLLOWING QUESTIONS WITH DIRECT REFERENCE TO THOSE ACTIVITIES YOU HAVE JUST IDENTIFIED.
IMPORTANT REMINDER
Your answers will only be useful if your comments identify how and why specific activities are affected.
Be specific in your commentary. Generalities do not lead to concrete solutions.
To Help you remember the activities you selected, a new button allows you to consult the information from the last two screens. Click on this new button to remind yourself of your selections. TRY IT!!
Help
Regulation Summary
Impacted Activities
Navigation Screen

Business Impact Test

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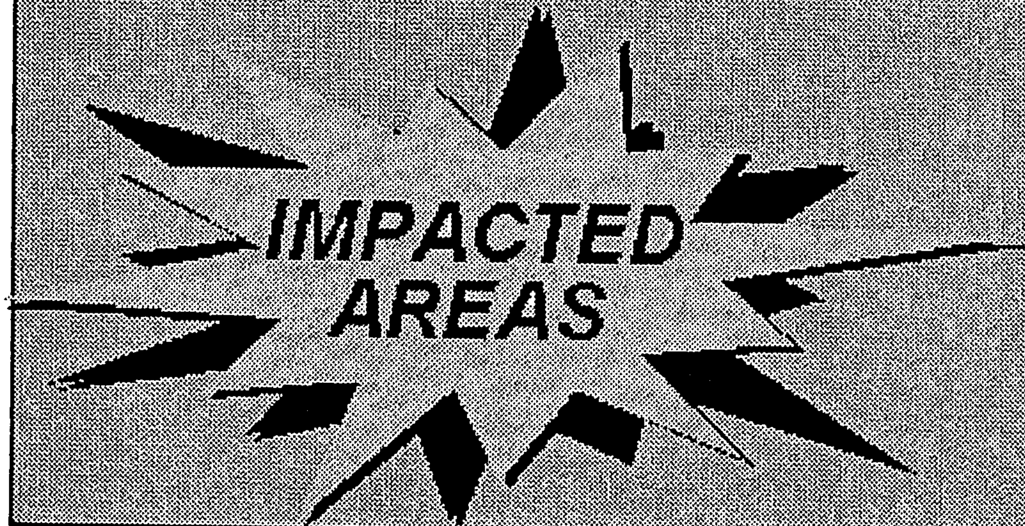
Activities (Goal)



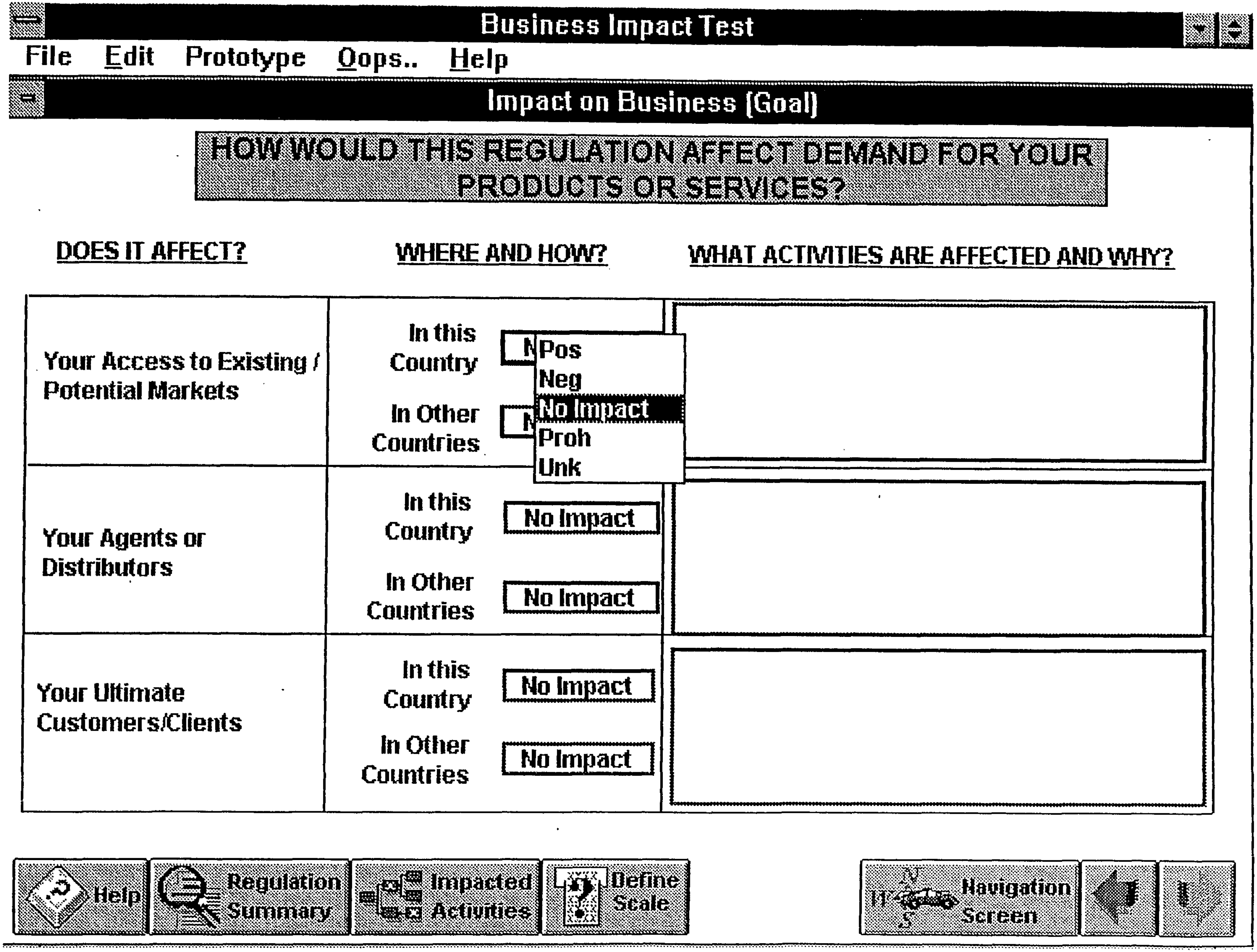
YOU HAVE INDICATED THIS REGULATION WILL HAVE A SIGNIFICANT IMPACT ON THE FOLLOWING TYPES OF ACTIVITIES WITHIN YOUR COMPANY:

