INTERNATIONAL STANDARDS (ISO 9000 AND ISO 14000) DEVELOPMENT INFORMATION AND KNOWLEDGE

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Summary

Agenda 21 advocates a strong role for business and industry in addressing sustainable development. A set of corporate policy instruments entailing environmental management systems, environmental auditing, life cycle analysis and environmental labeling will facilitate the process of more environmental responsibility.

These instruments are subject to standard establishment by the International Organization for Standardization. Two series of standards are relevant in this respect: ISO 9000 and ISO 14000.

- ISO 9000 is a general guide for implementing quality management in an organization.
- ISO 14000 specifically addresses environmental aspects of quality management. Three groups of instruments are dealt with: central to the system are the standards related to environmental management systems. The second group deals with evaluation and auditing. The third group entails product evaluation standards.
- ISO 14001 provides guidelines to establish and implement an environmental management system. This entails an environmental policy, an action plan, operational and implementation aspects, measurements, checks and evaluations, and a management review. Environmental management systems in the ISO concept are based upon legal compliance and continual improvement. They allow a company to do their societal job as far as responsibility to the environment is concerned.

An essential instrument in an environmental management system is environmental auditing. This is the subject of the ISO 14010 series. These standards specify auditing principles, procedures and the qualification criteria for auditors.
International standards for life cycle analysis and environmental claims of any sort are still being developed.

As a whole the ISO 14000 standards do not only appear as a practical roadmap to implement and use essential corporate instruments for environmental management. They equally provide a new paradigm where environmental responsibility and stewardship are key components. It must be demonstrated to which extent this will suffice as an organizational contribution to sustainable development.

1. Introduction

An industrialized society is an enormous mobilizer of materials. Extraction from the lithosphere amounts worldwide to 60 000 Mtons year^{-1}, of which only one third is useful, providing the service intended. The remaining two thirds are the not useful and are called the rucksack. This corresponds to 12 tons of extracted material per capita of which 4 tons are useful. Nearly one half of the worldwide rucksack is due to energy conversion; in practice the use of fossil hard- and browncoal. The extraction of mineral raw materials is dominated by building materials and energy minerals (fossil fuels) which are roughly consumed on the same scale, around 13 000 and 9000 Mtons year^{-1} respectively. Raw materials for basic inorganic chemicals and fertilizers are used in relatively large amounts; some of them in much larger quantities than the, non-iron metals. This applies to rock salt (NaCl), sulfur-containing minerals and phosphate minerals, as well as nitrogen from the air. This results in main changes in natural flows and ecosystems, illustrated in Table 1. The turnover of carbon, nitrogen, sulfur and metals gases changed by levels varying between 30 and 24 000% due to human activities. Needless to say, the per capita consumption of these environmentally important materials varies substantially worldwide.

	Human disturbance relative to natural levels	**System character of the disturbance**
Carbon (C)	+ 30% in the atmospheric stock	Lithosphere to ecosphere
Nitrogen (N)	+ 200–300% in the nitrogen fixation	1) inert to active N in ecosphere 2) lithosphere to ecosphere
Sulfur (S)	+ 1000% in the flow of reduced S to the atmosphere	Lithosphere to ecosphere
Metals	Up to 2400% in the flow from the lithosphere	Lithosphere to technosphere (eventually ecosphere)
Persistent/artificial compounds	Very large increases in the flow to the ecosphere	Technosphere to ecosphere
Terrestrial ecosystems	40% appropriation of the terrestrial net primary production	Ecosystems disruption, threat to biodiversity

Table 1. Some human disturbances of natural flows and ecosystems

Between one third and one half of land surface has been transformed by human activity. Carbon dioxide concentration in the atmosphere has increased by nearly 30% since the beginning of the Industrial Revolution. More atmospheric nitrogen is fixed by humanity than by all natural terrestrial resources combined. More than half of all accessible surface fresh water is put to use by humanity.

The quantitative aspects of amounts of materials used, the distortion of the basic ecological cycles (C, N, P) and the dispersion of pollutants indicate that human alteration of the earth is substantial and growing. We live on a human-dominated planet on which there is an enormous space for more sustainable, long-term targeted materials management. Part of this management is corporate environmental management.

Agenda 21, the moral blueprint of action targeted towards a more sustainable society which resulted from the 1992 UNCED Conference in Rio de Janeiro, Brazil, advocates more focus on corporate environmental management. An important instrument to this end is an intensified development of international environmental management programs and their supporting components as environmental auditing.

In this context, the International Organization for Standardization (ISO) is very instrumental. ISO is a worldwide federation of national standard bodies and is based in Geneva, Switzerland. More than 100 countries from all regions are members of this federation. It was founded in 1946 with the aim of promoting standardization and related activities to facilitate international exchange of goods and services. Historically the organization primarily addressed technical producer manufacturing standards; it then evolved into quality control system standards; it also currently addresses environmental management standards. The outcome of the ISO activities are international agreements, published as international standards. It operates in a procedurally well-established way in which technical committees have a central role. Technical Committee (TC) 207 oversees the subcommittees developing ISO 14000.

