Economic benefits of standards

International case studies

Volume 2

International Organization for Standardization

ISO

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ISO in brief

ISO is the International Organization for Standardization. ISO has a membership of 164* national standards bodies from countries large and small, industrialized, developing and in transition, in all regions of the world. ISO's portfolio of over 19 200* standards provides business, government and society with practical tools for all three dimensions of sustainable development: economic, environmental and social.

ISO standards make a positive contribution to the world we live in. They facilitate trade, spread knowledge, disseminate innovative advances in technology, and share good management and conformity assessment practices.

ISO standards provide solutions and achieve benefits for almost all sectors of activity, including agriculture, construction, mechanical engineering, manufacturing, distribution, transport, healthcare, information and communication technologies, the environment, energy, safety and security, quality management, and services.

ISO only develops standards for which there is a clear market requirement. The work is carried out by experts in the subject drawn directly from the industrial, technical and business sectors that have identified the need for the standard, and which subsequently put the standard to use. These experts may be joined by others with relevant knowledge, such as representatives of government agencies, testing laboratories, consumer associations and academia, and by international governmental and nongovernmental organizations.

An ISO International Standard represents a global consensus on the state of the art in the subject of that standard.

*in May 2012

Contents

Overview

Over the last decade, several studies have been conducted with the aim of determining the economic and other benefits of the use of standards. These studies were undertaken by ISO member bodies and other organizations, and had a mainly macroeconomic focus.

Although each of the studies confirmed the expectation that using standards had positive effects and resulted in economic and other benefits, it was difficult to compare the results because each study used a different approach to measure the impacts of standards.

The ISO Methodology

For this reason, ISO developed a methodology for assessing and quantifying the economic benefits of standards (the " ISO Methodology "), with the support of Roland Berger Strategy Consultants. The objective is to quantify the impacts of standards on different organizations, and make it easier to compare the assessment results.

The methodology is applied to individual organizations, mainly companies, and has a microeconomic focus. However, it can be extended to the analysis of whole industry sectors.

It should be noted that the assessment of the impacts of standards is not limited to International Standards developed by ISO, the International Electrotechnical Commission (IEC) or other international standardization organizations. In fact, national and other " external " standards developed by standards organizations to which participation is open and the resulting standards made publicly available, are included in the assessment. Not included are company-internal specifications that are neither publicly available nor developed through an open, consensus-based process that allows participation by interested stakeholders.

Pilot projects

ISO has worked with its members in over 20 countries to conduct pilot projects to assess and quantify the benefits companies can obtain from the use of standards. These pilot projects were undertaken in close cooperation between an ISO member body, an academic institution, a company in the respective country, and staff of the ISO Central Secretariat acting as advisors to the project team. The studies were conducted between October 2010 and June 2012 and are published in two books, the first issued in August 2011 and the second in August 2012.

Selection of companies

The selection of companies for the pilot projects was made by ISO members in their countries. The only requirement was that the company must have been a user of standards for several years, and that the member body had a good relationship with the company to make sure that key personnel were available for interviews and discussions with the project team. **Table 1** shows the spread of different industries of the companies assessed in 21 international case studies completed so far, and their inclusion in one of the two ISO books on the subject. Manufacturing entities constitute the large majority of the selected companies, which is not surprising considering the historical relevance of technical standards for manufacturing.

Industries	Countries	Book 1 or 2
Agri-food business	Cameroon	2
	Peru	1
Chemical industry	Thailand	1
Construction & construction materials	Botswana	1
	Indonesia	1
	Italy	2
	Lebanon	2
	South Africa	1
	Sri Lanka	2
Electrical appliances	Vietnam	1
Electrical power transmission	Germany	1
Food retail/food logistics	Singapore	1
Heating, ventilation, air conditioning	Jordan	2
Industrial automation equipment	Brazil	1

Industries	Countries	Book 1 or 2
Information & telecommunication	Germany	1
Juice production	Egypt	2
Pipes and piping systems	China	2
	Colombia	1
	Mauritius	2
Shipbuilding	China	2
Water supply	Senegal	2

Table 1 – Industries and countries covered by the case studies

An overview of the business functions in the selected companies where standards had the most impact, and which therefore were the subject of assessment, is given in **Table 2.** It shows that production is the business function most frequently assessed, followed by marketing and sales, procurement, and research and development.

The size of the companies varied from small enterprises with 25 employees and annual sales revenues of around USD 4.5 million, to those with several thousand employees and annual revenues of over USD 2 billion.

Variations in the use of standards, and case study results

The results demonstrate consistently that companies achieve benefits from using standards. From the case studies it is possible to identify three main types of use of standards, which cover significantly different functions :

- Standards can be used to streamline internal company processes, decrease waste and internal costs, and increase the efficiency of R&D. Gains in efficiency also occur through the reduction of transaction costs between suppliers and customers. Most of the case studies provide evidence of this type of impact, and the benefits from using standards are valued, in terms of contribution to company gross profit, at between 0.15 % and 5 % of annual sales revenues.

- Some case studies provide examples of standards used as the basis to innovate business processes, such as cold chain standards that helped a company extend the geographical area for food supply. In other cases, standards helped to reduce the risk to companies from marketing new types of products in national markets and contributed to customer acceptance of these products. Standards can also be used as a basis for the internationalization of company operations by providing a common management framework.
- Other case studies show that standards have been used as a basis for the development of new products, to support market take-up of new products, or the creation of markets that did not exist before (the term "new product" refers either to products that were completely new, or that may have existed before in other countries but were new to a national market). In some cases the impact of standards significantly exceeded the previous figure, reaching a contribution to company gross profit of up to 33 % of annual revenue.

By applying key standards, a company may be able to shape or access new markets. In such cases standards can play a central role in creating confidence in a new technology among potential customers, or in building trust that a company entering a new market will be able to consistently deliver products and services of the required quality.

The case studies also provide evidence that a focus on standards can be the core of an upgrading strategy through which companies can aim at entering higher value-added segments of the value chain in their respective industries.

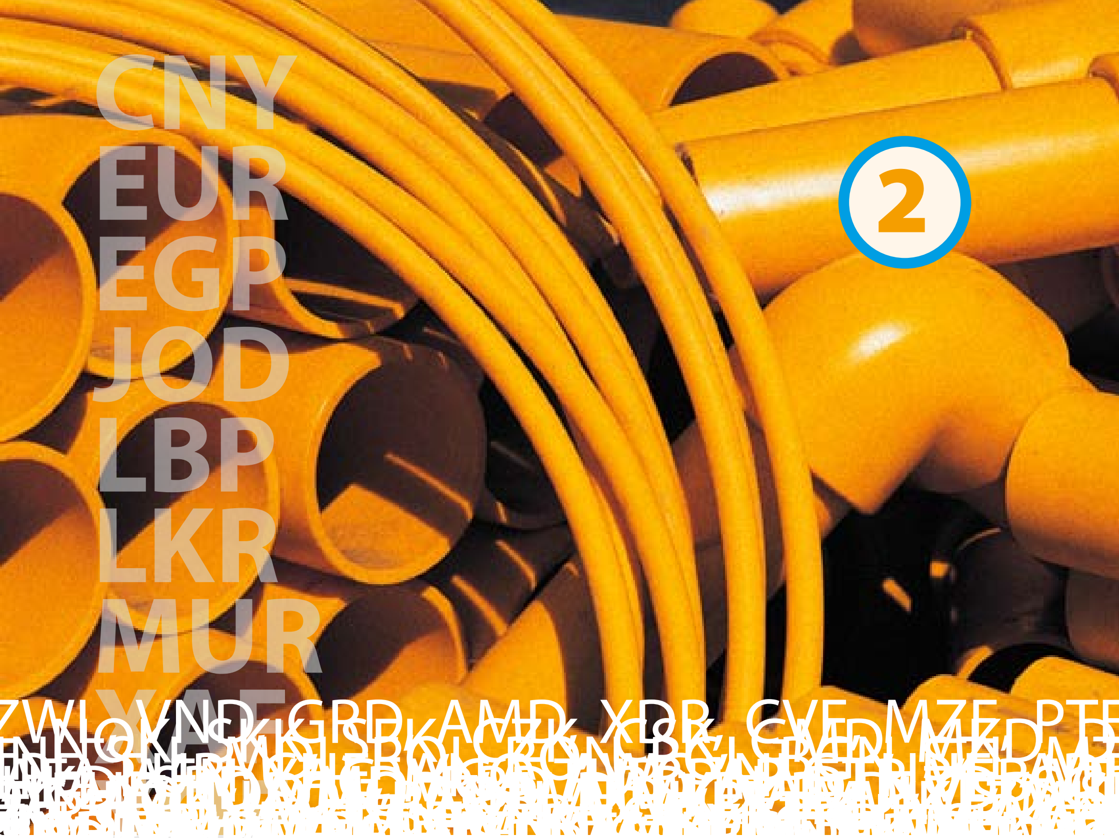
Those readers interested in more details of the case studies can find full versions of the reports published in the two books at the following location : www.iso.org/benefits_of_standards.

Companies/Countries	Business Functions (BFs) subject to case study assessment										
	Primary BFs					Support BFs				Additional BFs	
	Inbound Log	Production	Outbound Log	M&S	After Sales	M&A	R&D	Engineering	Procurement	S&L	Retail
PT. Wijaya Karya (Indonesia)	×	×		×			×				
NTUC Fairprice (Singapore)									×	×	×
PTT Chemical (Thailand)		×				×					
VINAKIP (Vietnam)	×	×		×			×		×		
Festo Brasil (Brazil)		×						×	×		
Gerfor (Colombia)		×		×							
DanPer Trujillo (Peru)	×	×	×	×							
Lobatse Clay Works (Botswana)		×									
PPC Cement (South Africa)		×		×			×		×		
Siemens AG (Germany)		×					×				
Nanotron (Germany)				×		×	×				
PPP PSL (Mauritius)	×	×							×		
Juhayna Food Industries (Egypt)		×	×	×						×	

	Business Functions (BFs) subject to case study assessment										
	Primary BFs					Support BFs				Additional BFs	
Companies/Countries	Inbound Log	Production	Outbound Log	M&S	After Sales	M&A	R&D	Engineering	Procurement	S&L	Retail
Petra Engineering (Jordan)		×		×		×	×		×		
Holcim Lebanon (Lebanon)		×		×		×			×		
Maga Engineering (Sri Lanka)	×	×							×		
Dalian Shipbuilding (China)							×				
Xinxing Iron Pipes (China)	×	×		×	×	×	×	×	×		
SDE (Senegal)		×		×	×	×			×		
Chococam (Cameroon)		×		×		×			×	×	
Mapei (Italy)		×		×	×	×	×	×			
TOTAL :	6	18	2	13	3	8	9	3	11	3	1

M&S = Marketing & Sales // M&A = Management & Administration // R&D = Research & Development // S&L = Storage & Logistics

Table 2 – Business functions selected in the assessment of economic benefits of standards



2

Plastic Pipes and Products Piping Systems Ltd., Mauritius

Country : Mauritius

ISO member body : Mauritius Standards Bureau (MSB)

Project team :

Project leader : Mr. Beejadhur Guness, Head of Standards Division, MSB
Member : Mr. Khemraj Ramful, Director, MSB
Member : Mr. Donald Lindsay, Head of Engineering Division, MSB
Member : Mr. Ramnarain Dewkurun, Administrative Officer, MSB
Member : Ms. Sameema Beebeejaun, Standards Information Assistant, MSB
ISO Central Secretariat advisor : Reinhard Weissinger, Manager, Research, Education & Strategy
Duration of the study : August 2011 – April 2012

2.1 Objectives and organization of the pilot project

Studies conducted earlier on the economic impacts of standards confirmed that the use of standards by organizations had positive effects and resulted in economic and other benefits. These studies had mostly a macroeconomic focus – that is, they covered the whole economy of a country – and each used a different approach to measure the impacts of standards. Since no common methodology was used, the results could not be compared.

In 2010, ISO published the 'ISO methodology' – a structured approach to assessing and quantifying the economic benefits of standards. The methodology has a microeconomic focus – it covers primarily the assessment of individual organizations, but can be extended to the analysis of whole industry sectors. It is based on the value chain model, a concept that represents a business as a sequence of value generating activities and quantifies the contributions of the various activities to value creation. By applying the same methodology, it is easier to compare the results of the impacts of standards obtained from different studies.

This study is an assessment of the economic benefits of standards carried out in a Mauritian company, *Plastic Pipes and Products Piping Systems Ltd*. (hereafter : PPP PSL) following the ISO methodology. It was undertaken by the Mauritian Standards Bureau (MSB) in close cooperation with the company's management and technical staff, and the advisory support of the ISO Central Secretariat.

This pilot study, together with other pilot studies using the ISO methodology, will provide valuable information on the impacts of standards in diverse organizations operating in different industry sectors. The information will help companies select and use appropriate standards in their operations.

The primary objective of this study is to apply the ISO methodology in PPP PSL to assess and quantify the economic benefits resulting from the use of standards. It could eventually be used to promote the implementation of standards in other companies, and to encourage stakeholders to participate in standards development.

The assessment was structured in several stages. Essentially, it comprised interviews with PPP PSL management and technical staff to obtain information for the study. A value chain analysis was first developed for the industry and the company. Key value drivers and those areas of the company most impacted by standards were identified and selected for the assessment. Operational indicators were identified to assess the impacts of standards on the activities, and quantified in monetary terms as cost savings or increases in revenue.

2.2 Introduction to the Company

PPP PSL is well-established in Mauritius, and is part of the Desbro Group of Companies. It is located at Plaine Lauzun near the capital, Port Louis, where it manufactures plastic pipes and fittings made of PVC-U in sizes ranging from 20 mm to 250 mm. Various types of PVC pipes are produced for different applications including cold and hot water supply, sewerage, drainage and conduits for electrical wires. PPP PSL has a subsidiary company located at La Tour Koenig, involved in the manufacture of polyethylene (PE) pipes.

PPP PSL also manufactures polypropylene (PP) single wall corrugated pipes in small sizes for electrical conduit applications. Recently, the company invested in machinery for the manufacture of PE double wall corrugated pipes in sizes from 50 mm to 250 mm under license from Fränkische Rohrwerke, Germany. The double wall pipes are manufactured for telecommunication and sewerage applications.

Quality is the guiding principle at PPP PSL. All products are manufactured according to international or European standards. It was one of the first companies in Mauritius to be certified to ISO 9001.

STR Marketing Ltée is the marketing arm for PPP PSL manufacturing. It has export markets in the Indian Ocean Islands and the East African Region. The company has been very active In Madagascar for over 10 years, supplying products to governmental institutions and the private sector. In Reunion island, PPP PSL also supplies its full range of double wall pipes to France Telecom approved contractors.

Pipe Technology Center Ltd is a newly registered company specialized in training in the piping sector. The annual turnover of the whole group is approximately USD 15 million. All companies in the Desbro Group are private entities.

2.3 Attitude of the company towards standardization

PPP PSL has been involved in standardization since 1975, when it started manufacturing plastic pipes, fittings and related accessories. The company uses standards as a strategic tool to improve the quality of its products, and to enhance competitiveness.

Various standards are applied in the chain of activities from procurement of raw materials,through production, and for conformity testing of final products. It has a well-equipped testing facility and trained personnel, and can perform most of the tests on raw materials and finished products in house. It implements a quality control system to monitor the production processes.

The company is among the first locally to obtain the MSB product certification mark for polyethylene and un-plasticized polyvinyl chloride pipes and fittings, based on the relevant ISO standards.

PPP PSL has built an excellent reputation in the local and regional markets. The company implemented a quality management system (QMS) in accordance with ISO 9001 to manage its internal processes, and has been certified to the standard since 1995. QMS and product certifications have assisted the company in obtaining tenders from public organizations in Mauritius (the Central Water Authority and the Irrigation Authority) for the supply of plastic pipes, and have opened up access to regional markets. The company has also obtained the Certification Mark of the Agence Française de Normalisation (AFNOR) for its PE pipe production, enabling access to the market in Reunion, which belongs to France.

PPP PSL participates in national standardization work related to plastic pipes and products. Its expert contribution has facilitated the adoption of several ISO International Standards for plastic piping systems.

The company uses standards as value drivers. It was an early adopter of the European Standard for structured wall PVC-U/PE/PP pipes for sewage, giving PPP PSL a competitive advantage on the domestic market. The company subsequently obtained product certification for this type of pipe and was awarded the tender to supply pipes for the national sewage project.

In addition, PPP PSL conducts regular training and education programmes on piping techniques and on the relevant standards. These are targeted mainly at upgrading the skills of contractors and others involved in pipe work.

2.4 Application of the ISO methodology

2.4.1 Analysis of the value chain

A value chain is a chain of activities to produce a certain output, product or service. In a company, products or services move through all activities in a prescribed order gaining value at each stage. The chain of activities inside a company is the company value chain.

The company value chain is part of a larger system that includes the value chains of the upstream suppliers and downstream customers. The sequence of activities that exceed the scope of a particular company and extend to an entire industry sector is called the industry value chain.

2.4.2 The value chain of the plastic and plastic pipe industry

The plastic pipe industry is principally engaged in the production of unplasticized poly(vinyl chloride) (PVC-U) and polyethylene (PE) pipes, fittings and auxiliary equipment from raw materials and resins. Plastic pipes are also imported from Europe, the Far East and South Africa. These pipes are widely used for drinking water supply, irrigation, sewage, waste and drain discharge. Other applications include conduits for electrical cables and underground telecommunication cables. **Figure 1** illustrates the value chain of the plastic industry.

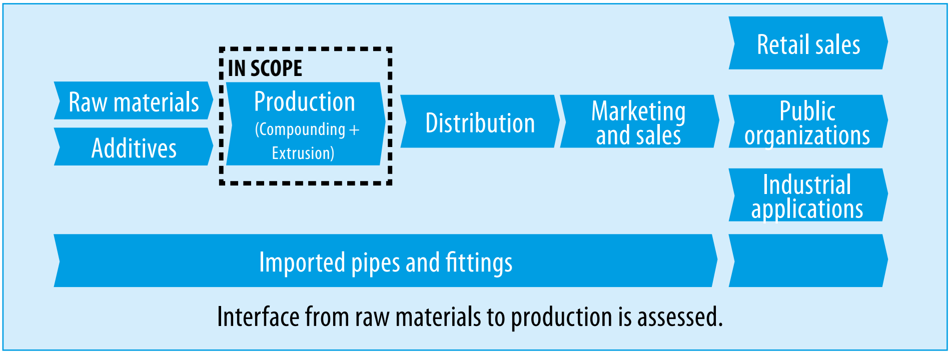


Figure 1 – Plastics industry value chain and scope

PPP PSL is part of the industry value chain and transforms raw materials into finished products. Raw materials include imported thermoplastic resins and additives. There are two major local companies producing plastic pipes and fittings, and several importers.

The value chain of PPP PSL in the plastic pipe industry value chain is illustrated in **Figure 2.**

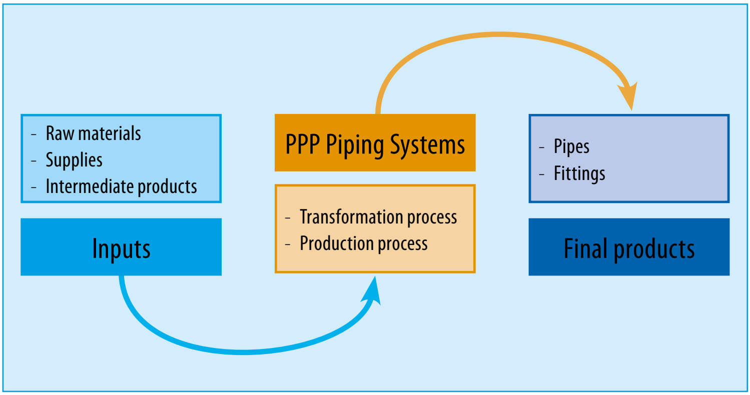


Figure 2 – PPP PSL in the plastic pipe industry value chain

PPP PSL's key target is the local market in Mauritius for sewerage, waste and drain discharge, including industrial applications and water supply. In addition to the local market it also exports a portion of its products to Reunion, Madagascar, Comoros and the Seychelles.

The local market is becoming highly competitive with the rise in pipe imports. For safety reasons and to protect consumers from substandard products, imported pipes are subject to national regulations. The relevant ISO standards have been adopted as mandatory national standards prescribed in local regulations.

2.4.3 Company value chain

The PPP PSL value chain model applied here is based on the generic model developed by Michael Porter (Harvard Business School), which mainly addresses manufacturing companies. As shown in **Figure 3,** the model has been applied essentially unaltered to represent the functions and activities of PPP PSL.

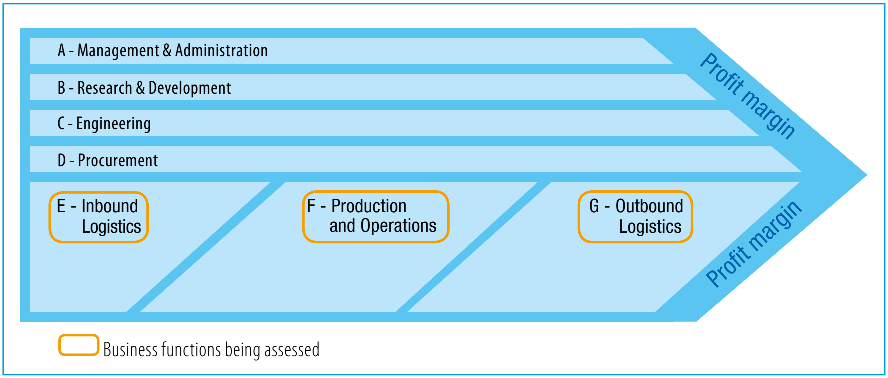


Figure 3 – Value chain of PPP PSL

The operations of the company are subdivided into a number of key business functions, each of which is associated with a set of specific value chain activities. The procurement function is responsible for purchasing raw materials and supplies for the company, and to evaluate suppliers. The activities concerned with the inbound and outbound logistics functions comprise, among other things, testing of raw materials and final products to verify conformity with applicable standards or other requirements of the company. The research and development (R&D) function is inherent throughout production to improve the production processes and increase productivity. The production function is the core activity of the company where the raw materials are compounded and transformed into pipes, the final product of PPP PSL. The activities include preparation of the dry mix, and monitoring of the production process and product quality. The functions of marketing and sales and customer services are outsourced to a partner company, STR Marketing Ltd.