Financing / Investment / Taxation -- Human Resources Management -- Marketing -- Production --

Help

PLEASE COMPLETE THIS TEST WITH REFERENCE TO THE SPECIFIC FUNCTIONS OR ACTIVITIES YOU HAVE IDENTIFIED.

Return


Business Impact Test
File
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Oops..
Help
Impact on Business (Goal)
HOW WOULD THIS REGULATION AFFECT DEMAND FOR YOUR PRODUCTS OR SERVICES?
DOES IT AFFECT?
WHERE AND HOW?
WHAT ACTIVITIES ARE AFFECTED AND WHY?
Your Access to Existing / Potential Markets
In this Country
In Other Countries
Pos
Neg
No Impact
Proh
Unk
Your Agents or Distributors
In this Country
No Impact
In Other Countries
No Impact
Your Ultimate Customers/Clients
In this Country
No Impact
In Other Countries
No Impact
Help
Regulation Summary
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Business Impact Test

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Impact on Business (Goal)

HOW WOULD THIS REGULATION AFFECT THE COST, QUALITY, AND AVAILABILITY OF THE LABOUR, GOODS, AND SERVICES YOUR FIRM USES?

DOES IT AFFECT?	HOW?		WHAT ACTIVITIES ARE AFFECTED AND WHY?
Your Supply of Materials, Components, and Finished Goods	Cost Quality Availability	N Increases N Decreases N No Impact Unknown	
Business Services You Use	Cost Quality Availability	No Impact No Impact No Impact	
The Equipment, Hardware and Software You Use	Cost Quality Availability	No Impact No Impact No Impact	

Help | Regulation Summary | Impacted Activities | Define Scale | Navigation Screen

Business Impact Test

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Impact on Business (Goal)

HOW WOULD THIS REGULATION AFFECT THE COST, QUALITY, AND AVAILABILITY OF THE LABOUR, GOODS, AND SERVICES YOUR FIRM USES?

DOES IT AFFECT?	HOW?		WHAT ACTIVITIES ARE AFFECTED AND WHY?
The Workforce You Employ	Cost	N Increases	
	Quality	N Decreases	
	Availability	N No Impact	
		Unknown	
The Infrastructure You Use (Transportation, Communications, Utilities)	Cost	No Impact	
	Quality	No Impact	
	Availability	No Impact	
Land, Energy and Natural Resources You Use	Cost	No Impact	
	Quality	No Impact	
	Availability	No Impact	

Help | Regulation Summary | Impacted Activities | Define Scale | Navigation Screen

Business Impact Test

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Impact on Business (Goal)

WOULD THIS REGULATION IMPACT GENERAL BUSINESS CONDITIONS AFFECTING YOUR FIRM?

