Overview of ISO Standards and their Impact on ICT and Engineering Practices

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Abstract
This paper describes a policy that can support many companies and governments, and this policy is known as the Standard. It is primarily aimed at companies to improve organizations' relationships with their customers. It also aims to help governments and especially those in developing countries to benefit from the experiences of developed countries. In this paper, we refer to of the most important organizations in this field - International Organization for Standardization (ISO). This report provides an overview of ISO's history and how the company is organized. It also discusses its impact on the world and in the field of Information and Communication Technology (ICT) and Engineering practice.

Keywords
Standard, International Organization for Standardization (ISO), Quality Management System (QMS), Standard Family, Information and Communication Technology (ICT), Information Security Management Systems (ISMS).

I. Introduction

Currently, products in different fields are becoming bigger and managing them is very difficult. Mass production causes many problems and one of the most serious is the decline in quality (Gullu and Motorcu, 2002). Users may find difficulties in comparing products' quality even though they may be made by the same company. Many companies reach a stage where they do not seem to care about product quality or customer safety. They focus only on increasing their profits. They end up producing a product that uses contaminated or compromised materials (Reliance Standards, n.d.).

Many people try to solve this problem by controlling the quality and not the quantity of products. They can regulate it by using systems or rules which help customers understand the quality of products being created. It also helps businesses recognise that good products mean less money and time are spent on rectifying any problems. These rules give both customers and businesses guidelines on how to make good products. These rules which are described as standards may refer to design and qualities, for example how reports should be written, how universities should be structured, etc. (Brunsson, Jacobsson and Associates, 2000). Standards are a collection of rules or ideals that ensure the desirable characteristics of products and services such as quality, environmental friendliness, safety, reliability, and efficiency. When products and services meet our expectations, we tend to take them for granted and not be aware of the role that standards play. However, when standards are absent, products will be of poor quality, do not fit, are incompatible with equipment that we already have, are unreliable or dangerous. On the other hand, when products, systems, machinery and devices function effectively and safely, this is because they meet the required standards (Lucas and Hatcher, 2006).

Standards are devised by people who are experts in certain fields of endeavour. Developing standards is based on a formal process and this can take years to do (Morikawa and Morrison, 2004). There are different types of standards, for example Private Standards, Open Source Standards, Publicly Available Standards (PAS) and Formal Standards. Each type has different users and developers. Most developers are private sector organizations or private persons (The British Standards Institution, n.d.).

II. International Organization for Standardization (ISO)

A. A Brief Introduction to ISO

The organization in question has different acronyms in different languages, for example in French it is OIN and in English it is ISO. ISO is derived from the Greek word isos which means equal and the link to standards is that if two objects meet the same standard, they should be equal (ISO website, 2009).

ISO is the largest developer and publisher of International Standards globally. It is a network of the national standards institutes that exist in 162 countries. All of those member countries have a central secretariat in Geneva, Switzerland which controls the system. It is a non-governmental organization although its members are part of their countries' governmental structure, or are mandated by their government or sections of the private sector (Cortina, 2010).

ISO forms a bridge with the public and private sectors in that it creates a consensus that can be established regarding solutions that meet both the requirements of business and society's wider needs. It creates internationally accepted standards on everything and it has a rating system that combines various rating systems into one unified and universally accepted scale (Geller, 2011). ISO's strategy and policies has led to the development of more than 18,500 International Standards. It publishes about 1100 new standards every year. All of these standards can be seen online (ISO website, 2009).

B. A Brief History of ISO

The organization which today is known as ISO began in 1906 as the International Electrotechnical Commission (IEC) in the electrotechnical field. In 1926 the International Federation of the National Standardizing Associations (ISA) was established following pioneering work in other fields. This organization focused on mechanical engineering but it ended bin 1942 during the Second World War (Martincic, 1997).

In 1944, the United Nations Standards Coordinating Committee (UNSCC) led to the creation of ISO. In 1946, a group of 25 countries decided to send delegates to meet in London and these delegates established a new international organization. Its main aim was to facilitate the international coordination and unification of industrial standards. It officially began operations on 23 February 1947 (ISO website, 2009).

In April 1947, a meeting in Paris produced a recommended list of 67 ISO technical committees, based on previous ISA committees. In 1950, ISO published the first standard titled "Standard reference temperature for industrial length measurement"; what were known at the time as "Recommendations". The International Standards developed by ISO are of high value to developing countries because many new members came from the developing world during the 1950s and 1960s (ISO website, 2009).