ISO/TC 176 is the technical committee responsible for developing and maintaining the ISO 9000 family of standards.

Two ISO series of groups of standards are of core importance to the environmental quality discussion: the ISO 9000 series which relates to quality management and the ISO 14000 series which deals with standards for (corporate) environmental management instruments.

The British Standard Institute (BSI) produced the world's first quality management standard, BS 5750. This BS 5750 has since become ISO 9000. The European Union (EU) started the worldwide spread of ISO 9000 in 1987, when it instructed the European Standards Body to adopt ISO 9000 as the harmonized single quality standard for the EU market. As European companies adopted ISO 9000, so did US companies in Europe and afterwards throughout the world. A worldwide trend on the adoption of management standards was set.

In 1992 the BSI published BS 7750 which was the first environmental standard. BS 7750 became a model for ISO 14000. BS 7750 equally anticipated the EU's Eco-Management and Audit Scheme (EMAS) regulation.
ISO 9000 is currently the most used standard worldwide. It has been estimated that by the year 2000 over 1 million companies will have adopted ISO 9000. On the other hand the application of ISO 14000 is also increasing. Both series are related as their focus is on general management issues with an emphasis on systems. Therefore there is a growing trend to develop an integrated standard package which combines ISO 9000 and ISO 14000 and to include health and safety management issues.

This article overviews ISO 9000 and ISO 14000. It looks into their scope, content and operational aspects. It discusses these instruments for environmental management in a context of sustainable development.

2. ISO 9000

2.1 Definition

The ISO 9000 series is an integrated, global system for optimizing the quality effectiveness of a company or organization by creating a framework for continuous improvement. It is a guide for implementing quality management in an organization. ISO 9000 is thus primarily concerned with quality management. The definition of 'quality' in ISO 9000 refers to all the features of a product or a service which are required by the customer. Quality management means what the organization does to ensure that its products conform to the customer's requirements.

2.2 Contents

Table 2 provides a simplified list of the ISO 9000 family of standards. The table shows that when the 9000-1 to 4 series is read in combination with ISO 8402, it provides an introduction to the application of these 9000 series guidelines. The three standards, ISO 9001, ISO 9002 and ISO 9003, demonstrate compliance to customers. ISO 9001 e.g. is

intended for companies which need to assure their customers that conformity to specific requirements is met throughout the whole cycle from design to service. It is the most complete and demanding of the series. It particularly applies in contract situations. All of the requirements of ISO 9004-1 are expected to be met rigorously in it. ISO 9004-1 is the core of the guide for implementing quality management. The other ISO standards in the series entail specifications for particular sectors or elements of quality management. The ISO 10011 and ISO 10012 series, which are specifically targeted to auditing and monitoring, are also closely related to the ISO 9000 series.

Standards and guidelines	Purpose
ISO 8402, Quality management and quality assurance – Vocabulary	Defines the fundamental terms used in the ISO 9000 family, which you need to know to be sure of avoiding misunderstandings both internally and externally.
ISO 9000-1, Quality management and quality assurance standards – Part 1: Guidelines for selection and use	Establishes a starting point for understanding and selecting the standards appropriate to your needs.
ISO 9000-2, Quality management and quality assurance standards – Part 2: Generic guidelines for the application of ISO 9001, ISO 9002 and ISO 9003	Assists you in interpreting and applying ISO 9001, ISO 9002 and ISO 9003.
ISO 9000-3, Quality management and quality assurance standards – Part 3: Guidelines for the application of ISO 9001: 1994 to the development, supply, installation and maintenance of computer software	Provides you with specific interpretation of the requirements of ISO 9001 for computer software development applications.
ISO 9000-4, Quality management and quality assurance standards – Part 4: Guide to dependability program management	Gives you guidance on how to plan, organize and control resources to produce reliable and maintainable products.
ISO 9001, Quality systems – Model for quality assurance in design, development, production, installation and servicing	This is the requirement standard you use when you wish to demonstrate capability for design/development of your product or service, as well as for production, installation and servicing.
ISO 9002, Quality systems – Model for quality assurance in production, installation and servicing	This is the requirement standard you use when you are not responsible for the design/development of your product or service, but wish to demonstrate capability for production, installation and servicing (identical to ISO 9001 except for design control requirement).