DOES IT AFFECT?	TYPE OF IMPACT	WHAT ACTIVITIES ARE AFFECTED AND WHY?
The Availability or Cost of Financing	N Pos Neg No Impact Proh Unk	
Exchange Rates	No Impact	
The Treatment of Licenses, Patents, or Copyrights	No Impact	
Other Companies or Organizations	No Impact	

Help | Regulation Summary | Impacted Activities | Define Scale | N W S Navigation Screen

Business Impact Test

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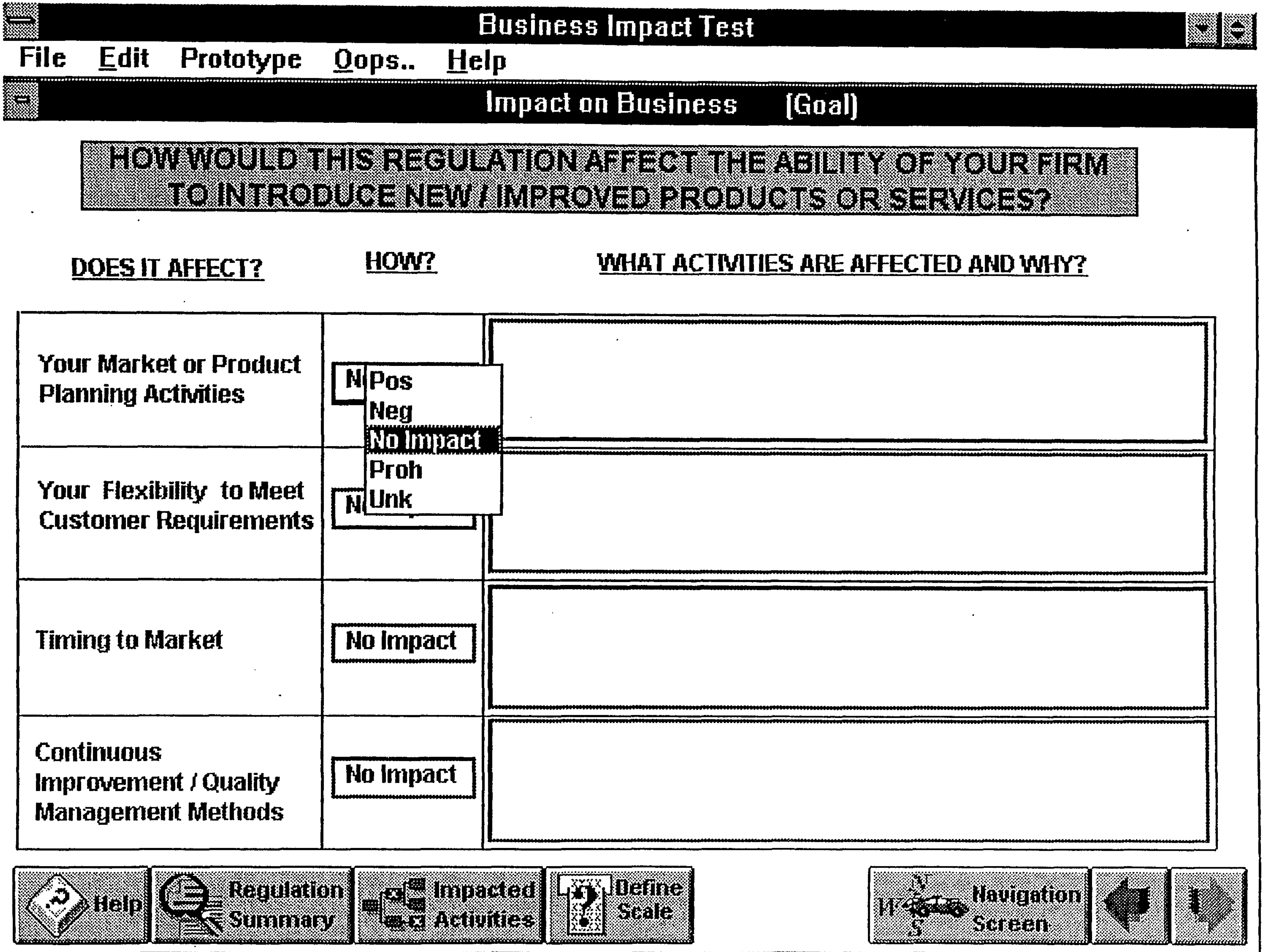
Impact on Business (Goal)

WHAT OPERATIONAL CHANGES IN YOUR COMPANY WOULD THIS REGULATION REQUIRE?