During this time many problems emerged in industrialized nations because they lacked established industrial infrastructures, technical components and financial and technical resources. For this reason, in 1961 the Committee on Developing Country Matters (DEVCO) was created to respond to the needs of these members. Other initiatives followed that helped developing countries play a role in ISO's work without incurring the cost of full membership (ISO website, 2009).

ISO – when it began operations - focused on standards for some products known as technical standards for things such as hardware, screws, sizing systems for clothing and shoes, and laser technology and photo film. Now ISO has expanded into many other products and systems and indeed moved into environmental and social policy (Morikawa and Morrison, 2004).

C. ISO's Aims

ISO facilitates communication between the manufacturer and the consumer so that their expectations are the same. The manufacturer understands their responsibility and the consumers are satisfied by what the manufacturer does to conform to established guidelines (Business Knowledge Source, n.d.). ISO aims to safeguard consumers and users in general from dangers emanating from certain products and services. It makes the manufacturing, development and supply of products and services better well-organized, safer and cleaner through its standards. A manufacturer may have to make more of a conscious effort in order to comply with regulations but they agree that it is better for all parties if there are manufacturing standards because it can help them market good better to international consumers (ISO website, 2009).

Moreover, ISO helps governments generally and government in developing countries especially. It provides governments with a technical basis for health, safety and environmental legislation or regulations, and conformity assessment. It enables them to benefit from standards. In the United States and around the world, ISO provides comprehensive data, leading -edge analytics, and decision-support services to the federal government and municipal leaders. With the cooperation and support of many federal, state, and local agencies, ISO delivers mission-critical information to solve any challenging infrastructure problems and assist in disaster readiness and threat assessment for communities (Government Solutions).

It also helps developing countries through technical assistance and training activities derived from the ISO Action Plan in order to respond to a wide variety of needs and requests received from ISO members in developing countries and their stakeholders. These deliverables take the form of seminars, training courses, workshops, e-learning, sponsorships, ICT (Information and communication technologies) support and training-of-trainers programs in every aspect of standardization and relevant activities (ISO website, 2009).

Facilitating trade between countries is another goal of ISO standards. International trade and commerce in today's world is vital for remaining competitive and profitable. It is therefore requisite

to have a standard that everyone can depend on. Such standards provide a reference framework, or a common technological language, between suppliers and their customers even though circumstances in business may change. It also facilitates other things that have a relationship with international trade such as freight, for example, and without the standards international trade would be slower, more expensive, and unscientific (services. indiabizclub.com, n.d.).

Finally, it is evident that ISO has certain goals it wants to achieve and makes our life simpler by providing solutions to problems. These are achieved when products and services are based on International Standards and these bring them an increasingly wide choice of benefits from the sometimes corrosive effects of competition among suppliers and other businesses. Also, it benefits manufacturers by improving the climate for international trade. This includes removing trade barriers to encourage uniform practices around the world (ISO website, 2009).

D. ISO's Structure

ISO has processes which help it to produce standards. These processes reflect how ISO is structured in terms of its governance and operations. These operations are the secret which make ISO very popular with many companies and governments globally. In this section I will overview ISO members and their positions, and how it ISO is organized. I will also highlight the processes and stages that ISO follows when it is producing standards.

ISO members approve a Strategic Plan that serves a five-year period. Member countries include correspondent members who have full access to information while subscriber members have reduced membership fees and limited access to required information. They may attend the general assembly as observers. Figure 1 depicts the distribution of ISO membership and country categories. The ISO general meeting is an annual event and consists of the Principal Officers of ISO and delegates nominated by member bodies (Morikawa and Morrison, 2004). The Principal Officers consist of the President, the Vice President (policy), the Vice President (technical management), the Treasurer, and Secretary-General.
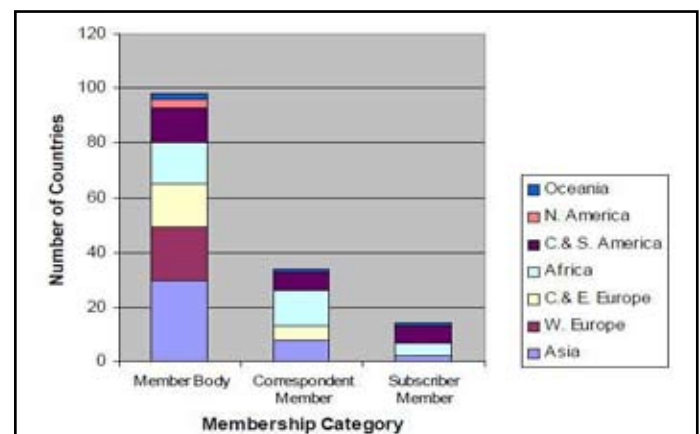