Each of the primary functions (E to G) are linked to the support functions (A to D) that help to improve their effectiveness or efficiency. The main activities of each business function are given in **Table 1.**

Business function	Activities
Management and administration	Organizational structure, human resource management, financing, risk management, quality management
Research and development	Applied research, design of new products and development up to the prototype stage
Engineering	Maintenance of equipment and repairs
Procurement	Evaluation of suppliers, monitoring, purchase or materials , equipment and supplies, incoming inspection
Inbound logistics	Supply management, testing of raw materials and supplies, warehousing
Production/operations	Order processing, production planning, processing, process monitoring, quality control, control of health, safety and environmental aspects
Outbound logistics	Packing, storage, transportation, order tracking

Table 1 – Business functions and related activities

2.4.4 Key value drivers

The ISO methodology defines a "value driver" as a crucial organizational capability that gives a company a competitive advantage. One way for a company to achieve a competitive advantage can be by achieving a lower cost level, or through the production of a differentiated product. The effects of value drivers can be observed in the form of increases in sales revenues, reduction in costs, or both.

The industry sector was analyzed regarding the degree of competition and market requirements for plastic pipes. It provided helpful indications on potential value drivers for the company. Management was interviewed and the following value drivers, given in **Table 2,** were identified:

Value drivers	Descriptions
Quality of products	Ability to produce high quality products, bearing the MSB product certification mark in conformity with relevant international standards
Quality of production processes	Ability to minimize failure rates in production
Efficiency of production	Ability to optimize production processes in terms of process time and costs
Efficiency of the quality control system	Ability to monitor the production process and to perform tests as per standards requirements
Strategic standards adoption	Early adoption of specific standards for new products

Table 2 – Value drivers for PPP PSL

The analysis of the industry sector provided evidence that the market is highly competitive, mainly as a result of increased imports of plastic pipes. Although plastic pipes are controlled products, there are indications that the quality of the imported products is not satisfactory.

Pipes manufactured by PPP PSL have obtained the product certification mark based on the relevant international standards issued by MSB. This mark gives consumers confidence in the products, and enables the company to broaden its potential markets. The company acquired several sewage pipeline and drinking water supply contracts from public organizations, including those for export markets in the region. PPP PSL was also able to access the market in Reunion, a French outer island, after its products were certified by AFNOR.

PPP PSL uses standards as a strategic tool to maintain competitiveness and increase sales revenue. The production unit has been equipped with a special machine to produce PVC-U structured wall pipes for sewage according to the European Standard. The advantage of this pipe, which is new to the Mauritian market, is that it uses less material without compromising performance. Production of structured wall pipes has doubled from 350 tons to 700 tons during the last two years, while revenue from the sales of these products has increased by about 6 % annually.

Another value driver is the ability of the company to minimize the failure rate and the percentage of scrap, resulting in an increase in productivity. PPP PSL has invested in high technology machines and implements an effective quality control system of its production processes. This has led to a decrease in failure rates, and in scrap from 5 % to about 3 %. The equipment consumes less energy and gives a higher output, resulting in cost savings for the company.

In addition, the use of standards for testing incoming raw materials, for process monitoring and testing of finished products has contributed to an overall increase in cost savings for the company.

PPP PSL combines the activities of R&D, inbound logistics and out-bound logistics in the production unit. Most of the costs accrue in production.

2.5 Scope of the pilot project assessment

The scope of assessment was defined in collaboration with the management and the technical staff of the company. The production of plastic pipes is 'raw materials' intensive thus product quality depends critically on the quality of raw materials used. The process is otherwise automated and quality control checks are performed at different stages along the process to ensure that it is under control.

The assessment focused on the core activities of the company including those areas where standards have the highest impact. The following business functions were chosen for the purpose of the case study:

- Procurement
- Inbound logistics
- Production/operations
- Outbound logistics

2.6 Standards used in the company value chain

The company uses standards essentially in the following business functions:

- Procurement – purchase of raw materials and other supplies
- Inbound logistics – testing of raw materials and supplies
- Production – process monitoring and quality control (including outbound logistics)

The activities of the business functions were analyzed and, for each business function, the key standards used were identified. These standards have been subdivided into three types – product, process, and those to ensure conformity – and are listed in the standards map in **Table 3** (the Annex contains a more extensive process map with a list of standards used).

Standard type	Business function	Activity	Standards	Description
Process standard	**All**	**Quality management**	ISO 9001:2008	Quality management systems – Requirements
Product standards	**Procurement**	**Incoming raw material -Specifications**	ISO 60:1977	Plastics – Determination of apparent density of material that can be poured from a specified funnel
			ISO 1269:2006	Determination of volatile matter of resins of vinyl chloride
	Inbound logistics	**Testing of supplied raw materials**	ISO 60:1977	Plastics – Determination of apparent density of material that can be poured from a specified funnel
			ISO 2591-1:1988	Test sieving – Part 1 : Methods using test sieves of woven wire cloth and perforated metal plate
			ISO 6186:1998	Plastics – Determination of pourability
	Production	**Testing of dry mix (Mixing of PVC-U resin powder with additives)**	ISO 60:1977	Plastics – Determination of apparent density of material that can be poured from a specified funnel
			ISO 2591-1:1988	Test sieving – Part 1 : Methods using test sieves of woven wire cloth and perforated metal plate
			ISO 6186:1998	Plastics – Determination of pourability
			ISO 182-2:1990	Plastics – Determination of the tendency of compounds and products based on vinyl chloride homopolymers and copolymers to evolve hydrogen chloride and any other acidic products at elevated temperatures – Part 2 : pH method (Thermal stability)
		Extrusion	**Pressure pipes** ISO 1452-1:2009 ISO 1452-2:2009	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure – Unplasticized poly(vinyl chloride) (PVC-U) – Part 1 : General Part 2 : Pipes

Standard type	Business function	Activity	Standards	Description
Product standards	**Production**	**Vacuum and cooling**	Non pressure pipes EN 13476-	Plastics piping systems for non-pressure underground drainage and sewerage – Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE).
			1 :2007	General requirements and performance characteristics
			2:2007	Specifications for pipes and fittings with smooth internal and external surface and the system, Type A
		Printing and marking	ISO 3633:2002	Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings – Unplasticized poly(vinyl chloride) (PVC-U)
		Cutting	ISO 4435:2003	Plastics piping systems for non-pressure underground drainage and sewerage – Unplasticized poly(vinyl chloride) (PVC-U)
			EN 1401-1:2009	Plastic piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system
		Pipes belling/ socketing	EN 12200-1:2000	Plastics rainwater piping systems for above ground external use. Unplasticized poly (vinyl chloride) (PVC-U). Specifications for pipes, fittings and the system
			EN 1329	Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure - Unplasticized poly(vinyl chloride) (PVC-U)
			EN 1453-1:2000	Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings. Unplasticized poly (vinyl chloride) (PVC-U). Specifications for pipes and the system

Standard type	Business function	Activity	Standards	Description
Product standards	Production		Conduits pipes EN 61386 –	Conduit systems for cable management. Particular requirements.
			21:2004	Rigid conduit systems
			22:2004	Pliable conduit systems
			23:2004	Flexible conduit systems
			24:2010	Conduit systems buried underground
		Final inspection	ISO 1167 –	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids – Determination of the resistance to internal pressure –
			1:2006	General method
			2:2006	Preparation of pipe test pieces
			3:2007	Preparation of components
			4:2007	Preparation of assemblies
			ISO 9969:2007	Thermoplastics pipes – Determination of ring stiffness
			ISO 527 –	Plastics – Determination of tensile properties –
			1:2012	General principles
			2:2012	Test conditions for moulding and extrusion plastics
			3:1995	Test conditions for films and sheets
			4:1997	Test conditions for isotropic and orthotropic fibre-reinforced plastic composites
			5:2009	Test conditions for unidirectional fibre-reinforced plastic composites
			ISO 6259 –	Thermoplastics pipes – Determination of tensile properties –
			1:1997	General test method
			2:1997	Pipes made of (PVC-U,(PVC-C and high-impact poly (vinyl chloride) (PVC-HI)
			3:1997	Polyolefin pipes
			ISO 9967:2007	Thermoplastics pipes – Determination of creep ratio

Standard type	Business function	Activity	Standards	Description
Product standards	**Production**		ISO 2505:2005	Thermoplastics pipes – Longitudinal reversion – Test method and parameters
			EN 744:1995	Plastics piping and ducting systems – Thermoplastics pipes – Test method for resistance to external blows by the round-the-clock method
			ISO 3127:1994	Thermoplastics pipes – Determination of resistance to external blows – Round-the-clock method
			EN 1446:1996	Plastics piping and ducting systems – Thermoplastics pipes – Determination of ring flexibility
			EN 1277:2003	Plastics piping systems – Thermoplastics piping systems for buried non-pressure applications – Test methods for leaktightness of elastomeric sealing ring type joints

Table 3 – Standards used in the business functions (standards map)

The basic standards used for producing unplasticized poly(vinyl chloride) (PVC-U) pipes and fittings are **ISO 1452, ISO 3633, ISO 4435 and EN 13476**. These product standards provide *specifications for materials and products* in terms of physical and chemical properties and underlying test methods and categorization. Each standard covers a given type of product intended for a specific application.

ISO 1452, *Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure – Unplasticized poly(vinyl chloride) (PVC-U)* is a series of standards for solid wall piping systems and components made of PVC-U for water and sewerage under pressure. It is applicable for :

- Water mains and services buried in the ground
- Conveyance of water above ground for both outside and inside buildings
- Buried and above ground drainage and sewerage

ISO 3633, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings – Unplasticized poly(vinyl chloride) (PVC-U)* specifies the requirements for solid wall, non pressure (PVC-U) pipes and fittings for soil and waste discharge (low and high temperature) inside buildings. It is intended to be used for the following purposes:

- Soil and waste discharge pipework for the conveyance of domestic waste waters
- Ventilation pipework associated with solid and waste discharge pipework for domestic waste waters
- Rainwater pipework inside the building

ISO 4435, *Plastics piping systems for non-pressure underground drainage and sewerage – Unplasticized poly(vinyl chloride) (PVC-U)* specifies the requirements for solid wall PVC-U pipes and fittings intended for non-pressure underground drainage and sewerage for the conveyance of soil and waste discharge of domestic and industrial origin, as well as surface water. It covers buried pipework but does not apply to piping systems buried within the building structure.

EN 13476, *Plastics piping systems for non-pressure underground drainage and sewerage – Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)* is a series of European standards for structured wall pipes for underground drainage and sewerage under pressure

The use of these standards in the production and related processes combined with a set of defined testing standards renders the process more efficient, and streamlines the work. They ensure that the pipes meet the performance requirements while reducing the amount of scrap and waste, thus increasing production.

The pipes and fittings produced by the company carry product certification marks based on the above standards. These marks are value drivers for the company and have helped it win an important tender for the supply of pipes for the national sewerage project, as well as several other public contracts.

Another strategic standard for the company is **ISO 9001** for *quality management systems*. This has led PPP PSL to improve the efficiency of the production processes. **ISO 9001** certification together with the product certifications reduce costs and help in marketing the products.

The adoption of **EN 13476** has given the company a net competitive advantage. Structured wall pipes have similar performance characteristics to solid wall pipes. However, they use less raw materials resulting in lighter pipes which facilitate handling and installation. Using this standard has lowered production costs and has increased the company's production and sales volumes.

Besides product standards, several tests specifications are used for testing of raw materials and finished products, and for monitoring the processes.

The impacts, as shown in **Table 4,** were identified from the use of standards by the company:

Business function	Impacts of standards
Procurement	Consistency in quality of raw materials
Inbound logistics	Increase in productivity
Production	Increase in the stability of processes
	Increase in efficiency
	Higher energy efficiency
	Reduction in waste and scrap

Table 4 – Impacts of standards

2.7 Selection of operational indicators to measure the impacts of standards

The impacts resulting from standards are assessed by choosing appropriate operational indicators and measuring the changes shown by these indicators. Quantification of the impacts of the standards is performed by translating the changes measured by the indicators into financial terms.

The operational indicators for PPP PSL have been selected by interviewing the managers and supervisors of the business functions, and are presented in **Table 5.**

Business functions	Related activities	Operational indicators	Definition of the indicators	Measurement of indicators
Procurement	Screening and selection of suppliers	**Time and manpower** needed in communication with suppliers	By referring to standards in communication and contracts with suppliers, time and other resources are saved and misunderstandings about required specifications for supplied raw materials and other goods are avoided	Time and number of people needed for communication with suppliers ; Preparation of contracts with suppliers
Inbound logistics	Testing of supplied raw materials	**Time and manpower** needed for testing incoming raw materials	The resources needed for testing raw materials have been reduced through the communication of requirements for supplies, and reference to standards. Fewer tests are performed	Time, number of people and other resources needed for testing supplied goods
		Conformance rate of supplied raw materials and goods	The conformance rate of supplied raw materials and goods has increased through the communication of requirements for supplies and reference to standards, resulting in cost savings	Percentage of nonconforming material supplied

Business functions	Related activities	Operational indicators	Definition of the indicators	Measurement of indicators
Production	Processing	**Reliability and stability** of the produc-tion process	Control over the process has increased through the use of standards to systematically monitor the production process,	Conformance rate of the goods produced
	Quality assurance	**Reduction in production stops**	downtime has been reduced and	Reduction in downtime
		Reduction of waste	the overall conformance rate and	Reduction of waste oc-curring in the production process
		Increase in production volume	production volumes have increased	Increase in production volume
	Processing	**Energy consumption per unit of product**	Energy consumption (fuels, electricity, etc.) has fallen in relation to the total production output	Costs of energy per unit volume of production
	Processing	**Reduction of waste**	Reduction of waste	Cost savings due to reduced waste generation
Production (Structured wall pipes)	Processing	**Saving in use of raw materials**	Raw materials have been saved through a new wall pipe design (with a three-layered structure) while retaining the performance characteristics of the product	Savings resulting from a reduction in use of raw materials ; Improvement in environ-mental performance by using less materials (and also by reducing waste and emissions)

Table 5 – Operational indicators to calculate the quantitative impact of standards

2.8 Calculation of the economic benefits of standards

The impact of standards can be assessed quantitatively through a change in the selected indicators and then expressed in monetary terms as a reduction in costs, an increase in sales revenues etc., as shown in **Table 6.**

Business function	Operational indicator	Quantitative benefits (in million MUR)	Quantitative benefits (% sales revenue)
Inbound logistics	Time, manpower needed for testing incoming raw materials **(reduced by 50 %)**	0.009	0.007
Production	Reduction in downtime **(from 5 % to 3 %)**	2.42	2.0
	Reduction of waste in production processes **(by 1.6 %)**	1.91	1.58
	Energy consumption per unit of product **(reduced from 0.8 KWh/Kg to 0.6 KWh/Kg)**	1.09	0.9
a) Contribution from " regular " products:		**5.43**	**4.5 (%)**
b) Contribution from structured wall pipes: Production – Saving in the use of raw materials (by 25 %)		**5.7**	**4.7 (%)**
Total contribution (a + b) :		**11.13**	**9.2 (%)**

Table 6 – Cumulative economic benefits of standards in selected business functions

The total benefits resulting from the impacts of standards for " regular " products amount to around 5.4 million Mauritian Rupees (MUR), which equals **4.5 % of the annual average sales revenues** of MUR [1] 121 million. These benefits reflect the impacts of standards on PPP PSL operations and on most of its products. This contribution can be grouped into two main categories :

- Cost savings (= 2.48 % of annual revenues)
- Increase in sales (= 2.02 % of annual revenues)

However, there is another contribution from standards for structured wall pipes – a new PPP PSL product based on European standard EN

1) MUR – 0.03301 USD.

13 476, and one which gives the company a leading, and currently unique, position on the Mauritian market. The benefit from the use of this standard has been estimated at 4.7 % of the average annual sales, or 5.7 million MUR. The main reason for this impact is that, while maintaining the typical performance of such pipes, the standard defines a special resource-saving use of materials via a production technique that PPP PSL has mastered. The company produces the pipes to special order for the national sewage project.

The total benefits of standards for PPP PSL amount to about **11.1 million MUR** (approximately USD 385 000 at April 2012 exchange rates) with a contribution from standards of **9.2 % of total annual average revenues**.

This is an example of the value of standards applied as the basis for developing and/or producing new products that can generate revenues over and above contributing to efficiency gains. Such standards can help a manufacturer gain a leading position in a market, resulting in higher than normal revenues.[2)] Such a unique position, however, will be challenged by competitors over time, and the revenues from the production of this new product will eventually decrease.

2.9 Qualitative and semi-quantitative considerations

The total impact of standards has been determined quantitatively at the organizational level by aggregating the impacts on the selected business functions. However, some impacts of standards could not be quantified.

2) This is in line with the caracterization of PPP PSL in section 2.3 where its attitude to standardization has been described as strategic and the company can therefore be considered as a strategic standards adopter.

1. **Product certification** is one such aspect that contributes positively to the benefits of the company. Certification marks have improved the company's reputation in the market and lowered transaction costs between buyers and sellers.
2. **Training and education on piping systems**: the company conducts training and education on piping systems and on the relevant standards. This activity has indirect benefits in disseminating knowledge about standards in industry and society.
3. **Environmental performance**: the environmental impact resulting from the adoption of European standard EN 13476 for structured wall pipes is a major qualitative benefit for the company. The improvement in environmental performance resulting from using less raw materials and thus producing less waste is significant but could not be quantified.
4. **Participation in standards setting processes** is another aspect that has given PPP PSL a competitive edge through early access to inside information on standardization.

2.10 Evaluation of results

The contribution of standards to corporate value creation is estimated at 4.5 % of average annual sales revenues for the period 2007 – 2011. If we include the special process for the production of structured wall pipes, it increased to 11.2 % in the last two years. Standards have made a major contribution to the production function, leading to greater efficiency and effectiveness and less downtime and scrap.

Conversely, the contribution of standards is negligible in procurement, and marginal in inbound and outbound logistics. The company is a mature organization and has adopted good procurement practices based on standards since inception. Consequently, the benefits of standard in procurement are at this stage no longer visible.

The company has used standards mainly in production and inbound logistics. Its competitive advantage rests mainly on undertaking these activities efficiently and effectively. It could have enhanced its competitive advantage by using standards in other value chain activities as well.

The objective of the study has been to identify benefits which can be attributed to the impacts of standards. However, it was not always easy to distinguish impacts from standards from other factors such as technology change and good human resource management practices, which certainly have improved the company's turnover.

It is further noted that the data has been gathered as first hand information provided by the personnel of the company under study. This information is subjective and may not be as precise as desired.

This is the first study on the quantitative impact of standards performed in a company in Mauritius. Consequently, there is lack of comparable data. Nevertheless, similar studies conducted in other countries have indicated that the benefits from standards typically range between 0.5 % and 4 % of annual sales. The results of this study seem therefore to be consistent with those findings.

It has also been found that the contribution of standards to cost reduction and increase in sales revenues in our study is more or less at par. Further verification of the benefits of standards could be obtained by undertaking similar studies in several companies in the same industry sector.

Standards are generally implemented to achieve cost reductions through a decrease in waste, and in the number of rejected products and rework. Other objectives are the efficient use of energy and good procurement practices, as also indicated by this study.

2.11 Conclusion

It is acknowledged that standards contribute to an organization's bottom line. However, it is surprising to discover that the contribution of standards for PPP PSL, operating in a small market like Mauritius, is 4.5 % (or even 9.2 %, if we include the special process) which is comparable with companies operating in larger markets. However, we feel that as other companies in the same sector will adopt the same standards, the competitive advantage will be gradually eroded given the size of the market.

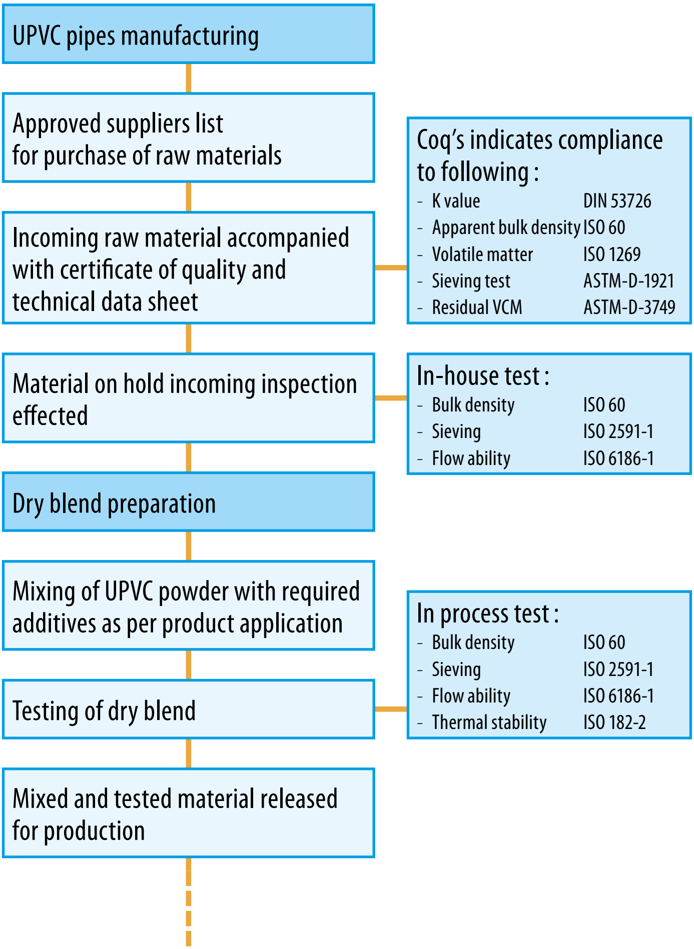
A longer study may reveal whether PPP PSL's competitive advantage can be maintained or improved by the use of standards.