DOES IT AFFECT?	TYPE OF CHANGE:	WHAT ACTIVITIES ARE AFFECTED AND WHY?
Personnel	☐ Hire ☐ Redeploy ☐ Dismiss ☒ No Change	
Current Operations	☐ Minor ☐ Major ☐ Prohibitive ☒ No Change	
Facilities / Equipment	☐ Add ☐ Modify ☐ Close Down ☒ No Change	

Help | Regulation Summary | Impacted Activities | Define Scale | Navigation Screen



Business Impact Test
File
Edit
Prototype
Oops..
Help
Impact on Business (Goal)
HOW WOULD THIS REGULATION AFFECT THE ABILITY OF YOUR FIRM TO INTRODUCE NEW / IMPROVED PRODUCTS OR SERVICES?
DOES IT AFFECT?
HOW?
WHAT ACTIVITIES ARE AFFECTED AND WHY?
Your Market or Product Planning Activities
Pos
Neg
No Impact
Proh
Unk
Your Flexibility to Meet Customer Requirements
Timing to Market
No Impact
Continuous Improvement / Quality Management Methods
No Impact
Help
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Business Impact Test

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Impact on Business (Goal)

HOW WOULD THIS REGULATION AFFECT THE ABILITY OF YOUR FIRM TO ADOPT NEW OR IMPROVED TECHNOLOGIES OR BUSINESS PRACTICES?

DOES IT AFFECT?	WHAT & HOW		WHAT ACTIVITIES ARE AFFECTED AND WHY?
Your Access to Infomation About...	Technology	N Pos	
	Internal Management	N Neg	
	Relationships with Other Businesses	N No	
		Proh	
		Unk	
Your INTENTION to Adopt/Reorganize...	Technology	No	
	Internal Management	No	
	Relationships with Other Businesses	No	
Your ABILITY to Adopt/Reorganize...	Technology	No	
	Internal Management	No	
	Relationships with Other Businesses	No	
Your Strategic Planning with Regard to...	Technology	No	
	Internal Management	No	
	Relationships with Other Businesses	No	

Help | Regulation Summary | Impacted Activities | Define Scale | N W S Navigation Screen

Business Impact Test

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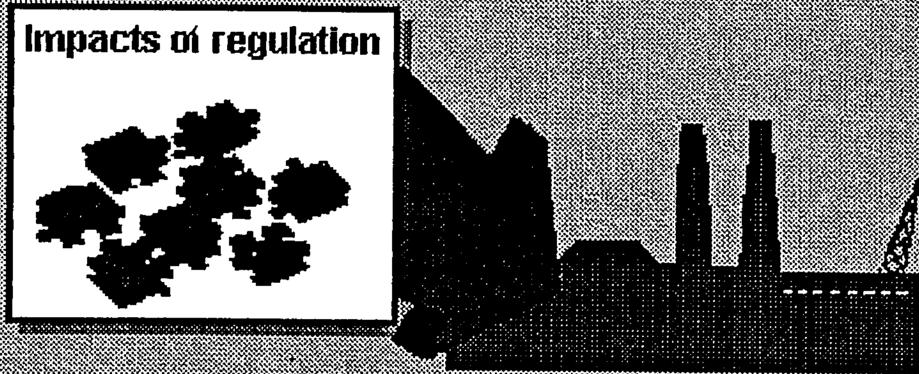
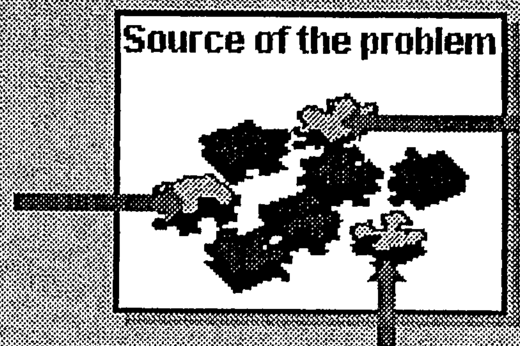
Design Issues (Complete)

IMPORTANT!!



the questions so far have tried to identify HOW this REGULATION would affect your firm. now we would like to find out more about WHY these impacts occur.

The following questions ask if any of the requirements of this REGULATION, as summarized in the "regulation summary", may cause problems and how they could be modified to eliminate unnecessary or unintended impacts.



Help | Regulation Summary | Navigation Screen

Business Impact Test

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Design Issues (Goal)

DOES YOUR FIRM ALREADY MEET THE REQUIREMENTS OF THIS REGULATION?

REQUIREMENT	NOW MET	IF REQUIREMENTS ARE MET, PLEASE EXPLAIN HOW (refer to specific aspects or sections of the regulation)
Objective(s) / Definition(s)	☐ Yes ☐ No ☐ Partially ☒ N/A	
Compliance Standard(s)	☐ Yes ☐ No ☐ Partially ☒ N/A	
Reporting & Monitoring Requirements	☐ Yes ☐ No ☐ Partially ☒ N/A	
Enforcement Procedures	☐ Yes ☐ No ☐ Partially ☒ N/A	

Help | Regulation Summary | Impacted Activities | Define Scale | Navigation Screen

Business Impact Test

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Design Issues [Goal]

INDICATE IF THE REQUIREMENTS OF THIS REGULATION ARE INCONSISTENT WITH YOUR BUSINESS PRACTICE.

