A framework for implementing ISO 14000 in construction

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Abstract ISO 14000 has been developed as a new international standard series for promoting environmental protection and sustainable development. Since the introduction of ISO 14001 in September 1996 it has attracted great attention from organizations in various industries. ISO 14001 specifies the requirements and procedures for establishing an environmental management system. An increasing number of organizations from various industrial sectors have actively participated in implementing this new standard. However, very few construction companies – for example, in Australia – have actively pursued certification to this standard despite having an obligation to implement it, as the services and products they produce directly impact the environment. By reviewing the strategic issues posed by the entire family of ISO 14000 standards, this paper analyses its relevance to construction and the difficulties and problems that may be encountered in their implementation. A framework for implementing the standard in construction companies is proposed. It is suggested that the adoption of ISO 14000 by construction companies may enable them to improve their environmental performance as well as the built environment, which in turn will contribute to sustainable development.

Introduction
Following the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, the International Organization for Standardization (ISO) established the Technical Committee (TC) 207 to develop a series of standards called ISO 14000 for incorporating environmental aspects into industrial operations and product standards.

The standards address the following aspects of environmental management:

- Environmental management systems (EMS);
- Environmental auditing and related investigations (EA&RI);
- Environmental labels and declarations (EL);
- Environmental performance evaluation (EPE);

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- Life cycle assessment (LCA); and
- Terms and definitions (T&D).

There are a total of 21 standards and guidance documents in the ISO 14000 family, which are being developed to cover the above issues. According to ISO (1998), seven of the 21 standards have already been formally endorsed by ISO, while the other 14 are still at various stages of development. Table I lists these standards. The cornerstone of the ISO 14000 standards is the Environmental Management Systems (EMS), which aims to assist organizations on a voluntary basis to improve their environment performance through a coherent allocation of resources, assignment of responsibilities, and an ongoing evaluation of practice, procedures, and process.

ISO 14001 is referred to as the specification document and is the only standard designed for purposes of audit and certification in the ISO 14000 series. The EMS is likely to stimulate and initiate a substantial change in environmental attitudes in every industry and will provide a useful extension and complement to the current ISO 9000 standards on quality systems. The distinction of this new code will be the responsibility involved in thinking about the health of environment and quality of life for communities both in and beyond the workplace.

ISO 14001 outlines the basic elements and functions of an effective EMS including establishing an environmental policy, determining environmental aspects and impacts of products/activities/services, planning environmental objectives and measurable targets, implementation and operation of programs to meet objectives and targets, checking and corrective action, and management review. By reviewing the strategic issues posed by the ISO 14000 standards, this paper analyses its relevance to the construction and the difficulties and problems that may be encountered in their implementation. A framework for implementing the standard in construction companies is proposed. The adoption of ISO 14000 by construction companies may enable them to improve their environmental performance as well as the built environment, which in turn will contribute to sustainable development.

**ISO 14000 and sustainable development**

The World Commission on Environment and Development (WCED, 1987) defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainable development considers the simultaneous improvement of the economy, the environment, and the wellbeing of people. In the corporate context, the International Institute for Sustainable Development (IISD, 1996) defined sustainable development as adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future. This definition captures the spirit of the concept proposed in the WCED definition and focuses attention on the specific interests
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**Notes:** CD = Committee Draft; DIS = Draft International Standard; FDIS = Final Draft International Standard; TR = Technical Report; WD = Workgroup Draft

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of business enterprises. It recognizes that economic development must meet both the needs of the business enterprise and its stakeholders. The latter include shareholders, lenders, customers, employees, suppliers, and communities who are affected (either positively or negatively) by the enterprise’s business activities. The definition also highlights the dependence of the enterprise’s economic activities on human and natural resources, in
addition to physical and financial capital. It emphasizes that economic activity must not irreparably degrade or destroy these natural and human resources. However, sustainable development cannot be achieved by a single enterprise in isolation from the rest of society.