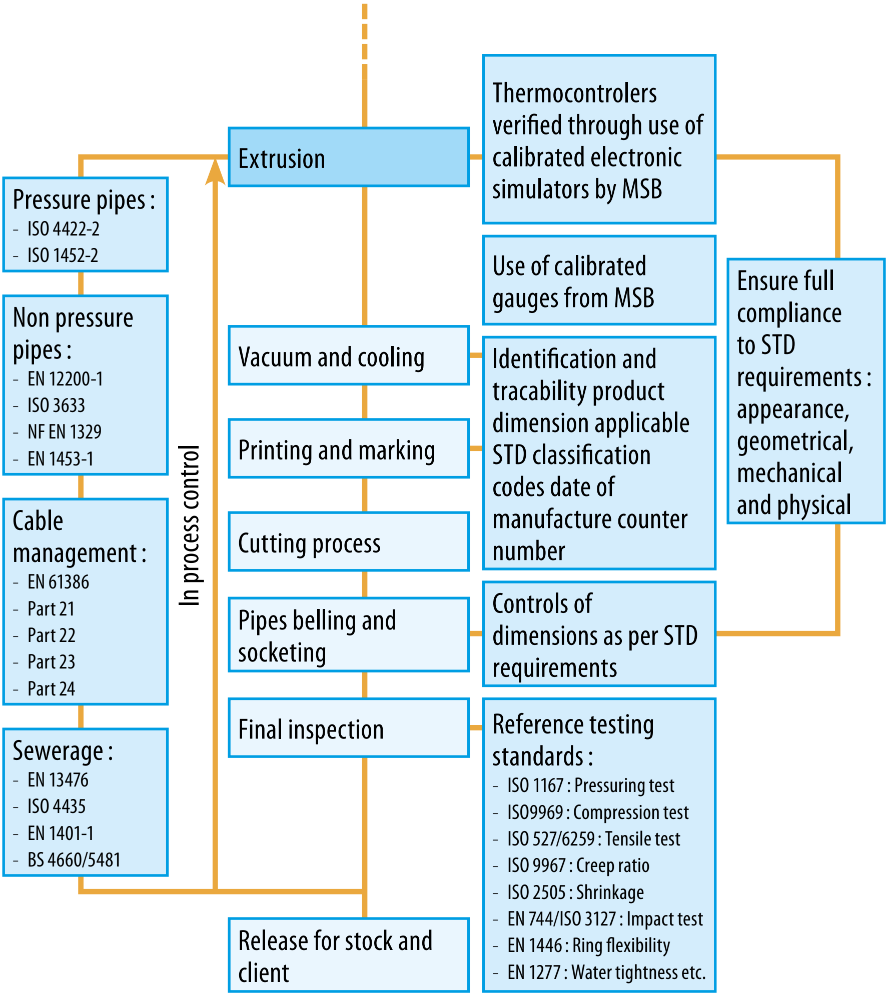
The methodology is applicable by comparing the results achieved before and after the implementation of the standards. Such a comparison, however, is often not available under real conditions, particularly for companies that have a certain history and operate in well established markets.

The ISO methodology has enabled us to identify, describe and evaluate the economic impacts of standards on various functions of an organization. However, with its current focus on identifying economic benefits, the methodology may not be fully applicable to quantifying benefits in organizations that implement standards such as ISO 26000, *Guidance on social responsibility*, ISO 14001, *Environmental management systems – Requirements and guidance for use*, and OHSAS 18001, *Occupational health and safety management systems, Specification*, which are also in great demand. The impacts of such standards are not limited to the value chain of a single organization, but exceed individual organizations and extend to the external environment in which they operate, i.e. the society at large.

Annex : Production process flowchart – Standards map

Steps in the manufacturing process of the UPVC production from receipt of raw materials including all testing required on the base materials




Extrusion
Thermocontrolers verified through use of calibrated electronic simulators by MSB
Use of calibrated gauges from MSB
Ensure full compliance to STD requirements : appearance, geometrical, mechanical and physical
Pressure pipes :
- ISO 4422-2
- ISO 1452-2
Non pressure pipes :
- EN 12200-1
- ISO 3633
- NF EN 1329
- EN 1453-1
Cable management :
- EN 61386
- Part 21
- Part 22
- Part 23
- Part 24
Sewerage :
- EN 13476
- ISO 4435
- EN 1401-1
- BS 4660/5481
In process control
Vacuum and cooling
Identification and tracability product dimension applicable STD classification codes date of manufacture counter number
Printing and marking
Cutting process
Pipes belling and socketing
Controls of dimensions as per STD requirements
Final inspection
Reference testing standards :
- ISO 1167 : Pressuring test
- ISO9969 : Compression test
- ISO 527/6259 : Tensile test
- ISO 9967 : Creep ratio
- ISO 2505 : Shrinkage
- EN 744/ISO 3127 : Impact test
- EN 1446 : Ring flexibility
- EN 1277 : Water tightness etc.
Release for stock and client

Juhayna Food Industries S.A.E., Egypt

Country : Egypt

ISO member body : Egyptian Organization for Standardization and Quality Control (EOS)

Project team :

Project leader : Eng. Ms. Heba Hammad Radi, Standards and Projects Expert, Textile Department (EOS)

Assistant project leader : Eng. Ahmed Abo Zaid, Head of TBT Enquiry Point Division (EOS)

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Member : Eng. Basma Ghazy, Food Standards Specialist, Enquiry Point in the General Organization for Export and Import Control (EOS)

Member : Eng. Samir Musallam, Quality Assurance Manager, Juhayna Food Industries

ISO Central Secretariat advisor : Reinhard Weissinger, Manager, Research, Education & Strategy

Duration of the study : November 2011 – June 2012

3.1 Objectives and organization of the pilot project

For a number of years, ISO has undertaken case studies in different countries to determine the economic impacts and benefits of standards for companies by applying the "ISO Methodology". This is described in documents such as the "ISO Methodology Essentials" and aims at assessing and quantifying in financial terms the benefits companies can derive from the use of standards.

These studies are undertaken in conjunction with the national standards body of the country as an ISO member organization, a local university or business school, the ISO Central Secretariat, and a local company.

The term "standard" used in this context refers to consensus-based documents that have been developed through an open and transparent process by standards organizations of all types (ISO, CEN, EOS or an industry consortium open to industry players) and that are available to any interested party. We call these types of standards "external" standards. The study does not include company-internal specifications developed by the company itself and not shared with others, unless those specifications are more or less identical to certain external standards.

This study is an assessment of the economic benefits of standards carried out in an Egyptian company, Juhayna Food Industries S.A.E., following the ISO Methodology. It was undertaken by the Egyptian Organization for Standardization and Quality (EOS) in close cooperation with the company's management and technical staff, and with the advisory support of the ISO Central Secretariat.

After the first meeting with Juhayna in November 2011, it was decided to focus the assessment on the use of standards in the company's fruit

Note: "El-Dawleya" is the name of the fruit juice factory of Juhayna which is the focus of this assessment.

juice business at its El-Dawleya factory, situated in the 6th October City near Cairo. The assessment was carried out in several stages starting from interviews with management, engineering and technical staff, with the cooperation of EOS experts.

The assessment of the industry and the company's main processes is called the value chain analysis. Key value drivers and those areas of the company mostly impacted by standards were then selected for the assessment. To measure the impacts of standards we used operational indicators for selected activities and quantified them in monetary terms as cost savings or increases in revenue.

3.2 Introduction to the selected company

3.2.1 Juhayna Food Industries S.A.E.

Juhayna is a leading producer and distributor of packaged milk, juice and yogurt products in Egypt. Since commencing operations in 1987, the company has established itself as a household name throughout the country, where, according to the Middle East Market Research Bureau (MEMRB), it held market-leading shares of 69 % of the plain packaged milk market, 31 % and 86 % of the spoonable and drinkable yogurt markets, and 35 % of the carton-packaged juice market in 2009 – representing approximately 15 % of the overall juice market in Egypt.

The company's products in these segments are sold to both consumer and business customers in domestic and export markets. In addition, it manufactures and sells concentrate products to local and export business customers. Juhayna's extensive range of products is marketed to a diverse range of consumer and business customers and, as at 31 March 2010, comprised 153 distinct products, or stock keeping units (SKUs). Most studies consider it as the leading dairy and juice industry company in the country.

For the year ended 31 December 2009, Juhayna's net sales were EGP 1 578.0 million (about USD 284.9 million), generating net profit after tax of EGP 184.8 million (about USD 33.4 million). For the three month period ended 31 March 2010, net sales were EGP 404.8 million (about USD 73.1 million) generating net profits after tax of EGP 60.2 million (about USD 10.9 million). This compared to net sales and net profits after tax of EGP 313.4 million (about USD 56.6 million) and EGP 16.3 million (about USD 2.9 million), respectively, for the same period in 2009[1)].

Juhayna operates its business through eight subsidiaries, divided into four key business segments: dairy (which includes UHT milk, cream and cheese); yogurt (which includes spoonable and drinkable yogurts); juice and concentrates. These business segments are supported by two subsidiaries, one of which is focused on the company's centralized sales, marketing and distribution activities, and the other on its agricultural activities. Through this latter subsidiary, Enmaa, it has acquired 2 595 acres of land and is in the process of acquiring rights over an additional 12 036 acres which it intends to develop for agricultural purposes. Furthermore, Juhayna has a 40 % minority interest in a joint venture company, Milks Dairy Co. ("Milks"), which owns and operates a dairy farm.

As at 31 March 2010, the company owned and operated six modern factories. Following the destruction of the EgyFood factory as a consequence of a fire in late April 2010, Juhayna intends to construct a new yogurt production factory at the EgyFood site, and has begun to commission designs for this new facility.

1) 1 MUR – 0.16433 USD.

The company has increased its overall production capacity from 35 tons per day when it commenced production in 1987, to approximately 2 700 tons per day as at 31 March 2010. It has 20 distribution centres located throughout Egypt, two key distributors and a fleet of 523 distribution vans which deliver an average of 700 tons of products daily. As at April, 2012, Juhayna had 3 860 employees.

Figures in EGP	2009 A	2010 F	2011 F	2012 F
EPS	0.3	0.3	0.4	0.5
EPS Growth	NA	21 %	35 %	23 %
P/E	22.8	18.9	13.9	11.3
Dividend Yield	0 %	0 %	2 %	4 %
EV/EBITDA	12.8	10.7	8.4	7.0
Revenue (Millions)	1,578	1,827	2,257	2,645
Revenue Growth	8 %	16 %	24 %	17 %
EBITDA (Millions)	341	410	519	622
EBITDA Growth	221 %	20 %	27 %	20 %
EBITDA Margin	22 %	22 %	23 %	24 %
A = actual, F =forecast. Sources : Reuters and NBK Capital				

Table 1 – Juhayna key financial information

3.2.2 The fruit juice industry in Egypt

3.2.2.1 The legal framework

As a dairy and juices manufacturer Juhayna is supervised by the Egyptian health and industry ministries, and is regulated by Law No. 48 of 1941 (amended by Law No. 281 of 1994) pertaining to Trade Deceit, and Law No. 10 of 1966, regulating foodstuffs and their circulation.

According to Law No. 48, a producer shall be liable in the event that he sells or distributes defective products. A product shall be considered to be defective if the producer misleads or attempts to mislead in connection with the design, production, installation, processing, packaging or display of such product. The producer of a defective product shall be liable vis-à-vis any third party who suffers damage if he proves that such damage has been caused by the product. The directors of an Egyptian company found guilty of a violation of the Trade Deceit Law could be subject to such penalties in their individual capacities. If found guilty, the company may also be subject to an equivalent fine and the court has the discretion to order the company to cease its activities for a period not exceeding one year. If the same violation is committed again by the company, the court may order that the company cease its activities for a period not exceeding five years, or alternatively terminate the company's operating license.

Law No. 10 prohibits the production, preparation, presentation or offering of products, or the storage, transfer or delivery of the same if this is not in compliance with the requirements specified by applicable laws and regulations; the products contain harmful ingredients; or if the labelling is misleading. Persons found to be in violation of any of the foregoing shall be subject to a penalty of up to one month's imprisonment. The directors of a violating company could also be subject to this penalty in their individual capacities. If found guilty, the company may be subject to a minor fine and the court has the discretion to order the company to cease its activity for a period not exceeding one year.

The Egyptian Standardization Authority amends the applicable standards from time to time.

3.2.2.2 Focus of the study : the El-Dawleya juice factory

The El-Dawleya factory is equipped with a control system with full up- and downstream traceability, built for integration with the business IT system, which provides fully automatic functions for controlling the production and cleaning processes. The factory produces juice products with a total average processing capacity of 2 000 tons per day, while total average filling capacity is 667 tons per day.

Juhayna has implemented and maintains a controlled manufacturing system which plays a key role in ensuring the quality control of its products. The company also has a dedicated quality assurance department responsible for good manufacturing practice, audits, ISO standards, inductions to HACCP for new employees, and refresher training of all employees with respect to food hygiene and safety. It has a legislation department that keeps the company updated as to the relevant changes to local and international laws and regulations applicable to quality control and food safety.

All products manufactured by Juhayna are subject to periodic quality control audits. Each factory is equipped with a laboratory to test that all products are produced and analyzed in accordance with the required specifications.

Several of the company's facilities have received a number of quality certifications including ISO 9001, ISO 14001, ISO 22000, EOS standards and OHSAS 18001.

3.2.2.3 Market size and market segments of the Egyptian juice industry

The juice market in Egypt is fragmented with more than 300 producers estimated to be active in 2009 according to the National Council for Production and Economic Affairs (NCPEA). This is mainly due to the low barriers to entry in the segment with some brands being produced in small houses in rural areas.

The juice market in Egypt can be categorized in two different ways, either by packaging type (carton, bottles and pouches) or by the fruit concentration level. Juice with 100 % fruit content is termed " **pure**

juice". "**Nectar**" juices are products with at least 25 % or more juice content, and "**drink**" juice products are those with up to 25 % juice content. These different packaging types and fruit concentration levels are designed to appeal to different demographic markets and often also to a different geographical region within Egypt.

In 2009 the total level of Egyptian juice consumption was approximately 218 000 tons (Source: MEMRB*).

This implies a per capita consumption of 2.8 litres per annum, which is considered to be one of the lowest consumption levels within the Middle East and North Africa (MENA) region. For example, juice consumption per capita in Saudi Arabia and Oman was 26 and 24 litres respectively in 2009.

One reason for the traditionally low consumption of juice products in Egypt was due to consumer's historic preference for water or tea to accompany meals and, more recently, the dominance of the carbonated soft drink (CSD) segment. In 2009, sales of CSD products significantly outnumbered those of juice products, driven by the extensive marketing campaigns of multinational players such as Pepsi and Coca Cola (Source: company estimates).

However, over the past three years, the size of the Egyptian juice market has increased by a compound annual growth rate (CAGR) of 18 % for the period 2007 to 2009 according to MEMRB*. This increase was driven by the historic under-penetration of this market and, in addition, reflected the increase in gross domestic product (GDP) per capita over this period. These trends, coupled with the increasing focus on the relative health benefits of juice consumption, in comparison with certain CSDs, mean that the Egyptian juice market is well positioned for future growth.

*MEMRB: International Market Studies & Analysis, Statistics, Statistics Consulting. Cairo, Egypt.

3.2.2.4 The juice segment at Juhayna

The following table sets forth the sales volumes for the products within Juhayna's juice segment product range, and the average prices per ton at which they were sold in its local and export markets during the specified periods, and a comparison of the actual and percentage change between the two periods.

	For year ended 31 December			
			2008 v 2009	
	2008	2009	Change	% Change
Domestic volumes (tons)	44,328	45,764	1,436	3.2 %
Export volumes (tons)	3,851	3,348	(503)	(13.1) %
Total volumes (tons)	**48,179**	**49,112**	**933**	**1.9 %**
Domestic price per ton (EGP)	5,657	5,993	336	5.9 %
Export price per ton (EGP)	3,545	3,753	208	5.9 %
Domestic sales (EGP 000's)	250,783	274,264	23,481	9.4 %
Export sales (EGP 000's)	13,652	12,565	(1,087)	(8.0) %
Segment net sales (EGP 000's)	**264,435**	**286,829**	**22,394**	**8.5 %**

Table 2 – Juhayna juice products sales volume and prices 2008-2009

The juice segment accounted for 18.2 % of Juhayna's consolidated net sales in 2009 as compared to 18.1 % in 2008. Juice segment net sales increased by 8.5 % to EGP 286.8 million (about USD 51.8 million) in 2009 from EGP 264.4 million (about USD 47.7 million) in 2008. In 2009, the company sold 49 112 tons of juice segment products, an increase of 932 tons (representing a 1.9 % increase) over the 48 180.0 tons sold in 2008. The increase in sales was principally attributable to growth in the size of the overall market, and an increase in Juhayna's production capacity as a result of the opening of the new El-Dawleya juice production facility. The increase in average selling prices between those periods reflected an increase in sugar prices.

Throughout the period the company sold its products at a lower price to its export customers than domestically in order to attract market share in export markets.

3.2.2.5 Juhayna's juice products

The products are divided into three main categories (nectar, pure and drinks), consumed in local and export markets.

Juhayna Nectar

Juhayna Nectar is the company's flagship brand within its juice division. As at 31 December 2009, the Egyptian nectar juice market represented 56 % of the total juice market. Juhayna Nectar had a 20 % share of the Egyptian nectar juice market, representing 11 % of the total Egyptian juice market in that year. The company began producing Nectar juice in 1987 and its Nectar range currently comprises 20 SKUs. Juhayna Nectar is targeted at urban adult consumers in the upper- and middle-income segments.

Juhayna Pure

The company introduced Juhayna Pure, the first pure juice product launched in Egypt, in 2001. Its Pure juice is marketed as a premium product and the range currently comprises eight SKUs. The Egyptian pure juice market is currently very small, representing 3 % of the total juice market (Source : MEMRB) but is growing rapidly ahead of the overall juice market in Egypt. In 2009 Juhayna Pure had a 55 % share of the Egyptian pure juice market representing 1.7 % of the total Egyptian juice market in that year (Source : MEMRB). Juhayna Pure is targeted at urban adults in the upper- and middle-income segments who are health conscious and willing to pay for a premium product.

Bekhero, Juhayna Jump and Juhayna Tingo Drinks

In 2009 Juhayna's Bekhero drink range comprised six SKUs and had a 6 % share of the drink market, which represented 2.5 % of the total

Egyptian juice market. The company planned to phase out Bekhero drink by the end of 2010 as part of its sales and marketing strategy to promote the two new Juhayna drink brands: Jump and Tingo, both of which were launched in November 2009.

Tingo, the company's first entry in the bottle segment of the juice market, is offered in PET bottles. Tingo is targeted at young adults in the upper- and middle-income segments who lead an active life. Jump is offered in carton packaging in three sizes (125 ml, 200 ml and one litre). Jump features various juice blends and is targeted at urban teenagers in the upper- and middle-income segments.

Product innovation remains key to Juhayna's strategy for its juice products. Accordingly, it strengthened and broadened its Tingo range in 2010 by introducing a new range of innovative flavours to provide an alternative to popular carbonated soft drinks.

Product	2007	2008	2009
Juhayna Nectar	15	16	20
Juhayna Pure	56	55	55
Bekhero Drink	13	11	6
Total juice market	16	16	15
(Source: MEMRB)			

Table 3 – Juhayna juice products and their market share (in %) 2007 – 2009

3.3 Attitude of the company towards standardization

The Quality Assurance Manager of Juhayna, Mr. Samir Musallam, expresses Juhayna's attitude towards standardization as follows:

"As a trusted dairy and juice manufacturer in Egypt serving our customers for more than 25 years, maintaining high quality standards and adopt-

ing best international practices are integral to promise to deliver quality products at best value and service to our customers. Juhayna is a real player in most of the Egyptian standardization organization committees, we share in reviewing the national standards, and we are also a member of the Codex Alimentarius. To be able to measure and quantify how our adoption of standards has helped our organization and our customers is invaluable as it helps us to clearly identify areas that we have done well, areas that we can further improve upon and to also identify gaps that we need to bridge. Similar to how we conduct surveys and gather feedback to further improve our product offerings to customers, the ISO Pilot project gives us the tools to measure how our implementation of standards have impacted our organization as a whole. It is certified against ISO 9001:2008, ISO 22000, ISO 14001 and OHSAS 18001.

Juhayna is a strong believer in standards and has been involved in the development and the implementation of standards in Egypt for more than 25 years."

3.4 Analysis of the value chain

Juhayna operates an extensive direct distribution and sales network in Egypt which would be costly and difficult to replicate. In general the steps of activities from input by suppliers to the final consumed products is called the value chain. The focus of the assessment was on the processes carried out in the company as part of the Juhayna value chain.