REQUIREMENT	INCONSISTENT WITH	IF INCONSISTENT, PLEASE EXPLAIN WHY (refer to specific aspects or sections of the regulation)
Objective(s) / Definition(s)	☐ Current Practice ☐ Planned Practice ☐ Best Business Practice	
Compliance Standard(s)	☐ Current Practice ☐ Planned Practice ☐ Best Business Practice	
Reporting & Monitoring Requirements	☐ Current Practice ☐ Planned Practice ☐ Best Business Practice	
Enforcement Procedures	☐ Current Practice ☐ Planned Practice ☐ Best Business Practice	

Help | Regulation Summary | Impacted Activities | Navigation Screen

Business Impact Test

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Design Issues (Goal)

INDICATE THE SOURCE OF ANY PROBLEMS ARISING FROM THE REQUIREMENTS OF THIS REGULATORY SYSTEM.

REQUIREMENT	SOURCE OF PROBLEM	IF A PROBLEM EXISTS, PLEASE EXPLAIN WHY (refer to specific aspects or sections of the regulation)
Objective(s) / Definition	☐ Clarity / Complexity ☐ Certainty ☐ Timeliness ☐ Other	
Compliance Standard(s)	☐ Clarity / Complexity ☐ Certainty ☐ Timeliness ☐ Other	
Reporting & Monitoring Requirements	☐ Clarity / Complexity ☐ Certainty ☐ Timeliness ☐ Other	
Enforcement Procedures	☐ Clarity / Complexity ☐ Certainty ☐ Timeliness ☐ Other	

Help | Regulation Summary | Impacted Activities | Navigation Screen

Business Impact Test

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Harmonization Issues (Goal)

DO THE REQUIREMENTS OF THIS REGULATION CONTRADICT OR DUPLICATE OTHER OBLIGATIONS YOUR FIRM MUST MEET?

REQUIREMENT	JURISDICTION	IF A PROBLEM EXISTS, PLEASE EXPLAIN WHY (refer to specific aspects or sections of the regulation)
Objective(s) / Definition(s)	☐ Federal Government ☐ Other Levels of Government ☐ Other Regulating Bodies ☐ International Requirements	
Approval Proceedures/ Compliance Standards	☐ Federal Government ☐ Other Levels of Government ☐ Other Regulating Bodies ☐ International Requirements	

Help | Regulation Summary | Impacted Activities | Navigation Screen

Business Impact Test

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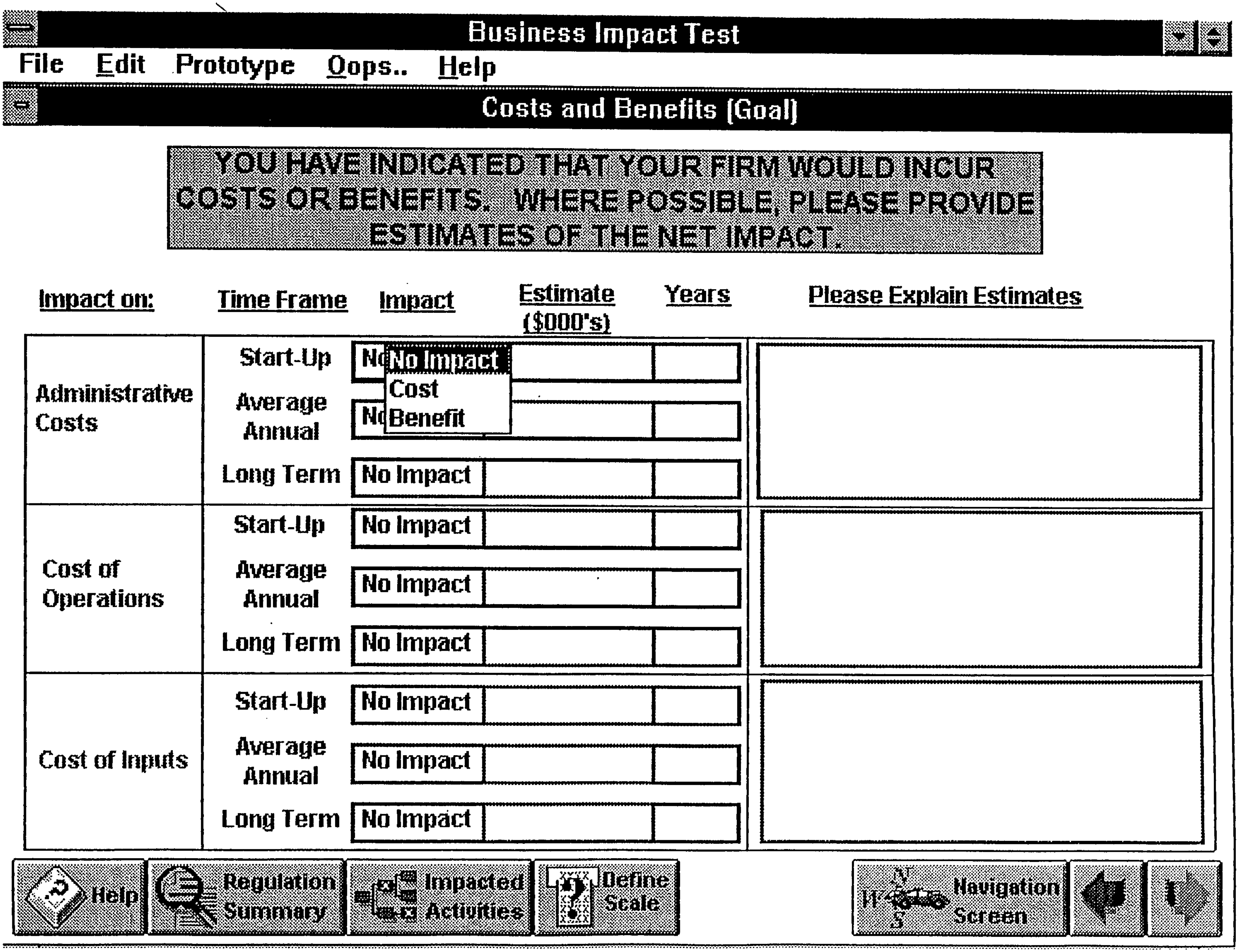
Harmonization Issues (Goal)