Sustainable development is a pervasive philosophy to which most participants in the global economy (including consumers and governments) must subscribe if we hope to meet today’s needs without compromising the ability of future generations to meet their own. ISO 14000 has been developed to contribute to sustainable development to the extent that it helps organizations move towards the above objectives. It endeavors to bring environmental issues into the mainstream of the corporate decision-making process.

The ISO 14000 standards have been developed to stimulate better environmental management practices by businesses. The framework of the ISO 14000 standards represents a move toward integrating sustainable development principles into business practices. The environmental management system defined in the ISO 14001 standard encourages self-organizing and self-regulating, which represents the groundwork for continuous improvement of environmental performance. It attempts to foster an alternative and more effective environmental ethic to product and process design, materials selection, and transportation logistics throughout a product’s life cycle, which may reduce its impact on the environment. For example, designing and specifying standard components could substantially reduce material waste on construction sites.

The ISO 14001 EMS also encourages the protection of non-renewable natural resources and the development of economics-driven reverse distribution systems that reclaim recyclable components at the end of a product’s service life. This is clearly a significant change, as traditionally we do not properly value the recycling process for renewable resources and care less for protecting non-renewable natural resources. Biggs and Nestel (1996) pointed that the ISO 14001 EMS has created a market-driven framework for balancing environmental protection with socio-economic needs that embodies the principles of sustainable development.

ISO 14000 provides the framework for designing environmentally friendly design processes and products. Many proactive companies have realized the competitive benefits of better environmental performance. For example, in the area of waste minimization and pollution prevention, better environmental performance and reduction in operating costs can bring more business opportunities, market share gains and lower cost relative to competitors. Design-for-environment strategies applying life-cycle concepts are emerging, and the new products from these design principles are selectively achieving market successes so long as the market pricing structure is carefully considered. Overall, as reviewed by Biggs and Nestel (1996), the ISO 14000 family of standards provides an integrated approach for improving regulatory compliance and for supporting environmental protection decisions in balance.
with other socio-economic needs. The authors argue that the introduction of ISO 14000 standards will significantly improve the environmental performance of business activities as well as the consistency of these activities with the principles of sustainable development (Ofori, 1998).

ISO 14000 and sustainable construction
All economic sectors, including the construction industry, now face an inescapable challenge posed by the term “sustainability”. Business activities of all kinds are the major causes of direct and indirect environmental impacts. The construction industry is commonly considered as one of the largest industries in both developed and developing countries in terms of investment, employment and contribution to GDP. Consequently, the impact of the construction industry on the environment is also significant.

Over recent years, an increasing number of researchers have investigated the impacts of the construction industry on the environment (e.g. Bourdeau et al., 1998; Cole, 1998; Trelar, 1996; Vanegas et al., 1996). Spence and Mulligan (1995) state that the construction has great environmental effects, particularly as far as concerning the loss of soil and agricultural land, the loss of forests and wild lands, air and water pollution, and the loss of non-renewable energy source and materials. After studying the possibility of incorporating sustainability in procurement, Ofori and Chan (1998) suggested that the impacts of construction activities on the environment include:

- competition for land with other activities such as agriculture;
- adverse effect on the plots of land which are developed, and their environment, such as changing their ecological characteristics;
- substantial consumption of both renewable and non-renewable resources;
- production of substantial volumes of wastes;
- consumption of large amounts of energy during the processing of materials, the construction process and in the use of constructed items;
- contribution to air pollution from the dust and substances, including some toxic ones, which are released during the production and transportation of materials, and in some construction operations; and
- disruption of the lives of the people living in the vicinity of the project through traffic diversions, noise pollution and others.

Thus, total environmental damage can be significantly reduced if the construction industry takes proper actions in improving its environmental performance.