3.4.1 Juhayna's value chain

The scale of Juhayna's value chain and processes are large, starting from international and local suppliers to the end-user – both local and export customers – to ensure that all consumer segments receive premium quality as shown in **Figure 1.**

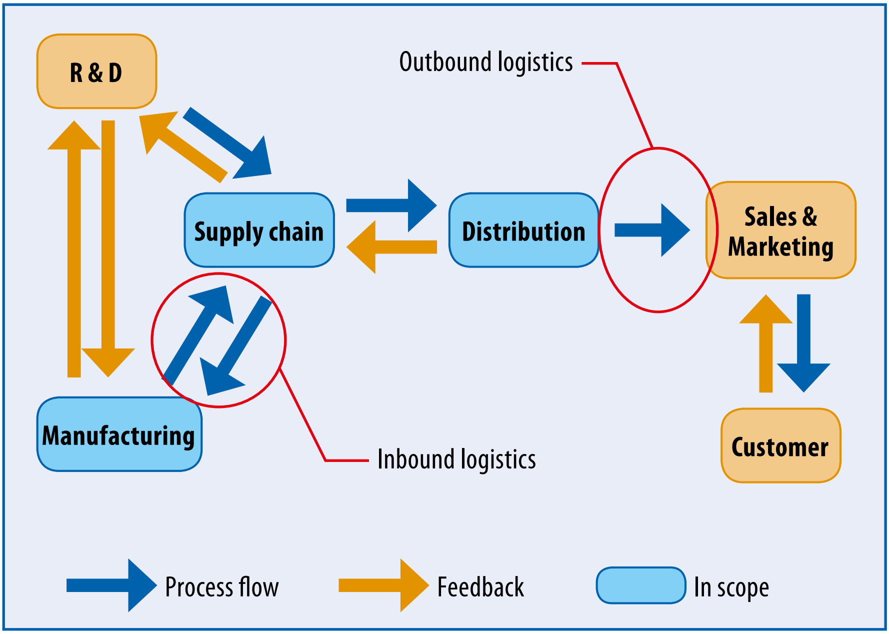


Figure 1 – Juhayna process chart

3.4.2 Company value chain

This study covers the El-Dawleya factory, which is specialized in producing all types of juice to cover all customer needs. The company value chain and the scope of this study is shown in **Figure 2.**

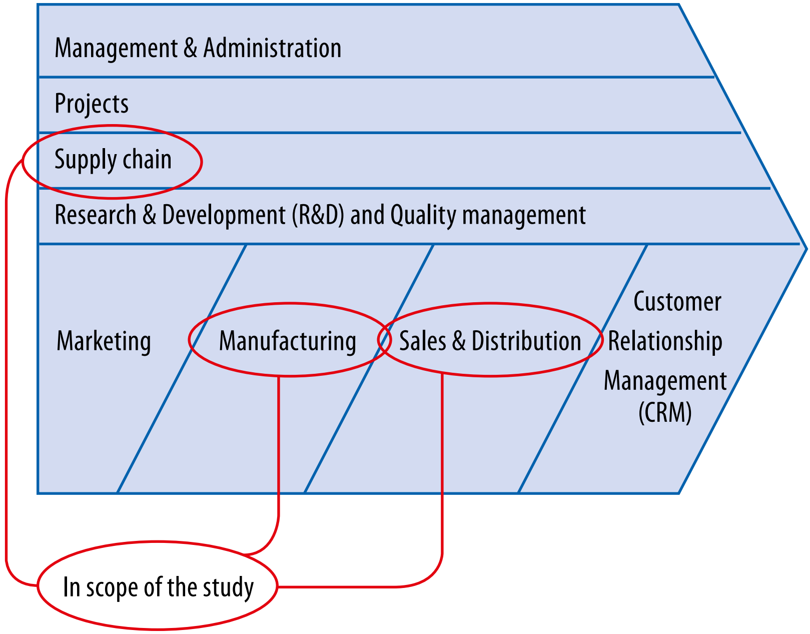


Figure 2 – Scope of the study

The operations of the company depend on several key business functions, each of which is associated with a set of specific value chain activities. The functions in supply chain operations are responsible for purchasing of raw materials and supplies for the company and the evaluation of suppliers. The activities deal with inbound and outbound logistics functions, testing of raw materials, supply manufacturing chain and final products to verify conformity with applicable standards or other requirements of the company.

3.4.2.1 Management & administration

The company's management includes the information technology department and is separated into two divisions: business support and technical support, each headed by an experienced manager. The business support division is responsible for matters such as enterprise software applications, IT services and training. The technical support department is responsible for technical application support, system administration and operational and maintenance support.

Juhayna currently operates a corporate computer network and enterprise software applications for certain business processes to integrate procurement processes with its production, logistics and distribution activities. Accordingly, all of the company's key business transactions are automated and periodically generated reports on its financial and operating performance enable management to take decisions based on reliable data. In addition, except for the El-Marwa factory which is semi-automated, all factories are fully automated with computer controlled reception, pasteurizing, standardization, concentrating and filling functions and cleaning processes. Over the last five years, management estimates that the company spent approximately EGP 8 million (about USD 1.4 million) on its information technology systems.

3.4.2.2 The project department

The project department is responsible to establish all new factories and distribution centres and to develop and maintain the current factories and distribution centres.

3.4.2.3 Supply chain

Juhayna believes that the supply chain control offered by a vertically integrated model will benefit it by ensuring the quality of key raw materials used in the manufacture of its products, and by helping to protect against future increases in their prices. The company believes that increasing its own production of raw milk and fruit while expanding the number of potential third-party sources will give it greater pricing leverage in relation to these key raw materials.

The company considers that its focus on supply chain control and integration assists it in ensuring reliable access to quality raw materials at an acceptable price, thereby enabling it to supply high quality products to customers while controlling manufacturing costs and increasing profit margins. In addition, this ability to control the supply of raw materials provides greater flexibility in developing new value-added or premium priced products and, in the future, to enter new market segments such as organic products and the fresh milk segment.

Supply chain processes:

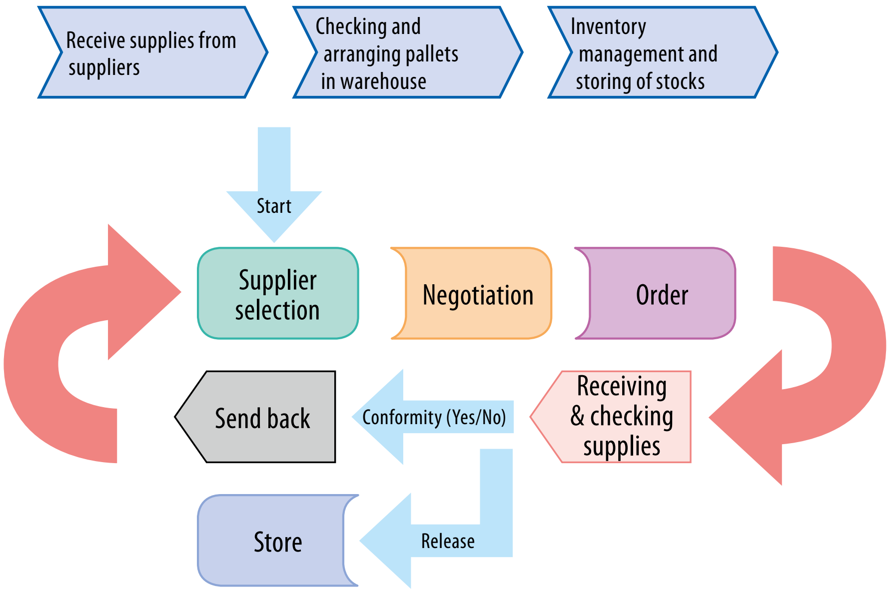


Figure 3 – El-Dawleya Factory supply chain (procurement and inbound logistics)

3.4.2.4 Research & development (R&D)

Juhayna has developed a consumer-focused innovation and product development strategy focused on the company's key product segments and aims to maintain a competitive edge through continued emphasis on product innovation and quality.

Product development is centrally managed by its quality and innovation division, whose purpose is to develop new and improve existing products, packaging designs, processes and technologies in order to deliver sustainable and value-added solutions and enhance profitability. The division, which currently comprises a team of nine specialists, benefits from in-house expert knowledge of milk and juice product development, as well as good relationships with international suppliers such as *Dohler*, *Danisco* and *WILD INDAG*, with whom the team liaises on occasions.

The quality management division has a dedicated product and technology team of nine people responsible for the development of new products and improvements to existing products. The team provides technical support to the company's facilities to enable them to maintain and enhance product quality, works closely with marketing to identify new product opportunities based on consumer research, establishes sourcing of ingredients for new products, and co-ordinates business to business project development.

3.4.2.5 Marketing

Management believes that the Egyptian juice market is currently under-developed and offers potential for significant growth. The company has established a modern production facility for its juice business division and aims to build its market position in the nectar and drink categories, as well as in the carton, bottle and pouch packaging categories.

Juhayna intends to produce drinks in pouches and to continue to market its carton and bottled drinks with innovative advertising campaigns. The company intends to focus its marketing efforts on the younger segment of the Egyptian population. Management believes that engaging with this consumer segment will assist in creating Juhayna brand loyalty from a young age. Many of its drink products have been specifically designed with young consumers in mind. For example, in November 2009 the company launched Tingo in a PET bottle and Jump in brightly coloured 125 ml., 200 ml. and 1 litre cartons designed to appeal to younger customers.

Juhayna also intends to emphasize general marketing and advertising in an effort to strengthen its market position. Although the Egyptian juice market has grown at a CAGR of 18 % from 2007 to 2009, management believes that this growth has occurred despite the absence of significant marketing or advertising efforts, or product innovation by producers. The company is eager to gain a " first mover " advantage and believes that the effective advertising and marketing of its juice products will provide significant market advantage. Juhayna began to execute this strategy with the dual launch of Tingo and Jump in November 2009. Since their inception, both brands have been supported by investment in branding, pack design, and advertising.

3.4.2.6 Manufacturing

The company's juice products are manufactured at its newly built and state-of-the-art El-Dawleya factory. This facility was designed and built according to international food and hygiene standards and, as it was a greenfield project, all utilities and buildings were designed to accommodate further expansion. Production at this factory uses an automated process that controls the reception of raw materials, the mixing process, package filling and palletizing of the final product via computerized systems. The system has proven to be efficient in securing high and uniform quality production with minimum waste and limited manual intervention by employees. The main stages of the production process are as follows:

- **Raw material reception**:
  - Fruit concentrates are automatically emptied and processed. The process is controlled by inline flow meters.
- **Production of sugar syrup and other ingredients**:
  - Sugar syrup and other basic juice ingredients are produced in a fully automated system to ensure a very high level of accuracy. All measures are automatically controlled by inline flow meters.
- **Mixing process**:
  - The mixing process of fruit concentrate, sugar syrup, aromas and other ingredients is fully automated. The process secures what management believes to be the most accurate mixing process currently available.
- **UHT treatment**:
  - The juice is sterilized by heating it to 98°C for four seconds. This treatment destroys nearly all bacteria in the juice and renders it commercially sterile.
  - A special system for aroma and flavour recovery ensures that the product maintains a high level of flavour throughout the heat treatment process. The process is controlled and monitored by computerized systems to ensure maximum accuracy. The equipment is designed to secure the most efficient use of energy and, at the same time, maintain product quality, reduce the product's air content and maximize ingredient and/or product recovery.
- **Filling**:
  - Carton products are filled using high speed and fully automatic UHT filling lines (60 000 packs per hour on average) supplied and serviced by Combibloc.

- PET bottles are filled by a modern high-speed hot fill system supplied by Krones (25 000 bottles per hour on average).
- **Palletizing** :
  - The palletizing process is fully automated, maximizing the stability of the pallets during transportation and handling in the market. Currently, the El-Dawleya factory has a total juice filling capacity of 667 tons per day.
- **Storing** :
  - The pallets are transferred to a storage until release by the quality department after chemical and microbiological testing.
  - They are then shipped to the distribution centre.
- **Manufacturing – feedback from R&D** :
  - The manufacturing chain sends to, and receives feedback from, R&D and the different processing units in order to maintain premium product quality for launching new products, and to ensure that production processes are following standards.

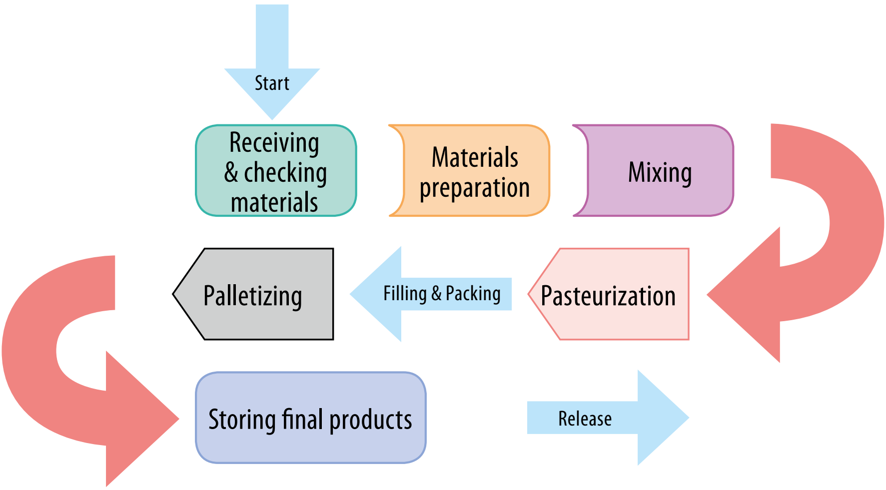


Figure 4 – El-Dawleya factory manufacturing value chain

3.4.2.7 Distribution

Juhayna's domestic distribution network, operated by its Tiba subsidiary, plays a key role in the penetration of its products into Egypt's fragmented customer base, and the company believes it also constitutes a barrier to entry for potential new competitors. As of 31 March 2010, Tiba owned and operated a fleet of 523 distribution vans of which 294 were adapted for dry goods and 229 for chilled goods (although the latter can also accommodate dry goods). This distribution network helps to ensure product delivery across a wide geographical area so that its products are kept in good condition. All vehicles used in the company's distribution network are branded with the Juhayna logo and therefore support the high levels of Juhayna brand recognition in Egypt. On average, its distribution vans currently transport approximately 700 tons of products per day, with vans adapted to deliver dry products twice per week, and those adapted for chilled products deliver three times per week. In addition to its distribution fleet, Juhayna operates a distribution network comprised of 20 branches located throughout Egypt. Through its direct distribution fleet and network, the company currently supplies an average of 25 000 retailers per week.

In rural areas too remote to be served directly by its own distribution fleet, the company operates through four sub-distributors and also wholesalers enabling its products to reach an additional 50 000 outlets.

Juhayna exports its products to Europe, the United States and the Arab Gulf region since 1988, and currently supplies products to 41 countries. For the year ended 31 December 2009, the company's key export markets were located primarily in the MENA region, where Libya, Lebanon and Jordan together accounted for 78.8 % of total exports during the period. The company believes it had approximately a share of 20 % of the milk segment in Libya in 2009. It assigns an exclusive distributor in each of its major export countries.

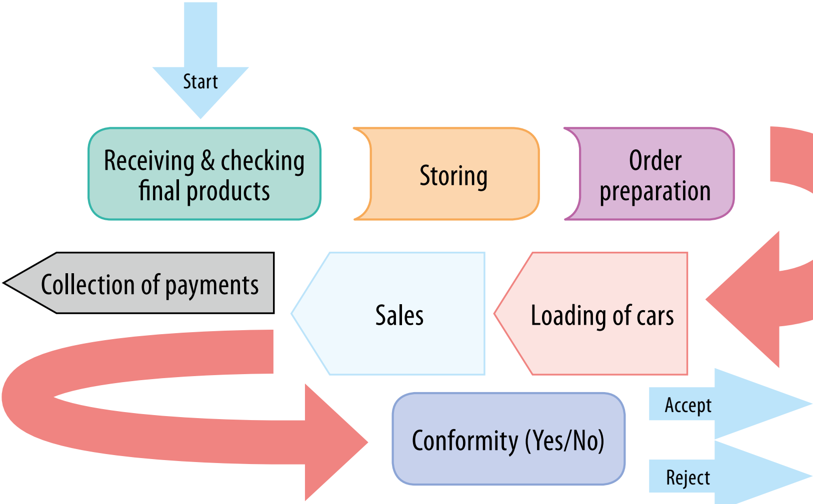


Figure 5 – El-Dawleya Factory distribution value chain (Outbound logistics)

3.4.2.8 Customer relationship management (CRM)

Customer relationship management was established one and a half years ago. The objective was to accelerate solving any product handling problems in the marketplace, by setting up a call centre to direct customer complaints to representatives who send defective products to the factory. Complaints are analyzed and feedback is provided to explain possible reasons for a defect and to ensure customer satisfaction. Juhayna's aim is to improve communications between the company and customers of all levels to resolve conflicts and respond to their enquiries. The process also opens an active channel to measure customer satisfaction and send their feedback to R&D to develop the best solutions to meet customer needs.

Business function	Activities
Management & administration	Organizational structure, human resource management, financial and risk management
Projects	Establishing new factories and distribution centres
Supply chain	IT management, procurement, inbound logistic, warehousing
Research & development and quality management	Quality management, study and apply up to date research, design and develop products, provide ideas to the units, testing of raw materials and supplies
Marketing	Launching new products, product campaigns, promotions and offers, marketing methods, studies and advertising
Manufacturing	Apply sales plans to production processes, packing, deliver final products to the warehouse, engineering and maintenance management, quality control, safety and environmental aspects
Sales & distribution	Supply and demand planning, export unit, local distribution, transportation, retail, wholesalers and special markets
Customer relationship management	Call centre, customer services, after sales follow up

Table 3 – Business functions and related activities

3.4.3 Key value drivers

According to the definition applied in the ISO Methodology, a value driver is a crucial organizational capability that gives a company a competitive advantage. Ways to achieve a competitive advantage include reducing cost levels or through the production of new and different products. The effects of value drivers can be observed in increased sales revenues, reduction in costs, or both.

The R&D department studies of the degree of competition and market requirements for juices provided helpful indications on potential value drivers for the company. Management was interviewed and the following value drivers were identified:

Value drivers	Descriptions
Quality of products	Produce premium quality products
Quality of production processes	Minimize mechanical and human errors
Efficiency of production	Optimize production processes in terms of accurate process time and low costs
Efficiency of the quality control system	Monitor the production process and perform tests as per standards requirements
National and international sales	Being positioned to cover all local and international customer segments
Marketing competition	Be the leader in the local and international dairy and juice products sector, matching the best marketing ideals
Up-to-date standards	Early adoption of specific internal and international standards for new products and consumers
Customer satisfaction	Achieve full satisfaction of all customers

Table 4 – Key value drivers

3.5 Scope of the assessment

The scope of the company assessment was chosen after discussions between the EOS team and company management and staff. We focused on the following business functions which include those areas where standards have the highest impact.

Business functions:

Key value chain components

1. **Supply Chain**
   - Central procurement, inbound logistics
2. **Manufacturing**
   - Production
   - Maintenance
   - Warehousing
3. **Sales and distribution**
   - Outbound logistics

- Wholesale and retail
- Distribution branch (DB)

3.6 Standards used in the company value chain

Egypt encourages food industry producers to follow the national food standards. Since Juhayna was one of the first and leading companies to apply the standards, our products are trusted in the marketplace. Most of the national standards we follow are adopted ISO International Standards.

Juhayna applies the latest editions of the standards and plans to implement those national and international standards that help in achieving premium quality.

Business function		Activity processes	Standards	Description
Supply Chain	Procurement	Supplier selection	ISO 9001:2008	• Quality management systems
		Negotiation		
		Ordering materials		
	Inbound logistics	Reception of inputs from suppliers	ISO 22000:2005 HACCP ISO 14001:2004 OHSAS	• Food safety management systems • Hazard analysis and critical control point • Environmental management systems • Occupational health and safety management systems • Food quality systems
		Testing materials	ISO 22000:2005 AOAC International* ISO 17025:2005	• Food safety management systems • Excellence in analytical methods • General requirements for the competence of testing and calibration laboratories
		Lot acceptance	ISO 22000:2005	• Food safety management systems
		Lot rejection		

*AOAC : Association of Analytical Communities

Other standards used in the supply chain process:	
Standard	**Description**
ES 2239/2007	Nectars for certain citrus fruits preserved exclusively by physical means
ES 3951/2008	Requirements for packaging fresh fruits
ES 6206-1/2007	Methods of analysis and testing – Part 1 : Physical analysis – Determination of net and drained weight, viscosity – Head space – Entrance matter and damaged fruits
ES 1012-2/2005	Apricot juices preserved exclusively by physical means – Part 2 : Concentrated apricot juice
ES 1690/2007	Fresh fruits banana
ES 1691/2007	Fresh fruits mango
ES 1704/2006	Strawberry fruits for local marketing
ES 1731/2007	Guava fruits for local marketing
CAC/GL 21-1997	Micro criteria for foods
CAC/RCP 57- 2004	Code of hygienic practice
ES 1602-1/2005 ES 1602-2/2005	Non-carbonated sweetened drinks Part 1 : Fruit nectar Part 2 : Fruit drinks and artificial drinks
ES 7136/2010	Maximum levels of certain contaminants in food stuff
ES 745/2008	Corrugated board boxes
ES 1546/2011 Codex 1/ 1985	Labelling of prepackaged food products
ES 2479/2006	Plastic sacks for milk packaging
ES 358 – 1/2005 Codex 212/1999	Refined sugar and white sugar – Method for analysis and testing – Part 1 : Refined sugar and while sugar
ES 190 – 1/2007	Drinking water and ice – Standard test method – Part 1 : Drinking water
ES 2613 – 1/2008	Durability periods for food products – Part 1 : General requirements
ES 2613 – 2/2008	Durability periods for food products – Part 2 : Shelf life
Codex Standard 234 – 1999	Recommended method of analysis and sampling – Part 1
Codex Standard 156 – 1987	Codex standard for follow up formula
ES 3120/2008 CAC/GL2 – 1985	Guidelines on nutrition labeling
ES 4245/2008	Determination method of printing ink resistance to removal from food packaging labels

ES 6050/2007	General requirements for packaging and wrapping
ES 3393/2005	Hygienic requirements for food products establishment
ES 3778/2005	Hazard Analysis Critical Control Point System and guidelines for its application (HACCP)
ES 3856/2006	Recommended Egyptian code of practice – General principles of food hygiene
ES 3857/2005 **Codex 30/1999**	Principles and guidelines of microbiological risk assessment
ES 4884/2008 **ISO 22000:2005**	Food safety management systems – Requirements for any organization in the food chain

Business function	Activity processes	Standards	Description
Manufacturing	Raw material reception	ISO 22000:2005 ISO 17025:2005	• Food safety management systems • General requirements for the competence of testing and calibration laboratories
	Materials preparation : sugar syrup and other production ingredients	GMP standards ISO 22000:2005	• General requirements for the competence of testing and calibration laboratories • Good manufacturing practice • Food safety management systems
	Mixing process	GMP standards ISO 22000:2005	• General requirements for the competence of testing and calibration laboratories • Good manufacturing practice • Food safety management systems
	UHT treatment (pasteurization)	GMP standards ISO 22000:2005	• General requirements for the competence of testing and calibration laboratories • Good manufacturing practice • Food safety management systems
	Filling and packing	GMP standards ISO 22000:2005	• Good manufacturing practice • Food safety management systems
	Palletizing	GMP standards ISO 22000:2005	• Good manufacturing practice • Food safety management systems
	Storing until dispatch to distribution centre	ISO 22000:2005	• Food safety management systems