DO THE REQUIREMENTS OF THIS REGULATION CONTRADICT OR DUPLICATE OTHER OBLIGATIONS YOUR FIRM MUST MEET?

REQUIREMENT	JURISDICTION	IF A PROBLEM EXISTS, PLEASE EXPLAIN WHY (refer to specific aspects or sections of the regulation)
Monitoring and Reporting Requirements	☐ Federal Government ☐ Other Levels of Government ☐ Other Regulating Bodies ☐ International Requirements	
Enforcement Procedures	☐ Federal Government ☐ Other Levels of Government ☐ Other Regulating Bodies ☐ International Requirements	

Help | Regulation Summary | Impacted Activities | Navigation Screen


Business Impact Test
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Oops..
Help
Costs and Benefits (Goal)
YOU HAVE INDICATED THAT YOUR FIRM WOULD INCUR COSTS OR BENEFITS. WHERE POSSIBLE, PLEASE PROVIDE ESTIMATES OF THE NET IMPACT.
Impact on:
Time Frame
Impact
Estimate ($000's)
Years
Please Explain Estimates
Administrative Costs
Start-Up
No Impact
Cost
Benefit
Average Annual
Long Term
No Impact
Cost of Operations
Start-Up
No Impact
Average Annual
No Impact
Long Term
No Impact
Cost of Inputs
Start-Up
No Impact
Average Annual
No Impact
Long Term
No Impact
Help
Regulation Summary
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Business Impact Test

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Costs and Benefits (Goal)

YOU HAVE INDICATED THAT YOUR FIRM WOULD INCUR COSTS OR BENEFITS. WHERE POSSIBLE, PLEASE PROVIDE ESTIMATES OF THE NET IMPACT.

Impact on:	Time Frame	Impact	Estimate ($000's)	Years	Please Explain Estimates
Capital Costs (Facilities and Equipment)	Start-Up	N No Impact Cost Benefit			
	Average Annual	N			
	Long Term	No Impact			
Sales Revenue	Start-Up	No Impact			
	Average Annual	No Impact			
Liabilities / Provisions	Annual	No Impact			
	Average Annual	No Impact			

Help | Regulation Summary | Impacted Activities | Define Scale | Navigation Screen

Business Impact Test

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Costs and Benefits [Goal]

WHERE POSSIBLE, ESTIMATE NET IMPACT ON PERSONNEL REQUIREMENTS.