ISO 9003, Quality systems – Model for quality assurance in final inspection and test	This is the requirement standard you use when you only need to demonstrate capability to control your product or service by final inspection and test.
ISO 9004-1, Quality management and quality system elements – Part 1: Guidelines	This is not a requirement standard, but provides you with guidelines to implement a quality system to satisfy your customers. and your own organization's needs.
ISO 9004-2, Quality management and quality system elements – Part 2: Guidelines for services	This standard is made up in a similar way as ISO 9004-1, but the guidelines are designed with special regard to the conditions pertinent to the service sector.
ISO 9004-3, Quality management and quality system elements – Part 3: Guidelines for processed materials	This standard provides you with quality management guidelines applicable if you are a producer of processed materials, which are typically provided in bulk.
ISO 9004-4, Quality management and quality system elements – Part 4: Guidelines for quality improvement	Provides you with guidelines for implementing continuous quality improvement within your organization using tools and techniques based on data collection and analysis.
ISO 10005, Quality management – Guidelines for quality plans	This standard gives you guidance on how to prepare quality plans for the control of specific products, projects or contracts.
ISO 10006, Guidelines to quality in project management	Guidelines to help you ensure the quality of both the project processes and the project product.
ISO 10007, Quality management – Guidelines for configuration management	Gives you guidelines to ensure that a complex product continues to function when components are changed individually.
ISO 10011-1, Guidelines for auditing quality systems – Part 1: Auditing	Provides you with guidelines for auditing a quality system, and for verifying the system's ability to achieve defined quality objectives. You can use this standard internally or for auditing your suppliers.
ISO 10011-2, Guidelines for auditing quality systems – Part 2: Qualification criteria for quality systems auditors	Provides guidance on the education, training, experience, personal attributes and management capabilities needed to carry out an audit.

ISO 10011-3, Guidelines for auditing quality systems – Part 3: Management of audit programs	Provides basic guidelines for managing quality system audit programs.
ISO 10012-1, Quality assurance requirements for measuring equipment – Part 1: Metrological confirmation system for measuring equipment	Gives you guidelines on the main features of a calibration system to ensure that measurements are made with the intended accuracy.
ISO 10012-2, Quality assurance for measuring equipment – Part 2: Guidelines for control of measurement processes	Provides supplementary guidance on the application of statistical process control when this is appropriate for achieving the objectives of Part 1.
ISO 10013, Guidelines for developing quality manuals	Provides guidelines for the development, preparation and control of quality manuals tailored to your specific needs.

Table 2. ISO 9000 family of standards (ISO, 1998)

As a whole this list shows that the ISO 9000 series addresses all the aspects of quality assurance management. In theory this also applies to environment, health and safety issues. In the traditional sense, however, these areas are not relative to 'quality' and, as such, are sometimes overlooked and remain undocumented.

2.3 Documentation

Three levels of documentation are needed in ISO 9000.

The top level is the Quality Manual. It contains the company's quality policy and a description of its quality system. It addresses this system in all its components. It is the basis for the checklists that are used both to develop the full system and to demonstrate compliance with the requirements of the standards to a certifying inspector. The Quality Manual is the core document of the system.

The second level contains all the specific documents needed to control the issues that are fundamental to quality. Selected examples include: quality plans, measurement and testing routines, inspection and test records, customer specifications, etc.

The third level is made up of the Standard Operating Procedures (SOPs). The titles of the SOPs are placed in an index ahead of, or at the beginning of the Quality Manual.

Although the documentation is a core element in the quality management system, the system is not driven by these written or computerized records. The motivation of all those involved in the system, is much more crucial for its success. In this sense, quality management systems are much less bureaucratic than they might look like at a first glance.

2.4 Support

ISO 9000 is a complex system and dynamic in its implementation. Therefore, special assistance tools are provided to users of the ISO 9000 series systems. The ISO 9000 Forum is operated by ISO and is known as a user-friendly organization. Its main instrument is the newsletter, the ISO 9000 News which provides information on relevant ongoing activities both in the development and the implementation arena. The ISO (monthly) Bulletin provides an overview of ISO's activities in international standardization. ISO online is the electronic information service on the Internet, accessible via the World Wide Web at: http://www.iso.ch/.

ISO 9000 support groups provide an independent forum for discussion, advice and information exchange. Their primary mission is to help companies promote a better understanding of the standard and the steps involved in implementation, the benefits of registration, and the process of becoming registered.

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Biographical Sketch

Luc Hens graduated as a Biologist and later received his Ph.D. in Biology from the Free University of Brussels (Belgium) where he is at present Professor and Head of the Human Ecology Department. The department organizes a Master's degree in Human Ecology which is targeted towards an international audience. Hens also lectures at the Technical University of Sofia (Bulgaria). His specific area of research concerns the elucidation of interdisciplinary instruments for sustainable development. This entails fundamental research on environmental impact assessment, life cycle analysis and environmental care systems. Professor Hens acts as an expert in environmental policy in several councils in Belgium. He is the European editor for the *International Journal on Environmental Pollution* and for the journal *Environment, Development and Sustainability*. Luc Hens has published 54 papers in international peer-reviewed journals and is the author, co-author, or co-editor of 24 books in the broad area of environmental management and human ecology.