Other standards used in the manufacturing process:

Standards	Description
ES 1012-1/2005	Apricot juice preserved exclusively by physical means – Part 1 : Natural apricot juice
ES 4339/2005	Canned fruit cocktail

ES 6206-1/2007	Methods of analysis and testing – Part 1 : Physical analysis – Determination of net and drained weight, viscosity – Head space – Entrance matter and damaged fruits
ES 129-1/2005	Preserved fruit products Part 1 : General standard for fruit juices preserved exclusively by physical means
ES 1012-2/2005	Apricot juice preserved exclusively by physical means – Part 2 : Concentrated apricot juice
ES 1550-2/2005	Mandarin juice preserved exclusively by physical means – Part : 2 Concentrated mandarin juice
ES 4206/2003	Refraction meters for the measurement of the sugar content of fruit juices
ES 129-2/2005	Preserved fruit products – Part 2 : Jams and jellies
CAC /GL 21-1997	Micro criteria for foods
CAC/RCP 57- 2004	Code of hygienic practice
ES 132/2005	Preserved tomato products
ES 132-5/2005 Codex 49/1981	Preserved tomato products – Part 5 : Natural tomato juice
ES 686-2 /2005 Codex 64 /1981	Orange juice preserved extensively by physical means – Part 2 : Concentrated and frozen orange juice
ES 1578 – 1 /2005 Codex 83/1981	Grape juice preserved extensively by physical means – Part 1 : Natural grape juic
ES 1578 – 2 /2005 Codex 82/1981	Grape juice preserved extensively by physical means – Part 2 : Concentrated grape juice – Concentrated grape juice frozen
ES 1581 – 2 /2005 Codex 63/1981	Apple juice preserved extensively by physical means – Part 2 : Concentrated apple juice – Concentrated apple juice frozen
ES 2360 – 1/2007	Maximum levels of certain contaminants in food stuff
Codex Standard 156 – 1987	Codex standard for follow up formula
ES 4245/2008	Determination method of printing ink resistance for removal from food packaging labels
ES 3120/2008 CAC/GL2 – 1985	Guidelines on nutrition labelling
ES 6050/2007	General requirements for packaging and wrapping used in food products
ES 3393/2005	Hygienic requirements for food product establishments
ES 3778/2005	Hazard Analysis Critical Control Point System and guidelines for its application (HACCP)
ES 3856/2006	Recommended Egyptian code of practice – General principles of food hygiene
ES 3875/2005 Codex 30/1999	Principles and guidelines of microbiological risk assessment

ES 4884/2008 **ISO 22000/2005**	Food safety management systems – Requirements for any organization in the food chain		
Business function	**Activity/ processes**	**Standards**	**Description**
Distribution (Outbound logistics)	Receiving and checking final products	ISO 9001:2008 GMP standards	• Quality management systems • Good manufacturing practice
	Storing	ISO 9001:2008	• Quality management systems
	Order preparation	ISO 9001:2008 GMP standards	• Quality management systems • Good manufacturing practice
	Loading of cars	ISO 9001:2008	• Quality management systems
	Acceptance (by customers)	ISO 9001:2008 CRM standards	• Quality management systems • Call centre and final control point standards
	Rejection (by customers)	ISO 9001:2008 CRM standards	• Quality management systems • Call centre level standards
Other standards used in the distribution process:			
Standards	**Description**		
ES 2613 – 1/2006	Durability periods for food products – Part 1 : General requirements		
ES 2613 – 2/2008	Durability periods for food products – Part 2 : Shelf life		
Codex Standard 234 – 1999	Recommended method of analysis and sampling – Part 1		
Codex Standard 156 – 1987	Codex standard for follow up formula		
ES 3120/2008 **CAC/GL2 – 1985**	Guidelines on nutrition labelling		
ES 4245/2003	Determination method of printing ink resistance for removal from food packaging labels		
ES 6050/2007	General requirements for packaging and wrapping used in food products		

Table 5 – Standards used in the business functions

Basically, Juhayna depends on three types of standards in the company :

1. **International standards :**
   - ISO 9001:2008, *Quality management systems – Requirements*
   - ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*

- ISO 22000:2005, *Food safety management systems – Requirements for any organization in the food chain*
- OHSAS 18001, *Occupational health and safety management system*

These standards are intended to be used for the following purposes:

- To establish management systems
- To ensure food safety in manufacturing and in delivery to markets
- To ensure optimal environmental conditions
- To ensure a healthy and safe environment for the work force

2. National standards of Egypt:

The relevant Egyptian Standards (ES) are listed in **Table 5** and are therefore not repeated here.

These standards are intended to be used for the following purposes:

- To provide criteria for the identification of suppliers
- To test materials
- To provide acceptance criteria
- To implement codes of best practice
- To ensure conformity to applicable regulations and laws

3. Internal standards:

Developed by suppliers and customers, such as McDonald's, Burger King, hotel chains, etc.

These standards are intended to be used for the following purposes:

- To enhance the functional quality of the units
- To define quality acceptance levels
- To provide a basis for customer acceptance or rejection
- To create Juhayna's own recipes

The key impacts from using standards for Juhayna are summarized in **Table 6.**

Business function		Key impacts from using standards
Supply chain	Procurement	• Basis for operating a high quality management system • An easy way to collect information from the company's design documentation • Application of an automated system that minimizes human errors • Reduction of cost due to re-work • Provision of more facilities especially between the company and suppliers • Easy accounting system saves time, reduces errors
	Inbound logistics	• Leads to high quality and safe food • Minimizes nonconforming materials • Helps in meeting regulations
Manufacturing		• Higher volumes and efficiency • Reduction in waste and scrap • Increased efficiency • Minimizes human error • Helps deliver safe products
Distribution (Outbound logistics)		• Increased market share • Helps deliver premium quality product • Minimizes nonconforming products

Table 6 – Key impacts from using standards

3.7 Selection of operational indicators

After identifying the standards used in the company and their impacts, we defined operational indicators in order to measure the changes that occured as a result of the use of standards. We then translated the quantified impacts of the standards into financial terms.

The operational indicators selected by interviewing company managers and engineering staff and EOS experts are presented in the **Table 7.**

Business function		Related activities		Value drivers	Standards used	Operational Indicator	Definition of the indicators
Supply chain	Procurement	Supplier selection		Quality of suppliers	ISO 9001:2008 ES 4884/2008	Order availability on time	Avoidance of misunderstandings about required specifications for supplied raw materials and other goods
		Order (formulation and communication)		Secure availability		Order availability on time	Availability of raw materials for manufacturing whenever needed
		Warehousing		Optimum storage conditions		Stock levels comply with planning	Cover all planned orders in both local and export markets
		Quality assurance		Comply with standard	ISO 22000:2005 HACCP	Rate of non-conforming materials	Minimize the risk of receiving nonconforming lots through inspection plans
		Quality control		Matching agreed specifications	ISO 9001:2008 AOAC ES 4884/2008	Analysis of supplies versus Certificates of Analysis (COA)	Measure control point to ensure materials conformity
	Inbound logistics	Receiving & checking of supplies	Return non-conforming supply	Acceptance criteria	ISO 22000:2005 GMP	Rate of non-conforming materials	Minimize the risk of receiving nonconforming lots through inspection plans
			Store conforming supply	Safe stock	ISO 22000:2005	Reduction in losses	Ensure optimal storage to reduce losses before manufacturing

Business function	Related activities	Value drivers	Standards used	Operational Indicator	Definition of the indicators
Manufacturing	Receiving ingredients	Correct specifications	ISO 22000:2005	Zero faults	Assurance of using the right materials in the right recipe
	Concentrates dump	Correct specifications	OHSAS 18001 ISO 14001:2004 ISO 22000:2005 FSSC	Time consumed per batch	Three hours reduced to one hour
	Solution preparation	Correct specifications	ISO 22000:2005 OHSAS 18001 ISO 14001:2004 ES 1012-1/2005 ES 6206-1/2007 ES 4206/2003 ES 2360/2007	Chilled store failure	Assurance of using the standard solution in the right recipe. 4 % error reduced to0.1 %
	Pasteurization	No contamination	ISO 22000:2005 ES 4884/2008	Customer feedback Pasteurization efficiency	No claims from customers about contamination risk. Pasteurization efficiency increased from 95 % to 100 %
	Filling	Meeting sales plan on time	ISO 22000:2005	Sales Satisfaction Product failure	Sales department receives the required products within the planned time. 3 % product failure reduced to 0.1 %

Business function	Related activities		Value drivers	Standards used	Operational Indicator	Definition of the indicators
Manufacturing	Palletizing and storage		Products conform to specification	ISO 22000:2005 ES 3120/2008 CAC/GL2 – 1985 ES 4245/2003 ES 6050/2007	Less non- conformity Product failure	Apply First-In-First-Out (FIFO) policy without problems. 2 % product failure reduced to 0.2 %
	Sending to distribution		Meet customer needs	ISO 9001:2008 CAC/RCP 57- 2004	Less product availability	Meet customer needs via country-wide distribution network
Distribution (Outbound logistics)	Receiving and checking final products		Products conform to specification	ISO 9001:2008 ES 2613/2006 ES 3120/2008 CAC/GL2 – 1985 ES 4245/2003	Less non-conformity & product failure	Apply FIFO policy without problems. 2 % product failure reduced to 0.2 %
	Storage		Safe stock	ISO 9001:2008	Ready to sell	Prepare stock to cover the sales plan
	Order preparation		Safe stock	ISO 9001:2008	Ready to sell	Prepare stock to cover the sales plan
	Loading of cars		Safe stock	ISO 9001:2008	Ready to sell	Prepare stock to cover the sales plan
	Sales	Acceptance (by customers)	Meet customer satisfaction	CRM	Rate of conforming product	Product meets or exceeds customer expectations
		Rejection (by customers)	Does not meet customer satisfaction	CRM	Rate of nonconfor-ming product	Product fails to meet customer expectations

Table 7 – Operational indicators and the impact of standards

3.8 Calculation of the economic benefits of standards

The changes as a result of the impact of standards in the selected indicators can be clearly observed in the years from 2008 to 2012. During this period Juhayna improved and extended the applied standards and added other new standards, compared with the time before 2007. The impacts of standards are seen as reductions in costs and increases in sales revenues, as shown in **Table 8** below.

Business Function		Operational indicators	Impacts	Contribution of stds (as % sales revenues) 2008-2012
Supply chain	Procurement	Time for orders	Reduced by 50 %	0.08
		Manpower to deal with suppliers	Reduced by 50 %	
	Inbound logistics	Downtime	Reduced by 2 %	5
		Manpower for testing incoming raw materials	Reduced by 50 %	
		Risk of using defective materials	Reduced by 25 %	
Manufacturing		Efficiency	Increased by 70 %	10
		Energy used in the units	Reduced to lowest level	
		Waste	Reduced by 2 %	
Distribution (Outbound logistics)		Nonconforming products in the market	Reduced by 5 %	1.5
Total percentage contribution (compounded over five years):				**16.58 %**
Average annual contribution:				**3.32 %**

Table 8 – Cumulative economic benefits of standards

If we express the average annual contribution of 3.3 % in absolute financial values on the basis of the revenues for 2009-2012 (see **Table 1)**, we can see that the impact of standards is as follows:

The average annual revenue over the period 2009-2012 is EGP 2 076 750 000. If we deduct 3.3 % from this revenue (assuming that the respective standards had not been used), we arrive at an average revenue of EGP 2 010 017 421. This means – in absolute terms – that the **annual average contribution of the standards of 3.3 % amounts to EGP 66 732 578 per year**.

3.9 Qualitative and semi-quantitative considerations

After having determined the quantitative impacts of standards in different business functions, we recognized that there are certain impacts which we could not quantify:

1. **Quality mark:** This is one of the most important benefits to the company from applying standards – it helps to improve the company's reputation in the market and lowers transaction costs between buyers and sellers
2. **Environmental aspects:** The positive environmental impacts resulting from the use of local and international standards are of huge benefit to the company. The improvement in environmental performance is the result of using less raw material and thus producing less waste, as well as raising the level of internal and external cleanliness of the company and its products
3. **Training and education in the food industry sector:** The company conducts training and education on the production of healthy foods, including training on the relevant standards. This

activity has indirect benefits in disseminating knowledge about standards in industry and society

4. **Advertising:** As a result of the high quality level of the company's products through the use of standards, Juhayna generates more responses from its advertising and publicity about healthy products and their benefits, and greater awareness of the importance of the quality factor – especially connected to human health
5. **Active participation** in the development of standards has given a competitive advantage to companies through access to information about standard specifications, and the incentive to achieve quality marks and certifications
6. **Opening a communication channel** to those interested in studying economics and food science in different research centres, universities, and scientific institutions, whether governmental or private, so they can observe the rapid growth of the company as a result of applying standards
7. **The use of technology** has helped to reduce the need for additional manpower to serve the increasing number of outlets over the last five years, and in handling the growing demand for Juhayna's products. This has helped to reach the higher-margin high-income market without lowering the level of service directed to the needs of the middle- and lower-income markets

3.10 Evaluation of results

The contribution of standards to corporate value creation is estimated at 3.3 % of the average annual sales revenues for the period 2009 – 2012. The major contribution of standards is in the production function. It has been found that the production process is more efficient and effective, resulting in less downtime and less waste and scrap.

Juhayna is a mature organization and has adopted good procurement practices based on standards since inception. The company has used standards mainly for three functions – supply chain, production and distribution. Its competitive advantage rests to a large extend on undertaking these activities efficiently and effectively. Juhayna may be able to further enhance its competitive advantage by using standards in other value chain activities as well.

It has been the objective of the study to identify benefits attributable to the impacts of standards. However, it was not always easy to distinguish those impacts from other factors such as changes in technology and good practices in human resource management, which certainly have improved the company's turnover.

It is further noted that the data has been gathered as first-hand information provided by the personnel of the company under study. This information is subjective and may not be as precise as could be desired.

Generally, standards are implemented to achieve cost reduction through a decrease in waste, in the number of rejected products, and in rework. Other objectives are the efficient use of energy and good procurement practices which reflect favourably in this study.

3.11 Conclusions

Juhayna Food Industries S.A.E. has developed sophisticated and integrated sourcing, production and distribution capabilities that enable it to leverage its scale and purchasing power to manage costs, and implement more efficient processes throughout its operations.

It is acknowledged that standards contribute to the organizational bottom line. A longer study of the impact of standards may reveal whether the competitive advantage can be maintained or further improved by the use of standards.

The ISO Methodology is applicable by comparing situations before a company has implemented standards with the results achieved after the implementation of standards. However, such a comparison is often not available under real conditions, particularly for companies that have a certain history with less involvement in standards, and operate in markets that are well established.

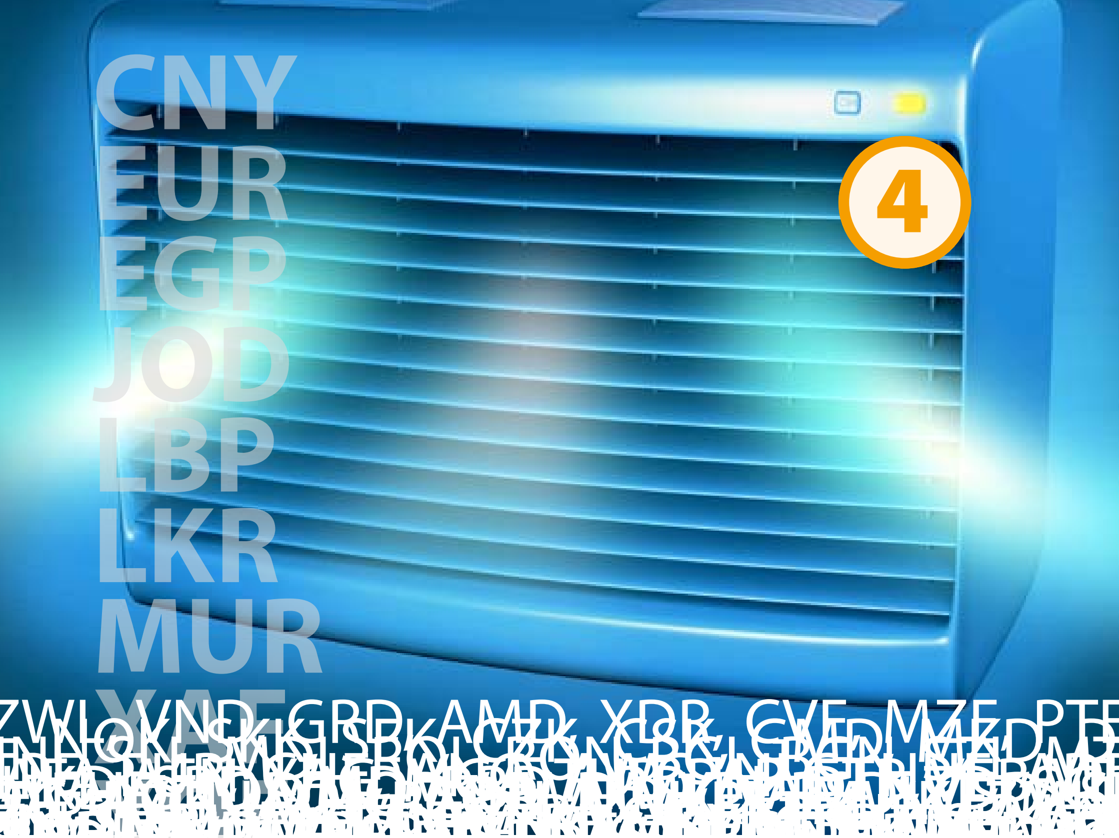
In addition, the project has shown that Juhayna's partnership with suppliers who have committed to using standards, including process chain management standards for their products, has also benefitted and resulted in less waste and improved operational efficiencies.

The methodology has enabled us to identify, describe and evaluate the economic benefits of standards on various functions of an organization.

A concerted effort by Juhayna to lead in standards development and implementation initiatives has been justified through this pilot study since it demonstrates the interconnectivity of standards throughout the company value chain, and the contribution of the standards to Juhayna's value drivers.

The impact of the standards is not limited to the value chain of an individual organization, but extends to the external environment in which the organization operates, including its network of suppliers.

Standards and in particular ISO International Standards have strengthened the position of the company in both the local and national markets, which has had an impact in sales turnover, leading to continuous growth for the company.



Petra Engineering Industries Co., Jordan

Country : Jordan

ISO member body : Jordan Standards and Metrology Organization (JSMO)

Project team :

Project leader : Ms. Rula Madanat, Assistant Director General for Technical Affairs, Director of Knowledge Management Department (JSMO)

Member : Ms. Zainab Khaleel, Head of TBT Enquiry Point Division, Knowledge Management Department (JSMO)

Member : Ms. Dima Jalal, Head of Planning Division, Organizational Performance Management Department (JSMO)

ISO Central Secretariat advisor : Reinhard Weissinger, Manager, Research, Education & Strategy

Duration of the study : June 2011 – April 2012

4.1 Objectives and organization of the pilot project

The main objective of this pilot project was to determine in a quantitative manner the economic benefits of the use of standards for the company assessed. The findings can be applied to promote the use of standards based on evidence that they can improve the financial results of companies through savings and increases in revenue.

The ISO pilot project in Jordan was conducted from June 2011 to April 2012 and was led by the Jordan Standards and Metrology Organization (JSMO), with the participation of MBA students from the University of Jordan under the guidance of ISO.

4.2 Introduction to the selected company

Petra Engineering Industries Co. was selected for this pilot study since it is a leading engineering company in the Heating, Ventilation and Air Conditioning (HVAC) industry in Jordan, committed to achieving a competitive advantage in providing high quality products that meet and exceed customer's needs and expectations. Petra is committed to adopting and implementing standards for design, production and compliance purposes. It seeks to achieve world-class performance and excellence by adopting TQM principles, and has obtained many certifications from established bodies for its compliance with well-known international standards.

Petra was founded in 1987 with a vision to produce a wide range of heating, ventilation, and air conditioning equipment meeting the diverse application requirements of major markets worldwide. The implementation of successful corporate and business strategies has taken Petra to a high level, and has enabled the company to compete with well-established, high-end companies from other countries.

Petra has expanded significantly throughout the years and continues to grow. The company is currently building a new facility in Mafraq, Jordan, that will cover an area of over 200 000 m^2 and be equipped with technically advanced production lines. At present, Petra has a 300 000+ m^2 production facility in Muwaqar, about 70 km south of the Jordanian capital, Amman, with more than 1 500 employees, including highly competent technical and managerial staff, and over 300 engineers.

In 1994, Petra extended its line of HVAC equipment, utilizing some of the industry's most advanced machinery and raw materials to achieve the highest quality standards. Petra's equipment has rapidly gained recognition in over 20 countries worldwide. After 2000, Petra's products entered the USA – a major milestone in its success, particularly in view of the strong competition in this market. Petra continues to export to the US and to over 50 other countries including Saudi Arabia, Qatar, the United Arabian Emirates (UAE), Egypt, and Palestine.