Cost Centre	Time Frame	Net Impact	Estimates (Person Years)	Explain Estimates
Management	Start-Up	N Increase / Decrease / No Impact		
	Annual	N		
Administration	Start-Up	No Impact		
	Annual	No Impact		
Operations (Development/ Production/ Sales)	Start-Up	No Impact		
	Annual	No Impact		

Help | Regulation Summary | Impacted Activities | Define Scale | Navigation Screen

Business Impact Test

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Summary and Alternatives (Goal)

WELCOME TO PART 3 OF THE TEST

The two screens in this section tie your focused observations together with summary comments. As well, you are asked to suggest alternative approaches to this

In summary, will this regulation place your company in a MORE or LESS advantageous position in relation to your competition:

Within this Country	☐ More ☐ Less ☒ Equal	
In Other Countries	☐ More ☐ Less ☒ Equal	

Help | Regulation Summary | Impacted Activities | Navigation Screen

Business Impact Test

File   Edit   Prototype   Oops..   Help

Summary and Alternatives (Goal)

BASED ON YOUR ANSWERS IN THIS TEST, DO YOU FEEL THAT:

IF POSSIBLE, PLEASE PROVIDE SPECIFIC SUGGESTIONS

This regulation is required?	☐ Yes ☐ No ☒ Don't Know	
This regulation could be better designed?	☐ Yes ☐ No ☒ Don't Know	
Alternative regulatory approaches could be used?	☐ Yes ☐ No ☒ Don't Know	
Approaches other than regulation could be used?	☐ Yes ☐ No ☒ Don't Know	

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Business Impact Test

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Company Profile (Goal)

INFORMATION ABOUT YOUR FIRM

This screen asks you to provide information about your company. Providing this information allows your answers in the test to be examined in relation to firms that share common characteristics i.e. by size, region, market etc. The goal is to improve the quality of analysis and increase the influence of your input on the decision -making process in government.

This information will be treated in commercial confidence and will not be divulged to a third party without your express written consent.

Company Name	
Address1	
Address2	
City	
Province	Postal Code

WHICH OF THE FOLLOWING CHOICES BEST DESCRIBES:

the growth stage your company is in at the present time?

your operation?

your firm's market focus?

your firm's ownership structure?

your firm's sales?

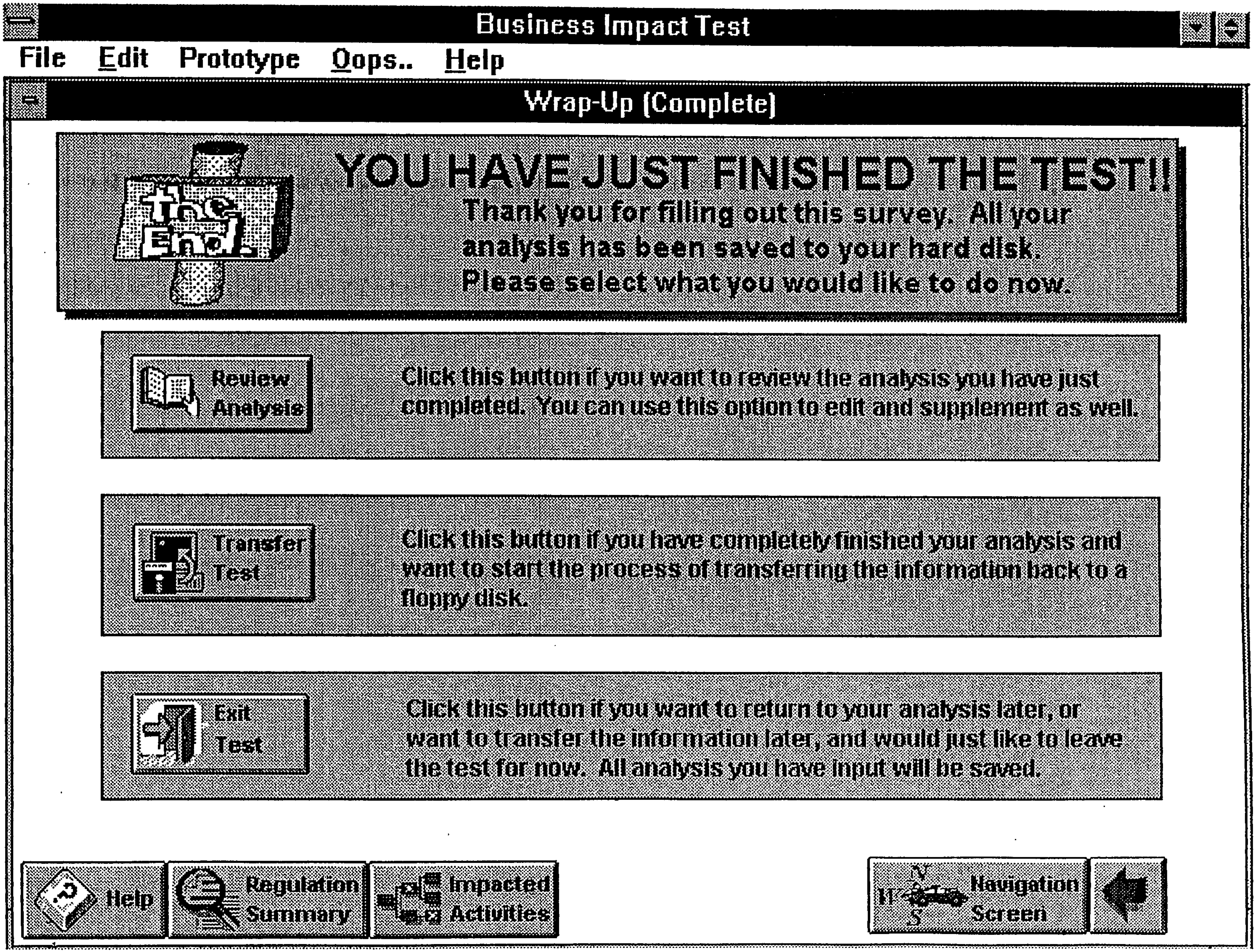
the number of people your firm employs?