Fig. 1: ISO Membership (Morikawa and Morrison, 2004)

This meeting's agenda concerns actions relating to the ISO annual report, Strategic Plan with financial implications, and the Treasurer's annual financial status report on the ISO Central Secretariat and others (ISO website, 2009). With reference to governance functions, these are mostly undertaken by the Council under the supervision of member bodies. The Council meets twice a year and it has a number of policy development: CASCO (conformity assessment); COPOLCO (consumer policy),

and DEVCO (developing country matters). The Council receives reports from the Technical Management Board (TMB) which is responsible for the overall management of technical work. All operations are managed by the Secretary-General (chief executive officer) who reports to the Council (ISO website, 2009). Figure 2 depicts ISO's organizational structure (Bannitz, 2010).

ISO publishes its standard in A4 format and this is the ISO standard paper size. ISO's standards are also available in soft copy format and carries the ISO logo and designation, "International Standard". Every ISO standard is categorized with a number which clearly articulates its position in the 'family' of standards. Each family refers specifically to a particular product, material, or process such as ISO 9001 (quality) and ISO 14001 (environment). Each standard in the family is numbered sequentially and this follows the number given to the family such as ISO 9001, which is the first standard in the ISO 9001 family. The number is followed by the year which is more commonly used when standards are updated or revised. For example, ISO 14001:2000 has been updated to ISO 14001:2008. The ISO 9000 and ISO 14000 families are implemented by 610000 organizations in 160 countries, and they are among ISO's most widely known standards (Morikawa and Morrison, 2004).
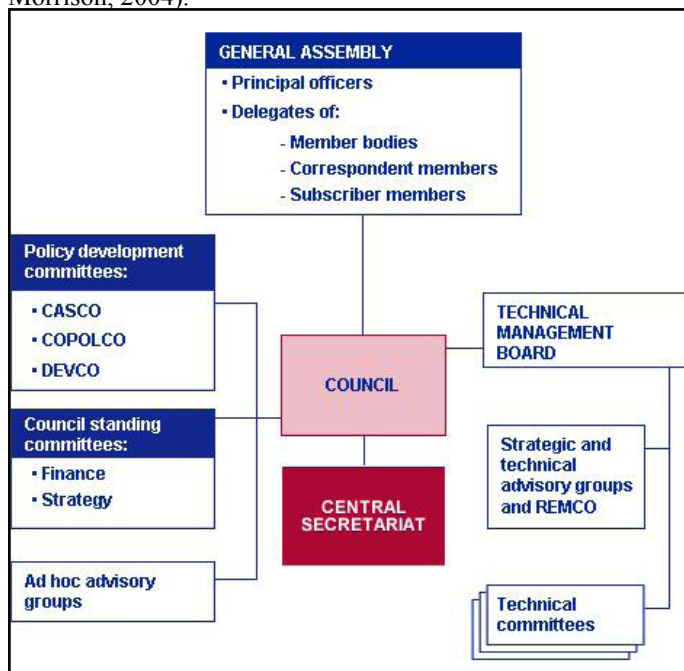
ISO's standards represent an international reference system that is applicable to any organization, large or small, whatever its product or service, in any sector of activity, and whether it is a business enterprise, a government department or public administration unit. This is called generic management system standards. ISO standards families are evaluated during the certification process concerning how a company functions and performs certain operations; it does not refer to the actual products or services produced. When any organization wants to obtain a certificate for its products or services, it must apply for the Conformity assessment form which is available on the ISO website. This form allows the ISO to test for conformity with specifications or compliance with safety, or other regulations before the certificate is issued (Maddox, 2011).

III. Impact of ISO

Lacking standardization in any work causes quality to decrease and problems to rise. It also leads to increased costs and more 'down

time' so that completed work is delayed. For these reasons ISO has provided great benefits to business in standardizing processes and compliance needs for government and non-government institutions (Vinelli, 2009).