According to figures for 2010, the following ten markets represent nearly 95 % of Petra's sales:

	Key markets for Petra	% of total sales
1.	Saudi Arabia	29.37 %
2.	Jordan	26.89 %
3.	Qatar	9.86 %
4.	USA	8.88 %
5.	UAE	8.81 %
6.	Egypt	3.21 %
7.	Iraq	2.41 %
8.	Palestine	2.09 %
9.	Kuwait	1.64 %
10.	Sudan	1.51 %
	Total:	**94.67 %**
	Rest of the world:	5.33 %

Table 1 – Key markets of Petra

As Petra is targeting global markets, it is competing with large multinational companies. Its main competitors are:

- Hitachi (Japan)
- LG (Korea)
- Samsung (Korea)
- Al Zamil (Saudi Arabia)
- York (USA)
- Carrier (USA)
- Train (USA)

Petra's production facilities include:

- Automatic coil brazing line condensing units
- Production plant large capacity chiller units
- Production plant packaged units
- Assembly plant sound testing room small chillers
- Production plant roof top packaged units
- Production plant sheet metal forming
- Plant pipe bending mini split units
- Production plant lab control room fin presses
- Production press heat exchanger fan coil units
- Production plant CNC sheet metal forming
- Unit air handling units

In order to meet customer requirements, Petra provides customized designs manufactured to specific customer needs. The company has a highly competent and dedicated design staff to ensure that all products incorporate state of the art technology in accordance with many internationally established HVAC standards.

4.3 Attitude of the company towards standardization

Petra believes that the road to success is achieved by providing competitive, high quality products and customer service at competitive prices, and by delivering reliable after sales-service in order to meet customer needs and expectations, and enhance their satisfaction. The company is confident that its success in supplying a large variety of high quality equipment is the result of working in accordance with international standards. It has adopted many standards, including those for energy efficiency, and has earned the following management system certifications:

ISO 9001, *Quality management systems – Requirements* : Petra has been certified to ISO 9001 since 1996, and the certification was renewed to reflect the current 2008 version of the International Standard.

ISO 14001, *Environmental management systems – Requirements with guidance for use* : Petra has been certified to ISO 14001 since 1999, and is currently applying ISO 14001:2004.

Both standards are generic and therefore applicable to all company operations, including design, manufacture and service of heating, ventilation, air conditioning and refrigeration equipment.

Based on European and US standards, Petra is entitled to use the following certifications for its products :

CE Marking (European Conformity) : By applying the CE mark, Petra assures that its products comply with all applicable EU Directives, and have been subject to the appropriate conformity assessment procedures. Petra products comply with Machinery, Low Voltage, Energy Efficiency and Electromagnetic Compatibility Directives.

This certification has been achieved by a testing and conformity assessment which emphasizes product properties such as safety, quality, durability, environmental compatibility, and conformity to standards.

- UL (Underwriter's Laboratories) : According to the 1995 heating and cooling equipment standards, Petra's products are UL listed, since it has complied with the relevant safety and high quality requirements.
- ETL Listing (Intertek Testing Services) : The ETL Listed Mark is proof of product compliance (electrical, gas and other safety standards) to North American safety standards. Authorities Having Jurisdiction (AHJs) and retailers in 50 states and Canada accept the ETL Listed Mark as proof of product safety. According to the 1995 heating and cooling equipment standards, Petra's products are ETL listed, since its testing laboratories conform to UL 1995, second

edition ; CAN/CSA C22.2, No. 236,, which are standards for heating and cooling equipment and Gas Unit Heater and Gas-Fired Duct Furnaces (ANSI Z83.8B ; CGA 2.6b-M00).

- ARI Certifications : AHRI Certified™ is the trusted mark of performance assurance for heating, ventilation, air conditioning and commercial refrigeration equipment, issued by the *Air-Conditioning, Heating, and Refrigeration Institute* (AHRI). Products earning this mark undergo rigorous independent annual evaluation to ensure that their performance complies with AHRI standards. The certification of HVAC equipment and components allows consumers to compare products independently on the basis of verified performance ratings.
- Eurovent Certification : This certifies the performance ratings of air-conditioning and refrigeration products according to European and international standards. Petra AHU products are certified and published on the Eurovent Certification website.

Petra is also a member of the national IEC technical committee, and is involved in the standardization technical committee for energy efficiency.

At the national level, Petra has been awarded the " King Abdullah II Award for Excellence " based on TQM principles (ISO 9004) and has been made a member of the Golden List Programme for the export model managed by the Jordan Customs Department. Such recognition has given the company competitive advantages enabling it to successfully penetrate new markets and expand in existing ones.

4.4 Analysis of the value chain

4.4.1 Industry value chain

Figure 1 gives an overview of the value chain of the HVAC industry :

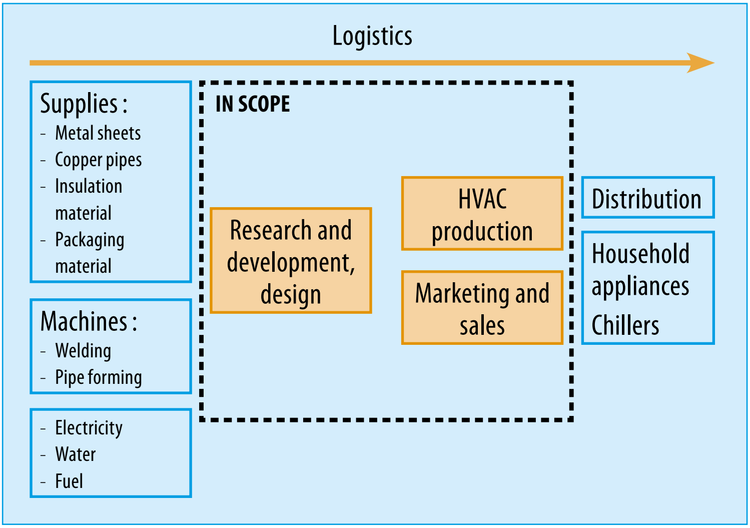


Figure 1 – Value chain of the HVAC industry

4.4.2 Company value chain

Figure 2 shows Petra's internal value chain :

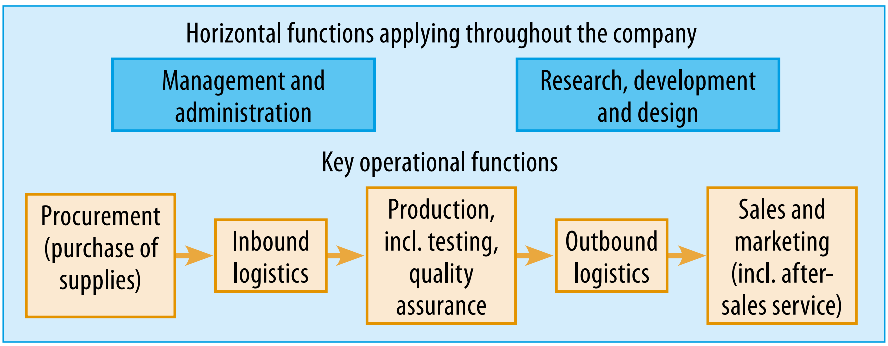


Figure 2 – Company internal value chain

4.4.3 Key value drivers

The key operations and business functions that contribute to the success of the company are research and development, procurement, production and marketing. We can identify the value drivers in each business function as follows:

	Business function	Activities	Value driver
1	Management and administration	Management systems Quality planning HR management Correction, prevention and innovation	Better quality management Better environmental management Reduced liability cost
2	Research, development and design	Applied research, and product development	Clearer product specification Variety reduction Customized and high quality products
3	Procurement	Screening of suppliers Selection of suppliers Contracting suppliers	Partnership with suppliers More efficient receipt of supplies Better product availability Variety reduction Better information transfer Reduced storage cost
4	Production	Production planning Order processing Quality assurance	Operational efficiency Compliance with safety and energy efficiency requirements
5	Marketing and sales	Market planning Client acquisition Contracting	Customer trust Better customer communication

Table 2 – Key value drivers

4.5 Scope of the pilot project assessment

The scope of the assessment was determined after interviews with Petra management. The business functions were selected based on the significant use of technical standards with high correlation to the company's value drivers, in addition to some other factors such as availability of resources for the assessment project, and the ease of access to key information.

The business functions included in this study, and for which the impacts of standards are assumed to be the highest, are the following :

1. Management and administration
2. Research, development and design
3. Procurement and inbound logistics
4. Production
5. Marketing and sales

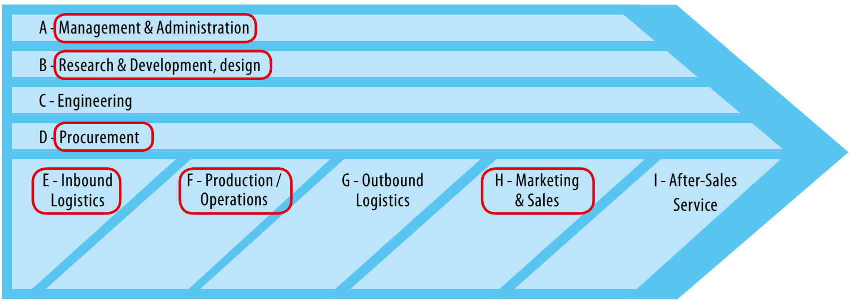


Figure 3 – Business functions selected for the assessment

4.6 Use of standards in the company value chain

The following table illustrates the main business functions in the scope of the project, and the standards used in each function :

	Business function	Edition of the standard currently used by Petra	First introduced in	Edition of the standard initially used
1	Management and administration	ISO 9001:2008	1996	ISO 9001:1994
		ISO 14001:2004	1999	ISO 14001:1996
2	Research, development and design	ISO 9001:2008	1996	ISO 9001:1994
		ISO 14001:2004	1999	ISO 14001:1996
		UL-2005	2000	UL – 1995
		AHRI 430	2007	––-
		AHRI 440	2002	
		ANSI/ASHRAE 30-1995	2007	AHRI 550/590
		ANSI/ASHRAE 37-1988	2007	AHRI 340/360
3&4	Procurement and inbound logistics Production, testing and quality assurance	ISO 9001:2008	1996	ISO 9001:1994
		ISO 14001:2004	1999	ISO 14001:1996
		UL-2005	2000	UL-1995
		AHRI 430	2007	––-
		AHRI 440	2002	
		ANSI/ASHRAE 30-1995	2007	AHRI 550/590
		ANSI/ASHRAE 37-1988	2007	AHRI 340/360
		AHRI 260	2007	
		AHRI 350	2007	
		OM-5-2009	2008	Eurovent 1986
		JS 60335-2-40	2007	JS 1590:2003
		EN 55011:1991	1998	
		EN 61000-4-3:1995	1998	
		EN 61000-4-6:1996	1998	
		EN 61000-4-2:1995	1998	
		EN 61000-4-4:1995	1998	
		EN 50204:1995	1998	
5	Marketing and sales	ISO 9001:2008	1996	ISO 9001:1994
		ISO 14001:2004	1999	ISO 14001:1996

Table 3 – Key standards used in the business functions

4.7 Selection of operational indicators to measure the impact of standards

In the table below, operational indicators are given for the selected business functions which are applied in section 4.8 to measure the impacts of standards. It should be noted that no indicators have been defined to measure the impact on marketing and sales.

	Business function	Indicator	Measurement of the indicator
1	Management and administration	**1.1** Reduced risk of liability claims for defective products, due to conformity of product and components to standards, and having obtained certifications for critical components	Average cost of liability claim * Number of potential claims
		1.2 Decrease in training costs due to the use of standards	Difference in training cost if trainees are trained externally versus actual internal training cost
		1.3 Savings due to the use of recycled (treated) water for irrigation purposes	Amount of treated water used for irrigation * price of 1 m3 of water
2	Research and development and design	**2.1** Reduction in design manpower due to computerized documentation system (based on ISO 9001) and design software, which also reduced design time	Differences in the design cost from year to year = (cost of designers per design + cost of software including software development and maintenance per design) * 10 % [the impact of the use of standards is estimated to be 10 % of the savings]
		2.2 Savings due to the use of validated software since testing type approvals are avoided	Annual savings in testing type approvals = cost of testing type approvals if software is not used – cost of software including the validation cost
3	Procurement and inbound logistics	**3.1** Savings in the cost of testing inputs due to purchasing from certified suppliers, taking into account the increase in purchase cost when purchasing from such suppliers	(Cost of testing inputs (10 % of purchased quantities) + cost of purchased inputs) in case of non-certified suppliers – (cost of testing inputs (1 % of purchased quantities) + cost of purchased inputs) in case of certified suppliers
		3.2 Savings due to higher reliability/ quality by using standardized components (decrease in number of returns)	Changes in the cost of returned items from year to year
4	Production and testing	**4.1** Decrease in number of inspectors due to the existence of clear work instructions and quality assurance at the design stage	Savings in cost of inspectors = difference in total salaries of all inspectors from year to year
		4.2 Savings due to testing in Petra's approved labs instead of external testing in US labs	Cost of external testing including cost of shipping – cost of internal testing in Petra's approved labs

Table 4 – Operational indicators

4.8 Calculation of the economic benefits of standards

In this section the operational indicators given in section 4.7 are applied to calculate the economic benefits obtained by Petra. The benefits are expressed as a percentage of the average sales revenue from 2006 to 2010.

	Indicators	Contribution as a percentage of revenue (%)
1.1	Reduced risk of liability claims for defective products due to conformity of product and components to standards, and having obtained certification of critical components	0.018 %
1.2	Decrease in training costs due to the use of standards	0.024 %
1.3	Savings due to the use of recycled (treated) water for irrigation purposes	0.009 %
Business function total : Management and administration		**0.051 %**
2.1	Reduction of design manpower due to computerized documentation system (based on ISO 9001), and to design software which also reduced the design time	0.0001 %
2.2	Savings due to the use of validated software since testing type approvals is avoided	0.432 %
Business function total : Research and development and design		**0.432 %**
3.1	Savings in the cost of testing inputs due to purchasing from certified suppliers, taking into account the increase in purchase cost when purchasing from such suppliers	2.212 %
3.2	Savings due to higher reliability/quality by using standardized components (decrease in number of returns)	1.492 %
Business function total : Procurement and inbound logistics		**3.704 %**
4.1	Decrease in number of inspectors due to the existence of clear work instructions and quality assurance at the design stage	0.001 %
4.2	Savings due to testing in Petra's approved labs instead of external testing in US labs	0.010 %
Business function total : Production, testing, quality assurance		**0.011 %**
Total contribution (as a percentage of Petra's average sales revenue between 2006 and 2010) :		**4.2 %**

Note : At Petra's request, the contribution of standards is given in the form of percentages of the average annual revenue and not in absolute figures.

Table 5 – Calculation of economic benefits of standards

4.9 Qualitative and semi-quantitative considerations

In addition to the measurable results shown in section 4.8, there are many examples of benefits from the use of standards that cannot be directly quantified, such as:

- Better environmental management and health and safety management compliance leading to an improved reputation for the company in the market
- The storage area and processing time needed for supplies handling could be reduced as a result of procurement from certified suppliers, according to standards
- Efficient customer service resulting in higher customer satisfaction
- Compliance to standards contributes to an increase in product market share, and is often a precondition of initial market entry

4.10 Evaluation of results

The overall result shows a total financial impact of over 4 % of the average annual revenues for the period 2006 and 2010.

The scope of the study included five business functions of the company decided on as a result of interviews, and an analysis of company functions where standards appeared to have a particularly strong impact:

4.10.1 Management and administration

Petra accomplished a saving of **0.051 %** of total revenues resulting from certification to, and implementation of, ISO 9001 and ISO 14001.

The implementation of ISO 9001 provides assurance that documented procedures and work instructions are in place. It also requires continuous improvement and monitoring of processes through established quality assurance and control systems, and by regular audits and management reviews. As a result, production variations and defects are reduced along with the risk of liability claims due to defective and unsafe products.

Having well documented systems with written procedures in which standards are integrated gives Petra the opportunity to train employees internally instead of externally. Since the company has its own qualified trainers, training costs can be reduced,

A more efficient use of resources has been achieved as a consequence of ISO 14001 environmental management system certification, following which water is treated for irrigation purposes resulting in reduced consumption.

Although, the company started implementing management system standards many years before this study, the effects of using standards are nevertheless clear because of the company's adherence to continuous improvement.

4.10.2 Research, development and design

The impact of standards is not very evident in software design. However, the use of validated software to perform type approval tests resulted in a saving of **0.432 %** of total revenues.

Standards are considered a major input to the design stage. Petra uses specific software for design purposes which is continuously updated to integrate any new or revised standards. As a result, man-days needed to produce a new design or revise an existing one are reduced, as are the number of designers needed. Nevertheless, the impact of standards is not very clear in this area since computerization has, in general, played a major role in supporting the work of the designers. A limited impact can be attributed to continuous improvement, since updates to standards are reflected in the software.

Also, the software is continuously validated thus saving Petra the cost of testing for type approvals that would otherwise be required in the absence of such software.

4.10.3 Procurement and inbound logistics

Standards make the largest impact in this area with a contribution of **3.704 %** of revenue. Purchasing from approved and certified suppliers leads to a reduction in the costs of inspection and testing, since the quality of purchased components is assured, and, because of the use of certified suppliers, the amount of testing can be reduced to only 1 % of the purchased supplies.

If we were to assume that Petra purchases from non-certified suppliers, then it would need to test about 10 % of the purchased quantities before using them in production in order to be sure the quality was up to requirements —resulting in a significant increase in costs.

Purchasing from certified suppliers who can deliver standardized high quality components that fit well with Petra's components and products has led to better quality and reliability in the finished products. This in turn has resulted in fewer returns from quality control check points during production.

4.10.4 Production, testing and quality assurance

In the production area, updated procedures and work instructions based on new standards are made available to all staff. Processes have been improved as a result of internal audits, and the certification of the internal quality lab has led to faster and more efficient testing during the production process. The result is increased production efficiency, a higher quality end-product, and a contribution of **0.011 %** to revenue.

Because of ISO 9001 implementation, fewer quality inspectors are required because work instructions are clearer and readily available during the process. Furthermore, it was possible to reduce in-process quality inspection during production due to quality assurance at the design stage.

In addition, Petra's testing labs are approved in conformity with standards such as UL and Eurovent, which has saved the cost of external testing of product samples.

4.10.5 Marketing and sales

The implementation of standards led to the introduction of Petra products in new markets such as the US, where UL standards compliance is a must. In addition, conformity to energy efficiency standards was a prerequisite of entry to the Saudi Arabian market, resulting in an increase in Petra's share in this market in 2010. However, we did not define operational indicators for this business function since entry into the US market, for example, had already taken place a number of years ago and was not related to continuous development.

4.11 Conclusions

This study has demonstrated the positive impact of standards both in the national Jordanian and international markets, particularly as certification to certain standards is often a key condition of market entry. Petra employees interviewed during this assessment clearly expressed their impression of the positive effects of mandatory and voluntary standards, the implementation of which enable Petra to be a step ahead of its competitors.

Annex 1 : List of key standards used by Petra Engineering Co.

Standards reference	Standards title
ISO 9001:2008	Quality management systems – Requirements
ISO 14001:2004	Environmental management systems – Requirements with guidance for use
AHRI 260	Sound Rating of Ducted Air Moving and Conditioning Equipment
AHRI 350	Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
AHRI 430	Central Station Air Handling Units
AHRI 440	Performance Rating of Room Fan-Coils
ANSI/ASHRAE 30-1995	Method of Testing Liquid-Chilling Packages
ANSI/ASHRAE 37-1988	Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment
EN 50204:1995	Radiated electromagnetic field from digital radio telephones – Immunity test
EN 55011:1991	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement
EN 61000-4-2:1995	Electromagnetic compatibility (EMC) – Part 4 – 2 : Testing and measurement techniques – Electrostatic discharge immunity test
EN 61000-4-4:1995	Electromagnetic compatibility (EMC) – Part 4 – 4:Testing and measurement techniques – Electrical fast transient/burst immunity test
EN 61000-4-6:1996	Electromagnetic compatibility (EMC) – Part 4-6 : Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
JS 60335-2-40	Household and similar electrical appliances – Safety – Part 2-40 : Particular requirements for electrical heat pumps, air conditioners and dehumidifiers [Jordanian Standard]
UL-2005	Heating and Cooling Equipment

Annex 2 : Websites

Intertek : www.intertek.com/marks/etl

Jordan Standards and Metrology Organization (JSMO) : www.jsmo.gov.jo

Petra Engineering Co. : www.petra-eng.com

Underwriters' Laboratories (UL) : www.ul.com/global/eng/pages

Holcim Lebanon S.A.L., Lebanon

Country : Lebanon
ISO member body : Lebanese Standards Institution (LIBNOR)
Project team :
Project leader : Ms. Léna Dargham, Acting Director General, LIBNOR
Consultant : Mr. Benoit Naous, Chief Executive Officer, 3ASolutions Group s.a.r.l
Member : Ms. Ghina El Meouch, Standards Officer, LIBNOR
ISO Central Secretariat advisor : Reinhard Weissinger, Manager, Research, Education & Strategy
Duration of the study : July 2011 – March 2012

5.1 Objectives and organization of the pilot project

Standards are usually perceived as tools to help organizations optimize their internal processes, improve the effectiveness of cooperation between them by reducing transaction costs, and facilitate entry into markets through compliance with regulatory and customer requirements. Standards can also help organizations become more competitive and enhance profitability. They are also a means of developing and transferring good practices.

However, despite numerous studies aimed at demonstrating the benefits of standards at the micro-economic level of individual organizations or at the macro-economic level of national economies, consistent and reliable data on the impacts of standards and the economic benefits resulting from their use are still rare. To address this deficiency, ISO has developed the " ISO methodology ", a structured approach to assessing the economic benefits of standards from the perspective of individual organizations, with the objective of helping them develop a sound basis from which to determine those benefits.

The ISO methodology gives practical advice on the steps in the assessment process, the phases in pilot projects and methods to calculate the benefits of standards.

5.2 Introduction to the selected company

This section starts with an introduction to the real estate sector in Lebanon, gives an overview of the Lebanese cement industry, and introduces the company selected for the assessment : *Holcim Lebanon*, the national branch of Holcim in Lebanon, a global cement company headquartered in Switzerland.

5.2.1 History of Holcim Lebanon

HOLCIM Lebanon S.A.L. (HL) was incorporated in Lebanon in 1929 as a subsidiary of Switzerland-based HOLCIM Ltd., one of the largest cement producers in the world. The company produces and markets grey and white cement and other related concrete construction products. HL's main production facility is located in Chekka, around 50 km to the north of Beirut, where it operates the largest cement kiln in Lebanon. Company headquarters are situated in Antelias, some five km north of Beirut. HL currently has an estimated 45 % share of the Lebanese cement market and is the largest cement company in the country, measured by sales. Its annual cement production capacity is 2.5 million tons, with products distributed to customers throughout Lebanon and limited exports to neighbouring countries.