Sustainable construction at an operational level includes recycling construction material and construction debris, using renewable materials and materials with high recycled content, designing efficient building systems, and informing building owners and managers how best to conserve energy and
resources in the operation and maintenance of facilities (Bourdeau et al., 1998). It calls for a systematic approach and continuous effort within the industry in order to achieve the objectives of sustainable construction. For this purpose, the ISO 14000 family of standards provides a systematic approach for construction enterprises to establish an effective EMS.

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An ISO 14001 EMS for the construction industry

A framework for implementing an EMS system for construction is shown in Figure 1. In many respects, the framework relies on Deming’s approach to continuous improvement (Plan-Do-Check-Act) as denoted by the feedback line. Construction companies need to evaluate how their business impacts the environment if they are to improve their overall performance. Fundamentally, if ISO 14000 is to become an integral part of a construction company’s culture it must be integrated with a corporate environmental management strategy. In fact, it is suggested that construction companies should be proactive in their approach to environmental management and not wait for governments to state that certification is a precursor for government contracts. Otherwise, construction companies will see it as a cost burden, as they have with the ISO 9000 standards (Love and Li, 1999).

ISO 14001 provides guidelines for construction organizations for developing an EMS for their business. The EMS can then be reviewed and audited for the purpose of registration with ISO. An EMS framework for implementing ISO 14001 in a construction company is proposed in Figure 1. The key components of the EMS are:

- an environmental policy;
- a planning strategy;
- an implementation and operation strategy;
- an operational control strategy;

![Diagram of Corporate Environmental Management System]

**Figure 1.** A framework for implementing an EMS in construction company
• strategies for checking and corrective action; and
• management review procedures.

Questions that a company should ask when evaluating environmental impacts as part of their EMS include:
• Does the company train its employees to understand and deal with environmental aspects and impacts, including hazards?
• Does the company have a system to prevent negative impacts from occurring?
• Could the failure of the company’s equipment or facilities result in a release to the environment that would have a significant environmental impact?
• Does the company’s work site(s) have facilities that are already contaminated or the subject of environmental concern?
• Will any intended changes to activities, products, or services, alter the environmental aspects and impacts?
• What state of affairs needs to exist for an environmental impact to occur?

These questions should form the basis of establishing the company’s environmental policy.

Environmental policy
The starting point of the EMS is to form an environmental policy (EP) for setting objectives and targets. The EP is the statement of commitment from top management to make a conscious decision about how their services and products impact the environment. This policy sets the overall EMS intentions of the company and contains a commitment to prevention of pollution and to continuous improvement as denoted in Figure 1. The EP is unique to a particular company, and must be communicated to all employees as well as made available to the public. Like ISO 9000, employee commitment is an essential ingredient for its successful implementation.

Planning
Planning is the stage where the environmental requirements are determined, and a program (or programs) is instituted to achieve the developed targets and objectives. Targets will generally vary throughout various functions in an organization depending on the activities, products, or services. Objectives are long-term goals, such as reduce solid waste to landfill, and targets on the other hand are short-term goals such as reduce non-hazardous waste by 50 per cent and hazardous waste by 80 per cent this year. In preparing the plan, a construction company needs first to review its operations, activities, products, and services, and to identify its interaction with the environment. This identification of the environmental aspects includes those that occur during
normal business operations, abnormal conditions, incidents and future activities. When the environmental aspects are identified, the organization needs to determine which aspects have, or can have, more significant impact on the environment. The company must also identify and have access to legal and other requirements which apply to its environmental aspects.

Implementation and operation

To implement the EMS, roles, responsibilities and authorities of personnel whose activities have an impact (directly or indirectly) on the environment need to be defined, documented and communicated throughout the company. The company must also provide adequate resources for the consistent implementation and maintenance of the EMS. Particular personnel need to be appointed by top management as the “management representative(s) for sustainable construction”. Irrespective of other responsibilities, the management representatives are given the responsibility and authority for ensuring that the implementation of the EMS complies with ISO 14001 and for reporting the performance of the EMS to top management.