International Standards have an impact on governments especially in developing countries by providing technological and scientific advice that underpins health, safety and environmental legislation. It gives developing countries a basis for making the right decisions when investing their scarce resources and thus not squander them. ISO helps businesses to develop and offer products and services that meet internationally accepted specifications in their market sectors (Magd, 2006).

Furthermore, ISO benefits customers around the world by giving them more choice in selecting suppliers and ensuring that the goods and services they receive are of high quality. ISO contributes to the quality of life in general by ensuring that the transport, machinery and tools we employ are safe (ISO website, 2009). In the next part, I describe ISO's influence on two important fields of endeavor: Information and Communication Technology (ICT) and Engineering practice.

A. Impact of ISO on ICT

In the 1980s ISO began the work of devising "process" standards, specifically the ISO 9000 Quality Management System standards. Firms in the ICT industry want to become ISO certified in order to improve their business practices and retain business with certain customers. More than 90% of ICT companies worldwide work within the needs of standardization. The term standardization is used in ICT companies to measure the quality of their services. Applying ISO in ICT companies is considered to be significant in that it allows these companies to implement the total quality management (TQM) strategy to improve their organizational performance (Magd, 2006).

ICT practices have used many ISO standards such as ISO 9001 QMS, ISO 20000 ITSM, ISO 27001 ISMS and other standards. For example, ISO 9001 QMS helps bring out the best in organizations by enabling people to understand the processes of delivering products/services to customers. ISO's Quality Management System is a model for continual improvement and customer satisfaction, and any organization looking to improve how it functions or does business can use it, regardless of size or sector. ISO 20000 ITSM promotes the adoption of an integrated process approach for effectively delivered managed services to meet business and customer requirements. To take another example, ISO 27001 ISMS provides information to responsible parties for establishing, implementing, operating, monitoring, reviewing, maintaining and improving a documented Information Security Management Systems (ISMS). It also designed to ensure adequate security controls that protect information assets, document ISMS and give confidence to customers and interested parties (Meskovska, Ohrid and Partners Consulting, 2009). Figure 3 shows the ISO standards used in management systems that employ ITC practices.
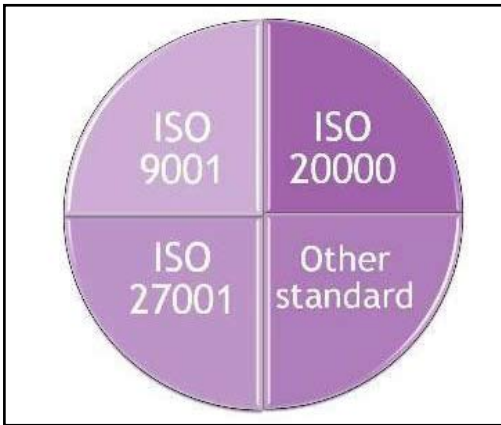
Fig. 3: Management Systems (Meskovska, Ohrid and Partners Consulting 2009).

Figure 4 describes the integration system that businesses can use. Integration of management system should be carefullyplanned and implemented because it can deliver an organization's needs in the simplest and most effective manner (Meskovska, Ohrid and Partners Consulting, 2009).

ISO has worked hard to improve ICT companies' operations such as developing Standardization and Innovation in IT (SIIT). It aims to promote interdisciplinary research about ICT standardization. It also helped organize the Academy for Standardization bi-annual conferences which typically attract around 70-100 participants and runs a mailing list with around 250 members. ISO also contributes to a semi-annual publication – the Journal on IT Standards & Standardization Research (JITSR).
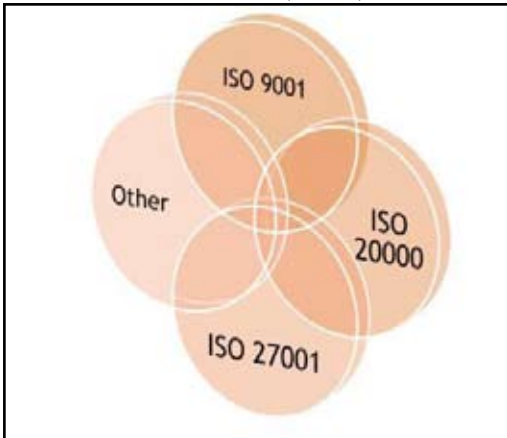

Fig. 4: Integrated Management Systems (Meskovska, Trajkovski and Partners Consulting, 2009).