In addition to its grey cement plant, HL operates a white cement plant through its subsidiary in Chekka, Société Libanaise des Ciments Blancs (SLCB), the only producer of white cement in Lebanon. It also runs four concrete plants in Nahr El Mott, Kfarchima, Chekka and Tyr along with a grinding station located in Northern Cyprus.

The annual cement production capacity of the Chekka plant, which amounts to 2.5 million tons, is attributed to modern manufacturing equipment and a sophisticated kiln.

HL's raw materials are mainly procured from its quarry in Chekka, which is expected to provide supplies for the next 30 years at least, assuming a modest growth in HL's annual production capacity. HL has three different revenue sources :

- Grey cement
- White cement
- Ready mix concrete

Revenue at HL is dominated by grey cement sales which represented 84 % of revenue in 2009. The sales volume from white cement sales is much lower and amounted to 100 000 tons in 2009, compared to 1.98 million tons for grey cement. Revenue has been traditionally weighted towards local sales with international revenue driven mainly from markets in Syria, Iraq, and in Cyprus where the company's grinding facility is located. There were no export sales in 2010, since company capacity was concentrated primarily on meeting growing demand from the Lebanese market.

HL has intentionally limited exports as falling prices in Syria presented a less attractive market. Moreover, new cement producers have started to operate in Syria allowing buyers to avoid expensive shipping costs from Lebanon.

As a result of HL's hedging strategy, gross profitability margins were maintained at between 31 % and 33 % over recent years, despite spikes in oil prices and aggressive fluctuations in energy costs.

HL focuses on offering high quality products and enhancing its image to customers as an environmentally responsible organization.

The company achieves this by leveraging its relationship with the parent company and through quality and process improvements. In addition, HL follows basic risk management principles by avoiding too strong a reliance on a few customers, or on focusing too much on a particular geographical area.

Regular equipment and plant upgrades, using the most innovative production technologies, have enabled HL to produce high quality cement. In 2010, the company invested USD 4 million in a new filter to reduce emissions, and improved the quality of its products and the efficiency of the production process by lowering maintenance frequency and expenses.

Reducing the impacts of production on the environment is a major consideration for HL as it works towards the objective of sustainable development. The company has obtained ISO 14001 certification for its environmental management system, and focuses on:

1. Water management: The company uses a closed circuit cooling system to reduce water use and effluents, in addition to a metering system to monitor water consumption.
2. Treatment of waste water: A physical treatment of wastewater is conducted in a sedimentation pool before discharge into the sea.
3. Energy consumption and efficiency: The company is planning to invest in the near future in a waste heat recovery plant that will enable it to recycle the heat used in the kilns producing clinker, an essential element in cement manufacture. As a result, energy costs and CO_2 emissions into the atmosphere will be reduced. In addition, HL is studying the use of industrial by-products as alternative fuels and raw materials for clinker production, to reduce the consumption of fossil fuels.

By maintaining a diversified customer base of more than 200 clients, HL ensures optimal market reach and product availability.

In terms of customers and markets, HL covers all regions in Lebanon : Beirut and North and South Lebanon are the major regions in terms of demand, followed by Mount Lebanon and Bekaa. Future demand is expected to shift more towards Mount Lebanon where construction activity is peaking as Beirut becomes saturated. Through its facilities located in different Lebanese regions, HL is able to satisfy the demand for its cement-related products across the country.

5.2.2 Developments in the real estate sector and the cement industry in Lebanon

Real estate prices have been rising quickly since the end of the Israeli-Lebanon war in 2005-2006. The real estate market in Lebanon is unique since many Lebanese citizens living abroad wish to invest and buy a house in Lebanon. More than four million Lebanese live in Lebanon while around 15 million live abroad. Based on a report from Bank Audi, the real estate market grew by 23.5 % from 2006 to 2010 but now shows signs of contraction.

Before the Lebanese war, the economic and political situation had been very difficult, especially after the assassination of former Prime Minister Rafik Hariri on 14 February, 2005.

The cement market in Lebanon has grown at a Compounded Annual Growth Rate (CAGR) of 10.3 % over the past ten years, reaching 5.10 million tons per year in 2010. This growth accelerated in 2007 following the reconstruction of bridges and regions damaged during the war.

Since 2008, the main driver of demand for cement in Lebanon has been real estate generated by the increase in capital inflows mainly from expatriates and Arab businessmen wishing to diversify away from markets impacted by the financial crisis. Moreover, with the continuous growth of tourist activity and the need for higher capacity in hotels and resorts, investments in the tourism sector have also had a tangible effect on construction.

Concerns about potential growth in real estate construction increase together with the risk of oversupply in the upscale and luxurious residential segment inaccessible to much of the population. Accordingly, it is expected that the cement market will downsize slightly during the next few years unless the development of Lebanon's infrastructure through potential public/private partnership boosts demand for cement.

5.2.3 Structure of the cement market in Lebanon

The cement market in Lebanon takes the form of an oligopoly of three companies with the following market shares (see : BlomInvest Bank, report dated 6 December, 2010) :

- HOLCIM Lebanon (43 % – 45 %)
- Cimentrie nationale (39 % – 41 %)
- Ciment de sibline (16 % – 18 %)

5.3 Attitude of the company towards standardization

HL has extensive experience in standardization and considers participation in standards committees to be highly valuable. It not only ensures a competitive advantage, but is a pre-condition for applying up-to-date standards in its operations.

In addition to national and international technical and management standards, HL applies a very elaborate system of procedures, methods and requirements developed by the Holcim Group, implementation of which is mandatory throughout the various national companies.

Examples are the manuals for procurement, and for design and project management.

HL also applies ethical and social standards in its operations. This implies sensitivity and a responsible management of natural resources throughout the construction life cycle, including operations and maintenance. Long-term environmental concerns, whether related to the flow of materials or energy, are an integral part of any project.

The company is certified to two management system standards: ISO 9001:2008 for quality management and ISO 14001:2004 for environmental management, as well as technical standard NL 53:1999 which defines the composition of cement and has been mandatory in Lebanon since 2003.

5.4 Analysis of the value chain

5.4.1 Industry value chain

The following figure gives an overview of the cement industry value chain. The area marked with a dot dash line is the core of the cement industry, of which more details are given below. All these activities are covered by HL operations. It also shows the inputs HL purchases from its suppliers and the key customers that procure HL products.

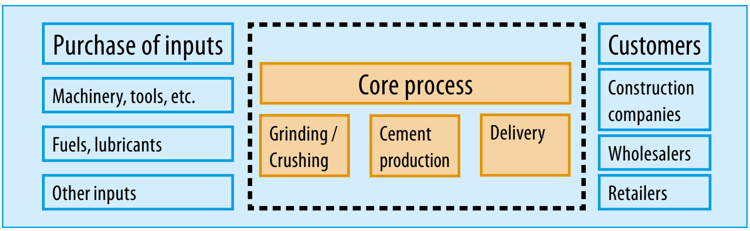


Figure 1 – The industry value chain

5.4.2 Basic process of cement production

The raw materials used in cement production are limestone, clay, shale, and silica sand.

Limestone is carefully blended before being crushed. Red mineral is added at the crushing stage to provide consistent chemical composition of the raw materials. Once these materials have been crushed and subjected to online chemical analysis they are blended in a homogenized stockpile. A bucket wheel reclaimer is used to recover and further blend this raw material mix before transfer to the raw material grinding mills.

The raw meal is fed into the top of a preheater tower equipped with four cyclone stages. As it falls, the meal is heated up by the rising hot gases and reaches 800°C. At this temperature, the meal dehydrates and partially decarbonizes. It then enters a sloping rotary kiln heated by a 1 800°C flame, where it is heated to at least 1 450°C to complete the burning process. At this temperature the chemical changes required to produce cement clinker are achieved.

The clinker discharging from the kiln is cooled by air to a temperature of 70°C above ambient temperature and heat is recovered from the process to improve fuel efficiency.

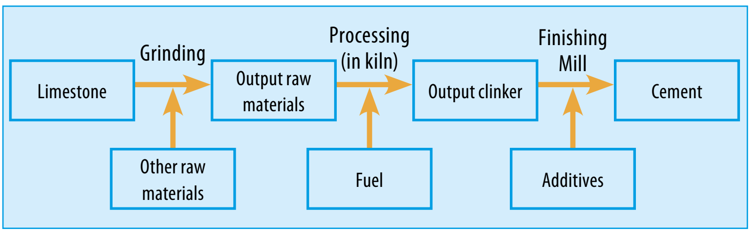


Figure 2 – Main stages in cement production

Figure 3 gives a process map of the main stages in the process of cement production from mining to delivery to the market :

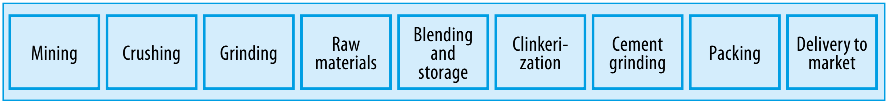


Figure 3 – Cement production : Process map

The full process as shown in Figures 2 and 3 is covered by HL operations.

5.4.3 Company value chain

The model developed by Michael Porter of Harvard Business School has been applied to the analysis of the company value chain. The business functions highlighted in the figure below have been chosen as the focus of the assessment.

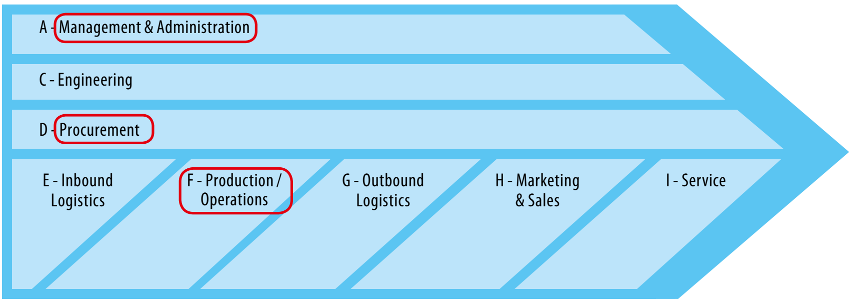


Figure 4 – Company value chain and selected business functions

HL's core businesses include the manufacture and distribution of cement and ready-mixed concrete. Those business functions subject to assessment of the impacts of standards are described below.

5.4.3.1 Business function : Management and administration

Quality and environment

To manage and monitor its operations better, HL implemented ISO 9001 in 2003 and ISO 14001 in 2004 across all its functions.

Since it is a part of the HOLCIM Group it has environmental commitments which exceed the requirements stipulated in Lebanese legislation.

HL is required to comply with the policy of the HOLCIM Group and its commitment to environmental responsibility. For this purpose, it has taken measures to reduce the consumption of key resources such as water and fuel, and it is also recycling and reusing parts of the waste it generates.

This commitment is intended to reflect positively on the reputation of the company and to strengthen its brand. It is HL's objective to continuously improve its environmental performance and to provide positive contributions to the business.

Cement manufacture is a resource- and energy-intensive process. With the objective of becoming and remaining eco-efficient, HL undertakes to preserve non-renewable natural resources and privileged material recycling through the following measures :

- Monitoring of stack emissions
- Dust reduction
- Modernization of the power plant
- Waste management

HL places a high priority on the safety of its employees. For this reason, the Holcim Group has developed a management system that aims at ensuring health and safety.

In order to apply the principles of its sustainable development strategy and manage its commitments strategically, HL has dedicated resources in different departments. Roles and responsibilities are clearly defined to ensure that efforts are effective and coordinated, and that internal and external stakeholders are adequately involved.

The Group strategy and approach to value creation integrates economic, environmental and social impacts – the three elements of the triple bottom line.

HL has integrated assessment tools and management systems into its business processes and supports their implementation with appropriate training. Managing the company's environmental impact focuses on identifying and assessing levels of impact, setting targets to reduce them, and a commitment to continuous improvement as part of its organizational policy-making.

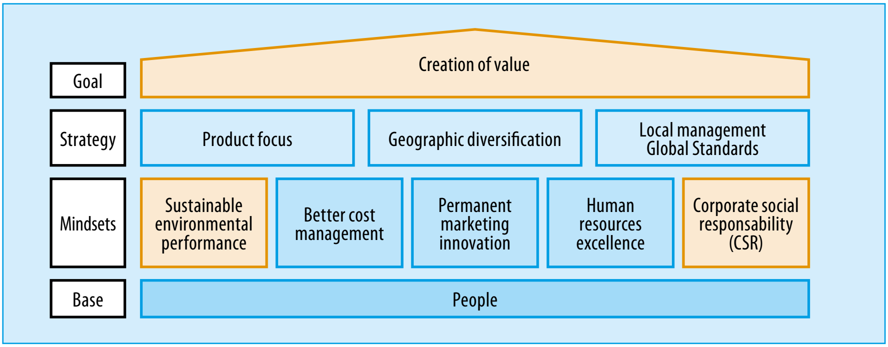


Figure 5 – HOLCIM strategy and the triple bottom line

A basic component of the HOLCIM approach to environmental management is the Plant Environmental Profile (PEP). PEP is an internal monitoring and reporting tool. Applying this self-assessment tool environmental performance can be studied and quantified through measurements and calculations, thus presenting the stakeholders with objective information. The purpose is to assess progress and to provide a benchmark across a range of environmental impacts. Obtaining accurate results requires intensive training for plant personnel, and regular evaluation reports to management.

As a resource and energy intensive process, higher eco-efficiency during the process of cement production is achieved through minimizing waste materials (reuse and recycling) and by reducing fuel and water consumption. The figure below shows the environmental impacts that occur during the stages of cement production :

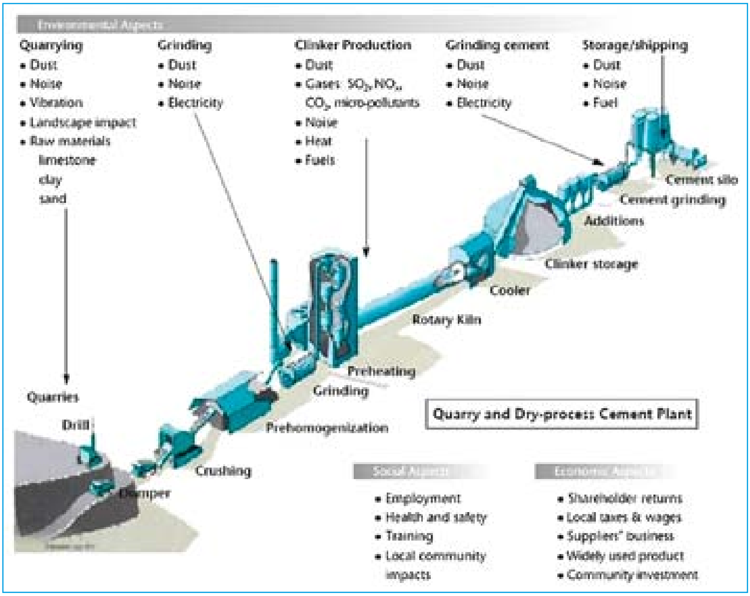


Figure 6 – Stages in cement production and its environmental aspects

Source : World Business Council for Sustainable Development " Cement Sustainability Initiative : Our Agenda for Action ", courtesy by R. Rivet

HL recognizes water as a fundamental natural resource, and the need to deal with growing water scarcity. Its water management strategy incorporates protection of water resources, control of water consumption, surface water management, and wastewater treatment.

Occupational Health and Safety (OH&S)

HL places high importance on ensuring health and safety by striving for zero risk for its employees, sub-contractors, third parties and visitors. The company applies OH&S standards and guidelines, and provides the resources and training to measure its performance. In making safety a top priority, the commitment to OH&S extends from top management to every worker.

5.4.3.2 Business function : Procurement

This function comprises supplier assessment, the selection of suppliers, negotiations and contracting, and purchasing of raw materials. It also covers management of sourcing and the relationship with suppliers.

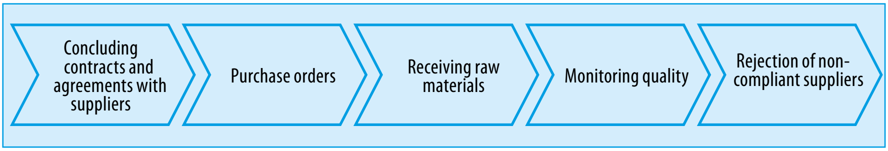


Figure 7 – Activities in the procurement function

Through the implementation of an ISO 9001-based quality management system, suppliers are assessed to ensure that only those meeting specific quality requirements are selected, and those not complying are rejected.

5.4.3.3 Business function : Production

The production process for cement, as operated by HL, has been described under 5.4.2. The main HL products are :

- Grey cement
- White cement
- Ready mix concrete

5.4.4 Key value drivers

The definition of " value driver " in the ISO methodology is the capability that creates a competitive advantage for an organization. The following aspects have been identified as value drivers at HL :

Know-how leadership : Being a member of the Holcim Group, HL has access to technological and procedural know-how that it would otherwise have to generate internally or purchase on the market. Much know-how is communicated from the Holcim headquarters in Switzerland to all national companies in the form of group management systems and group-wide operational and design manuals. Access to knowledge is therefore readily available as needed for the national companies.

Reputation and image : HL has a high reputation as representing one of the world's leading cement producers with a commitment to high-level environmental, health, safety and quality objectives.

Supplier and customer relationship : HL has a wide network of suppliers as well as a large number of customers throughout the country.

Production capability : The main value drivers in production can be summarized as :

1. Operational excellence,
2. Ability to optimize costs
3. High and flexible production capacity to respond to shifts in market demand

5.5 Scope of the pilot project assessment

Following several rounds of interviews at HL, it was decided to focus the study on the following three business functions :

- Management and administration
- Procurement
- Production

5.6 Use of standards in the company value chain

Table 1 lists the most important technical and management system standards used by HL in its different business functions. As mentioned earlier, HL is certified in conformity with ISO 9001:2008, ISO 14001:2004 and NL 53:1999.

Business function	Activities	External standards (currently used)	Year when HL started using these standards (possibly an earlier edition than that currently used)
Management and administration		ISO 9001:2008 ISO14001:2004	2003 2004
Procurement		ISO 9001:2008 ISO14001:2004	2008 2004
Production	Quarry and preparation of raw material	EN 197-1 : 2004 NL 53:1999 ISO 9001:2008 ISO 14001:2004	2004 1999 2003 2004
Production	Clinker production	NL 53:1999 ISO 9001:2008 ISO 14001:2004 ASTM D 388:1999 ASTM C 465:1999	1999 2003 2004 2011 2011
Production	Grinding	ISO 14001:2004 ISO 9001:2008	2004 2003

Business function	Activities	External standards (currently used)	Year when HL started using these standards (possibly an earlier edition than that currently used)
Production	Laboratory	EN 197-1:1999	2004
		NF EN 196-1:2006	2006
		NF EN 196-2:2006	2006
		NF EN 196-3:2006	2006
		NF EN 196-5:2006	2006
		NF EN 196-7:1990	2005
		NF EN 196-8:2004	2005
		NF EN 196-9:2004	2005
		NF EN 196-10:2005	2005
		NL 53:1999	1999
		prEN 932-1:1996	1996
		ISO 9001:2008	2003
		ISO 14001:2004	2004
		ASTM D 388:1999	2011
		ASTM C 465:1999	2011
		Syrian specifications	
Outbound logistics	Expedition	NL 53:1999	1999
		ISO 9001:2008	2003
		ISO 14001:2004	2004
		ASTM D 388:1999	2011
		ASTM C 465:1999	2011
Marketing and sales		NL 53:1999	1999
		EN 197-1:2004	2004
		ISO 9001:2008	2003

Table 1 – List of standards used at HL

Following interviews with HL staff, it was determined that the most important and widely used standards were the following:

ISO 9001:2008, *Quality management systems – Requirements*

This International Standard specifies requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide products that meet customer, applicable statutory and regulatory requirements. Effective application of the system aims at enhancing customer satisfaction, achieving continual improvement and providing assurance of conformity to requirements.

HL implemented ISO 9001 in 2003 to enhance customer satisfaction by meeting customer requirements. By implementing the quality management system all functions and departments are linked together thereby facilitating the transfer of information.

In procurement HL follows a purchasing process which ensures that purchased products conform to specified purchase requirements, and that suppliers are evaluated and selected based on their ability to supply in accordance with HL requirements.

ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*

This International Standard specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account both legal and other requirements to which the organization subscribes, as well as information on significant environmental aspects. It applies to those environmental aspects the organization deems it can control and influence.

The standard can be used as an audit tool, or to specify and evaluate objectives, or specify the elements and tools that must be in place for an environmental management system to be complete and effective.

NL 53:1999, *Cements – Portland Cement Type P, Portland Composite Cement Type Pa with Additives, Composite Cement Type C*

NL 53 is the main standard in Lebanon which contains definitions for different compositions of cement. Based on the European Standards EN 197-1 and EN 196, it was published in 1999 and was made mandatory in 2003.

NL 53 describes the properties of cement constitutions and the combinations necessary to produce different cement types and classifications. It also describes the mechanical, physical and chemical requirements applied for these types and classes, and defines the rules of the evaluation of conformity to certain specifications.

Details of NL 53 and its impact on the cement industry in Lebanon are discussed in section 5.8.

5.7 Selection of operational indicators to measure the impacts of standards

The following set of operational indicators in **Table 2** has been developed by the project team on the basis of interviews and discussions with HL staff members. The column on the right indicates whether or not a calculation was possible, either on the basis of data available from the company, or on the basis of estimations by HL staff.