your percentage of production exported?

PLEASE ESTIMATE YOUR AVERAGE ANNUAL EXPENDITURE FOR:

the development and improvement of products and services you sell, as a percent of sales:

the market development and marketing as a percent of sales:


Business Impact Test
File Edit Prototype Oops.. Help
Wrap-Up (Complete)
YOU HAVE JUST FINISHED THE TEST!!
Thank you for filling out this survey. All your analysis has been saved to your hard disk. Please select what you would like to do now.
Review Analysis
Click this button if you want to review the analysis you have just completed. You can use this option to edit and supplement as well.
Transfer Test
Click this button if you have completely finished your analysis and want to start the process of transferring the information back to a floppy disk.
Exit Test
Click this button if you want to return to your analysis later, or want to transfer the information later, and would just like to leave the test for now. All analysis you have input will be saved.
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Appendix B

Basic Information on a Proposed Standard

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO/IEC JTC1/SC29/WG11 N 0271
MPEG92/700 Rev NP N367
06 November 1992

Source: Leonardo Chiariglione - Convenor
Title: New Work Item Proposal (NP) for Very-Low Bitrate Audio-Visual Coding
Status: Adopted at 20th WG11 meeting

SCOPE

The scope of this project consists of the development of international standards for generic audio-visual coding systems at very-low bitrates (up to tens of kilobits/second).

The generic nature of the work indicates that the scope includes development of provisions that allow application in a wide range of fields.

"Audio-visual coding systems" indicates that the scope includes development of standards for video coding algorithms, audio coding algorithms, and system multiplexing methods.

"At very-low bitrates (up to tens of kilobits/second)" indicates that the scope includes development of algorithms which are optimized for very-low bitrates, from 4.8 kilobits/second up to perhaps 64 kilobits/second.

Work related to videophone and communication applications of very-low bitrate audio-visual coding should be done in close collaboration with CCITT SGXV to achieve a harmonized solution.

PURPOSE AND JUSTIFICATION

Applications for very-low bitrate audio-visual coding systems are those that are restricted in the capacity available for transmission or storage. Limited transmission capacity is a characteristic of several important networks, including Public Switched Telephone Networks (PSTN), Local Area Networks (LAN), and mobile (wireless) networks. Restricted storage capacity is characteristic of interchange media, such as Smart cards and memory cards, and very-large audio-visual delivery systems, such as electronic mail or information databases.

Potential applications that require using such networks or interchange media include videophones, multimedia electronic mail, remote sensing, electronic newspapers, interactive multimedia databases, multimedia videotex, games, interactive computer imagery, multimedia annotation, and sign language captioning. These applications are currently the subject of considerable interest.

The key requirement that is not met by existing visual coding standards (CCITT H.261, ISO 11172) is acceptable visual quality at very-low bitrates. When existing standards are operated at very-low bitrates, the trade-off between temporal and spatial resolution results in visually annoying motion or spatial artifacts.

A solution is needed to provide acceptable audio-visual quality for a wide range of applications at very-low bitrates. The quality must be markedly better than what is available using existing standards at very-low bitrates. It is expected that new coding concepts will be required to obtain the necessary improvement in quality.

The completion of this project will provide the following benefits:

- enable new and improved audio-visual services;
  Potential applications include videophones, multimedia electronic mail, remote sensing, electronic newspapers, interactive multimedia databases, multimedia videotex, games, interactive computer imagery, multimedia annotation, and sign language captioning;
- more efficient use of bandwidth by utilizing narrow-bandwidth transmission channels on PSTN, LAN, and mobile networks;
- more efficient use of storage media, especially in storage-limited systems, such as Smart cards and memory cards;
- generic coding will provide commonality of electronics between applications, facilitating lower costs;
- generic coding will enable easy interchange of audio-visual information between application domains;
- robustness of digital media, e.g. relative permanence of digital storage media;

Additional details in support of this NP, can be found in WG11 N0270 titled, "Project Description for Very-Low Bitrate A/V Coding".

NGL

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