ISO like other academies or organizations that focus on standardization has produced a series of books on advances in IT Standards and Standardization Research (Jakobs 2010). To help achieve high standards of customer service in many areas such as ICT Systems, Business Systems Development, Web Developments, Business Process Review, ISO has adopted a standards-based approach to service delivery and has successfully achieved accreditation in Quality ISO 9001, IT Service Management ISO 20000, and Information Security ISO 27001 (Twaissi, 2008).

All these standards complement each other and support the work of the department which aims to provide the following benefits to its staff and customers through improved efficiency, standardization and consistency, enhance customer responsiveness, recognition and staff morale. In the field of information technology, ISO

and IEC have established a Joint Technical Committee 1: ISO/ IEC JTC 1. Draft International Standards adopted by the joint technical committees are circulated to national bodies for voting and publication. An International Standard requires approval by at least 75% of the national bodies that cast their votes (Provencher, 2009).

B. Impact of ISO on Engineering

The impact of ISO's standards has been very strong in the field of electrotechnical work. It has devised technical and engineering standards for things such as hardware and photo film, but moved into larger engineering practices and projects.

The first standard created by ISO mechanical engineering was done 40 years ago, and ISO followed its initial mission by focusing on technical standards for specific products or technologies such as screws, sizing systems for clothing and shoes, and laser technology (Morikawa and Morrison, 2004).

ISO created standards that have impacted on engineering and safety such as ISO 12000 Standard Family, ISO Standard 13849 and ISO 9000 Standard Family. ISO 12100-1 is titled Safety of Machinery, Basic Terminology and Methodology, while ISO 12100-2 is called Safety of Machinery Technical Provisions. ISO standard 12100 parts 1 and 2 provide engineering guidelines to maximize a product's safety. ISO Standard 12121 defines how safety risk assessments are performed. ISO 13849 is known as Safety Related Parts of Control Systems. ISO Standard 13849 provides safety requirements for the design of safety-related parts of control systems for any type of machinery (Wilhite, 2010).

Linked to its work in engineering practice is ISO's research into Quality Assurance. One of these quality system standards is the ISO 9000 standard, which has been adopted by many countries and is applied in engineering and construction. It is important in the engineering and construction industry because of the risks involved in any project. The risks involved in not completing a project on time are high, because many external factors will affect how a project ultimately functions. It is vital that a built-in quality assurance system is developed to avoid what may result in poor quality products and service being delivered to the customer. Everyone involved in the engineering and construction business has, in different ways, benefited from a common approach to quality work. Systematic quality work reduces the costs of failure in the final product or project. ISO's standards do make quality work more efficient by creating uniformity. A contractor's in-house quality assurance system is therefore of primary importance (Bubshait and Al-Atiq, 1999).

In 1997 ISO published a draft paper for comment regarding the standard on Fire Safety Engineering. It wanted to provide guidance on a flexible, performance-based approach to assess the consequences of fire in terms of saving lives, property loss, business interruption, contamination of the environment and destruction of heritage. This work took four years to do and as a result, a suite of documents was prepared. The first describes a framework approach to Fire Safety Engineering. Further documents describe the components of initiation, growth and suppression of fire and analyzing the effect of fire on people's lives and the design of buildings (Reynolds and Berry, 1997).

IV. Conclusions

Today's global economy demands a series of standards that everyone can rely on. International manufacturing standards ensure that doing business with a company that values standardization

will lead to customers receiving at least a minimum standard level of performance in quality. This is a role that ISO plays as a premiere standards organization. It facilitates communication between manufacturer and consumers so that both entities have the same expectations. The manufacturer understands their responsibility and the consumers are satisfied when both agree that product or service guidelines have been met.

In this report the importance of standards to our way of life has been articulated and how ISO has helped over the last 60 years. ISO has worked in many areas of endeavor, but especially so in health, safety, developing countries' economies and engineering In this report, ISO's history and structure have been described, and this was followed by an analysis of its goals and how its standards benefit the world economy. The procedures involved in producing ISO standards were also articulated and the organizational structure affects related processes.

V. Acknowledgement

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