The company may also need to identify training requirements of personnel whose work may have significant impacts upon the environment and ensure that these personnel have received appropriate training. Awareness is required for all personnel throughout the organization of the EP, on the EMS program and procedures, and on the actual or potential impacts of their activities on the environment. Also, the competence of personnel performing activities which might have significant environmental impacts needs to be determined by the company through education, appropriate training, and/or the development of appropriate experience as required.

Communication of relevant information on environmental aspects and the EMS is required throughout the organization and externally to concerned parties such as clients, consultants, and government bodies, etc. Information must be developed and maintained to describe basics of the EMS, reflect the interaction of the EMS with organization practice, and to provide direction to related documentation. Essentially, EMS documentation needs to be controlled to ensure that the current versions of the documents are available when and where the activities or tasks are undertaken. The documents must be reviewed on a regular basis, revised as needed and approved before issue or re-issue. Obsolete documents must be removed or otherwise safeguarded against inadvertent use.

Operational control

Processes and activities that can have a significant impact on the environment and that are relevant to the organization’s policies, objectives and targets need to be identified. The construction company must ensure that these operations are carried out under controlled conditions. Controlled conditions may include documented procedures, norms and standards for operation. The firm must also identify the significant environment aspects concerning the goods and
services through which the firm communicates the relevant procedures and requirements to its suppliers and sub-contractors. The company needs to identify the potential for accidents and emergency situations. Effective procedures should be established for appropriate response to the accidents and emergency situations, which include the prevention and mitigation associated with the environmental impacts such as air and noise pollution. Emergency plans and procedures need to be developed, communicated and tested to help the company ensure that any accidents will be effectively and efficiently dealt with by specific personnel.

**Checking and corrective action**

Characteristics of operations and activities, which can have significant impacts on the environment, need to be monitored and measured regularly. Records of monitoring and measurement information are required to track performance, to prove that operating controls were effective and to demonstrate conformance with objectives and targets. Monitoring and measurement results need to be compared to the legal and other requirements to demonstrate compliance. Any equipment used for monitoring and measurement must be capable of the accuracy required and calibrated on a regular basis. Responsibilities and authorities need to be defined for dealing with non-conformance found in the EMS including the actions to be taken to mitigate any impact caused and for initiating corrective and preventive action. Records of implementing the EMS must be identified, collected, stored and maintained to provide objective evidence of conformance to the ISO 14001 standard, legal and other requirements. These records include training records, EMS audit results, management review records and the results of monitoring and measurement.

**Management review**

Audits are required on a periodic basis in order to provide assurance that the EMS is operating as planned, and providing the information for management review and to determine the capability of the EMS in achieving the company’s environmental objectives and targets. It is imperative that top management regularly reviews the EMS so that it keeps aligned with the company’s overall strategic approach to environmental management. This review should then be also conducted by middle management to ensure that the system is operating effectively and provides the opportunity to address at the coalface any changes that may be required to the EMS. Changes to policies, objectives or targets may be required, due to changes in stakeholder’s expectations, altered business operations, advances in technology, results of audits, or simply for continual improvement.

**Conclusion**

Sustainable practices represent a global trend of social and economic development. Every government, organization, and individual has its role to play. The principle of sustainability is increasingly challenging the
construction industry, which has significant impacts on environment. If a construction firm does not keep up this trend and consider implementing some measures for improving environment performance in their business, the company will find limited opportunity for its survival in the market, which is becoming more and more environmentally conscious.

ISO 14000 standards provide a mechanism that links the concept of sustainable development with the construction procurement process. Although the standards are voluntary by design, they are relevant to any company as long as its business activities have environmental impacts. The implementation of the system does not incur extensive burdens. In fact, if properly implemented, the system may help win more businesses and reduce cost in production and operation through improving environment performance. As construction is an important industry in any economy, it has an obligation and the potential to make a significant contribution to sustainable development through implementing ISO 14001. It is suggested that the implementation of an ISO 14001 EMS by construction companies may improve the performance of the built environment – only time will tell.

References