No.	Business Function	Operational indicators	Explanation of the operational indicators	Data available ?
1	**Procurement**	Evolution of the number of (“ active ”) suppliers over recent years	Evolution of the number of active suppliers. Key question : Has this number been reduced due to the application of ISO 9001, resulting in more efficient supplier management ?	YES
2	**Production**	Clinker factor	Cement produced with lower clinker factor sold at an established market price (regular Portland cement) resulting in higher profit margins	YES
3	**Production (laboratory)**	Average rejection rate of supplies (raw material) due to nonconformity	Calculation of the average rejection rate of supplies due to nonconformity and savings from not accepting nonconforming raw materials	NO
4	**Production (laboratory)**	Number or percentage of prevented nonconforming product	The number or percentage of prevented nonconforming products due to identification of deviation from specifications during the production process	NO
5	**Management and administration (environment)**	HL’s environmental performance in relation to current legal requirements in Lebanon • HL’s own internal environmental objectives		NO (only qualitative evaluation)
6	**Management and administration (environment)**	Use of key resources	Calculate the reduction in the use of certain key resources, such as : • water • fuels and relate the savings per ton of output to the environmental management system HL has introduced (ISO 14001)	YES (no financial aspects yet)

No.	Business Function	Operational indicators	Explanation of the operational indicators	Data available ?
7	**Management and administration (environment)**	Reuse of waste/recycling	Check whether the reuse/recycling of waste, although small, can be seen as an impact of the EMS standards (and other standards that HL may use to monitor its environmental performance, such as NF N 14181 for emission monitoring)	YES
8	**Management and administration (environment)**	Reputation (for environmental performance)	Is it possible to calculate an economic value for the " good environmental image " of Holcim due to ISO 14001 implementation ?	Qualitative
9	**Management and administration (Occupational Health and Safety)**	HL's OHS performance in terms of • number of major internal accidents • cost of lost work time (due to staff injuries) • cost of medical treatment • cost of insurance	Are there any external standards applied in HL's measures regarding OH&S ? Is the decrease in the indicators (for example, major internal accidents, cost of lost time, etc.) due to the introduction of the OHSAS 18001 standard or equivalent ?	YES

Table 2 – Operational indicators considered to determine impacts of standards at HL

5.8 The impact of standards on cement production

There are several impacts of standards which will be outlined in this section. However, the main area of economic impact can be found in the production of new types of cement related to the influence of Lebanese standard NL 53 on cement production. This impact is complex and only partially a result of the technical content of the standard. Its impact is more in shaping the cement market in Lebanon on the producer and supplier side for companies such as HL, as well as for cement customers. To understand the impact of NL 53 better, this section is devoted to a review of how this standard impacted the cement market in Lebanon.

5.8.1 Cement standards in Lebanon and their implications for HL

In Lebanon, the key cement standard is NL 53:1999, *Cements – Portland Cement Type P, Portland Composite Cement Type Pa with Additives, Composite Cement Type C*. This standard was published in 1999 by the Lebanese Standards Institution (LIBNOR) and became mandatory on 11 March 2003 through Lebanese legislation. Similar to, and influenced by European standards (in particular EN 197), NL 53 allows different compositions of cement through different clinker factors (that is, a higher or lower proportion of clinker). NL 53 describes seven different compositions of cement with six different clinker factors ranging from 95 % to 100 % of clinker as a maximum, to between 35 % and 64 % as a minimum. Irrespective of the different composition of cement due to different clinker factors, the performance and durability of cement for specified purposes is ensured so that there is no difference in terms of usability and functionality of the cement for the end-user.

In the late 1980s and 1990s, HL – as with other cement companies in Lebanon and abroad – produced traditional Portland cement with a clinker factor of around 95 %. In the late 1990s, however, HL started to produce new types of cement in line with some of the options in NL 53 allowing a lower clinker factor. The reduction of clinker results in the increase of other additives in cement such as slag, pozzolana or limestone. Although the market prices for these additives vary over time, it can be stated, as a general principle, that the reduction in the amount of clinker resulted in lower production costs for cement as well as improved environmental performance (due to a decrease in CO_2 emissions during the production process). This resulted in an increased profit margin because HL continued selling cement at the original prices established and accepted by the domestic market in Lebanon.

The contribution of NL 53 can be seen from two perspectives, that of the cement market as a whole and that of HL:

1. NL 53 contributed to a change in the cement market in Lebanon by altering the perception of customers who began accepting other types of cement with lower clinker factor as being equivalent in performance and functionality to traditional Portland cement. This led to a growing market acceptance for these types of cement.
2. Although HL had the technology to produce cement with lower clinker factor before the publication of NL 53, the fact that the standard came into existence significantly reduced HL's risk in introducing new types of cement to the Lebanese market. HL could refer to NL 53 as a standard developed through consensus by stakeholders in Lebanon, and one based on a widely accepted European standard. It could use NL 53 as an assurance of equal performance between different types of cement. To achieve market acceptance for the production of more profitable types of cements with lower clinker factor without NL 53, HL would have had to rely exclusively on its reputation as one of the world leaders in the cement industry (Holcim Group), but would most likely have had much more difficulty in gaining customer acceptance in the Lebanese market. Furthermore, the risk of being held liable by customers for accidents or damage would have made the decision to introduce the new types of cement to the Lebanese market much more difficult for HL, in spite of the perspective of higher profits.
3. Another factor which has become increasingly important is conformity with environmental regulations, in particular in the context of mitigat-

ing climate change. However, environmental law that reflects climate change, for example, in the form of carbon taxes, is still in an early stage of development in Lebanon, so that there are only limited economic benefits for HL from implementing higher environmental standards. On the contrary, higher environmental performance requires significant investment, which HL undertakes in compliance with the policy of the Holcim Group and its commitment to environmental responsibility. Nevertheless, it is likely that better environmental performance will become an increasingly important economic factor in Lebanon in the next few years, leading to legislation that will have an impact on market prices and therefore on economic decisions of companies.

In summary, it can be concluded that NL 53 has contributed to a shift in market acceptance in Lebanon for cement with a lower clinker factor, as well as stimulating cement companies to introduce new types of cement, since the standard has significantly reduced the risk of doing so.

5.8.2 Comparison between EN 197-1 and NL 53

NL 53 is based largely on the European Standard EN 197-1, *Cement – Part 1 : Composition, specifications and conformity criteria for common cements*, concerning the composition of cement in particular. EN 197-1 was first published in 1992 as ENV 197-1:1992, and is now available in the 2011 edition. It contains a list of 27 different compositions of cement used in various countries. These compositions exist unchanged since the 1992 edition.

As shown in the table in **Annex 1,** NL 53 covers part of EN 197-1, but excludes compositions with the lowest clinker factor. Since NL 53 has mandatory status in Lebanon, this means that companies do not have the option to choose the most cost-efficient types of cement composition even though a lower clinker factor results generally in lower production costs (as well as better environmental performance).

5.8.3 Estimate of the economic benefits of producing lower clinker cement types

As mentioned above, the reduction in clinker in the composition of cement generally results in cost savings during production, as well as reduced environmental impacts such as reduced CO_2 emissions. Following the increase in market acceptance of cement with lower clinker factors in Lebanon, HL began production of such types in 2002 and decreased the clinker factor steadily in subsequent years, reaching an average of 85.5 % between 2003 and 2006, the subject of this estimate. This is consistent with cement type CEM II in NL 53.

Table 3 shows HL's development of the clinker factor and the total production volume of grey cement. The changes over the years reflect shifts in market demand. Only the period from 1999 to 2006 has been used in calculating the economic benefits of standards derived from a reduction in the clinker factor. This is because the role of NL 53 in changing the perceptions of the market players in Lebanon, and in reducing the risk for cement companies in introducing cement with lower clinker factor, had been exhausted by that time. Although the clinker factor was further reduced from 2007 to 2011, this can no longer be attributed to the impact of NL 53, since by that time the principle of cement with lower clinker factor had been widely accepted in the domestic market in Lebanon.

Years	Clinker factor (average)	Total volume of production of grey cement (in tons) (averages)
1999-2000	91 %	1 200 000
2001-2002	88 %	1 250 000
2003-2006	85 %	1 650 000
2007-2011	82 %	2 000 000

Table 3 – Development of the clinker factor at HL (1999 – 2011)

As already mentioned, the prices of raw materials for cement production vary over time. For this reason, the calculations below have been simplified for guidance only.

If we assume that the production cost per ton of cement decreases with a lower clinker factor, and if we apply an average cost of **100** for clinker in one ton of cement and a total average cost of **50** for the other raw materials (mineral components substituting clinker in a ton of cement), then we can conclude that for an average decrease of 5 % in clinker factor the cost for cement production per ton of cement (clinker cost + mineral component cost) decreases by 2.5 %.

Therefore we conclude that HL could have made possible savings estimated at USD **1 300 000** annually from 2003 to 2006, due to producing cement with a lower clinker factor [1).

5.8.4 Summary : Impacts of NL 53 on the cement market in Lebanon

As stated in 5.8.1, the function of the NL 53 standard was not to enable HL technically to produce cement with lower clinker factor, but to reduce the risk to the company in doing so, and to contribute to the market acceptance of such cement as having performance and reliability equal to traditional Portland cement. It is therefore assumed that NL 53 had a significant impact on the cement market in Lebanon, and for HL in particular, in the early years after market acceptance of the new types of cement started to emerge.

Additional savings would be possible for cement companies in Lebanon if NL 53 could be brought further in line with EN 197-1 by including the possibility of producing cement types with even lower clinker factors than currently permitted (see **Annex 1)**.

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1) 1 LPB – 0.0006 USD.

A lower clinker factor would also be beneficial for environmental reasons, and lead to a reduction in emissions and other environmental impacts.

5.9 Impacts of standards in the selected business functions

5.9.1 Business function : Management and administration (environmental aspects)

According to HL staff interviews, the implementation of ISO 14001 has been a key contributor to achieving environmental improvements.

Year	2006	2007	2008	2009	2010	2011
CO_2 (kg / ton of cement)	803	821	782	739	727	717

Note : The main factor determining the amount of the CO_2 emission is the clinker factor applied in cement production.

Table 4 – Environment

Year	Percentage of substitution	in USD
2007	1.02	242 689
2008	0.05	25 092
2009	0.08	71 988
2010	0.26	21 937
2011	0.45	27 450
Annual average saving		**USD 77 831**

Note : The increase in the year 2009 is due to changes in the price of fuel.

Table 5 – Reuse of waste fuel (oil and waste fuel)

Year	Percentage
2009	10 %
2010	10 %

Table 6 – Recycled waste (tons per year)

5.9.2 Procurement

It was possible to obtain information about the number of suppliers between 2006 and 2011. However, no clear trends could be identified. It was not possible to translate the changes in the number of suppliers into financial impacts.

Year	2006	2007	2008	2009	2010	2011
Number of active suppliers	345	423	398	429	407	368
Total number of purchase orders	3614	4312	4664	5468	6518	7465

Table 7 – Procurement

5.9.3 Production

The calculation in this section is based on the general relationship between a lower clinker factor and the cost of production. It is an estimate intended to give an overall impression of the approximate extent of the savings, but does not apply precise costing for all factors of production. The cost estimations are based on average prices for 2003 to 2006 (as stated in section 5.8.3). Details of how this calculation was made can be found in **Annex 2.**

Year	Total cement production	Clinker factor	Percentage of reduction of clinker factor	Savings due to lower clinker factor
1999	1 200 000	91 %	0 %	-
2000	1 200 000	91 %	0 %	-
2001	1 250 000	88 %	-3 %	USD 492 424
2002	1 250 000	88 %	-3 %	USD 492 424
2003	1 650 000	85 %	-6 %	USD 1 300 000
2004	1 650 000	85 %	-6 %	USD 1 300 000
2005	1 650 000	85 %	-6 %	USD 1 300 000
2006	1 650 000	85 %	-6 %	USD 1 300 000
Average annual savings 2001 – 2006:				**USD 1 030 808**

Table 8 – Savings due to lower clinker factor

5.10 Calculation of the economic benefits of standards

The table below lists the data collected about the impacts of standards on the selected business functions:

No.	Business Function	Operational indicators	Financial impacts of the indicators (annual savings)
1	Procurement	Evolution of the number of (" active ") suppliers over recent years	–––
2	Production	Decrease in clinker factor (estimation)	USD 1 030 808
3	Production (laboratory)	Average rejection rate of supplies (raw material) due to nonconformity	–––
4	Production (laboratory)	Number or percentage of prevented nonconforming products	–––
5	Management and administration (environment)	HL's environmental performance in relation to : • Current legal requirements in Lebanon • HL's own internal environmental objectives	Legal emission limits in Lebanon are consistently observed and performance is significantly below these legal limits. Due to lack of legislation to encourage additional steps towards improved environmental performance (for example, through a taxation scheme), financial impacts, in the form of cost savings, do not exist.
6	Management and administration (environment)	Use of key resources : • Water • Fuels	–––
7	Management and administration (environment)	Reuse of waste fuel	USD 77 831
8	Management and administration (environment)	Reputation (for environmental performance)	–––
9	Management and administration (Occupational Health and Safety)	HL's OH&S performance in terms of: • Number of major internal accidents • Cost of lost work time (due to staff injuries) • Cost of medical treatment • Cost of insurance	–––
Total impacts of standards (period 2001 – 2011) :			**USD 1 108 639**

Table 9 – Financial impacts of the use of standards

The estimated **USD 1 108 639** contribution of standards occurred over the period 2001 to 2011. However, the two factors that caused this impact – the reduction in the clinker factor and the increase in the reuse of waste fuel – did not occur in parallel but in sequence, the first between 2001 and 2006, and the second from 2007 to 2011.

Annex 3 gives an overview of HL revenue and EBIT (Earnings Before Interest and Taxes) **between 2001 and 2010** on the basis of published annual reports for these years which can be found on the HL website.

The contribution of standards, as identified in this study, is **0.84 % of the average annual revenue** and **2.3 % of the average annual EBIT** calculated as averages over the whole period.

Savings in the period **2001 and 2006** – when the impact of NL 53 facilitated a reduction in the clinker factor in cement production – amount to **about 1 % of average annual revenue** and **2.5 % of the average annual EBIT** for the period.

The other measurable impact of standards – an increase in the reuse of waste fuel attributed to the use of ISO 14001 – is significantly lower and amounts to **0.05 % of average annual revenue and 0.14 % of average annual EBIT** for the period **2007 and 2011**.

5.11 Qualitative and semi-quantitative considerations

Through stringent requirements concerning the purchase of supplies, it can be assumed that HL makes a positive impact on the performance and quality of its suppliers in the domestic market in Lebanon. However, no specific information related to standards could be found to support this statement in more detail.

As an environmentally responsible company and an environmental leader, it is likely that HL also influences other companies in the Lebanese cement and construction industry.

Finally, HL's commitment to social responsibility has an impact on the local community as well as on employee attitudes and, together with its environmental performance and high quality of products, contributes to the high reputation of the company – key factors that support its strong market position.

5.12 Evaluation of the results

The most visible impact from standards is from NL 53 which played an important role in the introduction of cement with lower clinker factor to the Lebanese market. As described in section 5.8, the financial impacts stated in this report present an estimation intended to give an overall impression of the approximate size of the savings, but not a comprehensive calculation applying precise costing for all factors of production. However, it became clear that the main function of the standard was to help change the perception of market players to new types of cement and, for HL, to help reduce the risks of introducing such cement types to the market. Thus the main impact of the standard was not in providing technological know-how new to HL, but in contributing to changes of the perceptions of the market players in Lebanon and to risk reduction for HL.

At the outset of the assessment it had been assumed that impacts of standards could be found in other business functions, such as procurement. However, HL operates a comprehensive system of internal procedures, methods and approaches that have been developed in close cooperation with and under responsibility of Holcim headquarters in Switzerland, and which are used throughout the group and its national subsidiaries. It turned out to be very difficult or even impossible to relate certain procedures to specific standards and impacts. It is most likely that standards are a key source of many of Holcim's internal procedures, but they have been extended, integrated and combined with Holcim-internal know-how to form the Holcim set of procedures. This was very evident, for example, with regard to Holcim's OH&S management system, which can be related to OHSAS 18001. However, it exceeds the operational health and safety management system standard to such an extent that a direct link between this standard and Holcim's OH&S performance could not be established.

The Holcim Group and HL itself have taken many measures towards improving environmental performance, including the introduction of ISO 14001. However, due to the lack of respective legislation in Lebanon, economic benefits from the introduction of these measures still do not exist. Nevertheless, in addition to the benefits of these initiatives for HL's reputation, and the need to comply with Holcim Group policies, the steps taken by the company can also be seen as proactive measures in anticipation of future legislation containing financial incentives to improve environmental performance. In that event, the measures taken may contribute to further strengthening of HL's competitive position.

Identifying impacts from the introduction of ISO 9001 and ISO 14001 was also difficult, in particular because HL has implemented parallel measures of reorganization, making it hard to distinguish between the impacts from those management systems and from other internal measures.

5.13 Conclusions

The assessment has shown that standards have a visible impact on HL's operations and contribute to 0.84 % of average annual revenue (and to 2.3 % of EBIT). However, the key impact of standards, which is through NL 53, has been to change the perceptions of the market players, and in reducing the risk for cement companies like HL that used the standard for their benefit. For HL, the standard did not provide technological know-how which it did not already possess.

Due to the comprehensive management systems developed by the Holcim Group, which acknowledge and exceed existing standards and combine them with other sources, it has not been possible to identify and quantify the impacts of particular standards, except in the case of the clinker factor in cement production (NL 53) and reuse of waste fuel (ISO 14001).

Annex 1 : Comparison between the 27 cement products in EN 197-1 and those permitted in NL 53:1999 (highlighted in table)

Main Types	27 Pro-ducts		Clinker	Slag	Silica	Pozzolana		Fly ash		Burnt shale	Limestone		Minor addi-tives
						natural	natural claimed	sili-ceous	cal-care-ous				
			K	S	D	P	Q	V	W	T	L	LL	
CEM I	Portland Cement	CEM I	95-100										0-5
CEM II		II/A-S	80-94	6-20									0-5
		II/B-S	65-79	21-35									0-5
		II/A-D	90-94		6-10								0-5
		II/A-P	80-94			6-20							0-5
		II/B-P	65-79			21-35							0-5
		II/A-Q	80-94				6-20						0-5
		II/B-Q	65-79				21-35						0-5
		II/A-V	80-94					6-20					0-5
		II/B-V	65-79					21-35					0-5
		II/A-W	80-94						6-20				0-5
		II/B-W	65-79						21-35				0-5
		II/A-T	80-94							6-20			0-5
		II/B-T	65-79							21-35			0-5
		II/A-L	80-94								6-20		0-5
		II/B-L	65-79								21-35		0-5
		II/A-LL	80-94									6-20	0-5
		II/B-LL	65-79									21-35	0-5
		II/A-M	80-88	12-20	12-20	12-20	12-20	12-20	12-20	12-20	12-20	12-20	0-5
		II/B-M	65-79	21-35	21-35	21-35	21-35	21-35	21-35	21-35	21-35	21-35	0-5

Main Types	27 Products		Clinker	Slag	Silica	Pozzolana		Fly ash		Burnt shale	Limestone		Minor additives
		III/A	35-64	36-65									0-5
CEM III		III/B	20-34	66-80									0-5
		III/C	5-19	81-95									0-5
CEM IV		IV/A	65-89										0-5
		IV/B	45-64										0-5
CEM V		V/A	40-64	18-30									0-5
		V/B	20-38	31-49									0-5

ANNEX 2 : Calculation of production cost savings from applying lower clinker factors

Year	Total cement production	Clinker factor	Percentage of reduction of clinker factor	Savings due to lower clinker factor	Savings as a percentage of production costs	Calculation of savings based on average savings for the period 2003-2006	Savings per ton of cement
1999	1 200 000	91 %	0 %	USD 0	0		
2000	1 200 000	91 %	0 %	USD 0	0		
2001	1 250 000	88 %	-3 %	USD 492 424	1.5		
2002	1 250 000	88 %	-3 %	USD 492 424	1.5		
2003	1 650 000	85 %	-6 %	USD 1 300 000	3	USD 433 333	USD 0.26
2004	1 650 000	85 %	-6 %	USD 1 300 000	3		
2005	1 650 000	85 %	-6 %	USD 1 300 000	3		
2006	1 650 000	85 %	-6 %	USD 1 300 000	3		
Average annual savings 2001 – 2006:				**USD 1 030 808**			

Explanation of the calculation : As stated in 5.8.3, a decrease in the clinker factor of 5 % is estimated to result in a reduction of 2.5 % in the costs of cement production (clinker cost + mineral component cost). The annual reduction in production costs between 2003 and 2006 was USD 1 300 000. On this basis, the calculation above assumes that a decrease of 1 % in the clinker factor results in a decrease in production costs of 0.5 %. Using 1999 as the base year (clinker factor was 91 %, reduction = 0 %), the clinker factor was reduced by 6 % (from 91 % to 85 %) in the period between 2003 and 2006, which translates into a decrease in production costs of 3 %. The savings as a consequence of the lower clinker factor amounted to USD 1.3 million during this period (= 3 %). 1 % of these savings – USD 433 333 and USD 0.26 – is the average saving per ton of cement (= 433 333 / 1 300 000). This figure of the per-ton-saving (on the basis of the average savings for the period 2003-2006) is the basis for calculating the savings in 2001-2002 (USD 0.26 × 1.5 % × 1 250 000t) on the basis of the following formula: (Per-ton-savings × Savings as a percentage of production costs × Total amount of cement produced). It should be noted that this calculation is a) that it is based on averages and b) on constant prices during the period 2003-2006, which limits its precision. However, it is evident that significant savings must have occurred.

ANNEX 3 : Annual revenue and EBIT of Holcim Lebanon 2002 – 2010

The following information is based on HL Annual Reports available on HL's website at: www.holcim.com.lb. The historical exchange rates from Lebanese Pound (LBP) to US Dollar (USD) at year end have been obtained from www.oanda.com.

Year	Revenue of HL (in LBP)	EBIT of HL (in LBP)	LBP – USD exchange rate (end of year)	Revenue of HL (in USD)	EBIT of HL (in USD)
2002	120 812 557 000	54 167 188 000	0.0006	72 487 534	32 500 313
2003	117 300 157 000	58 048 600 000	0.0006	70 380 094	34 829 160
2004	148 446 138 000	40 526 726 000	0.0006	89 067 683	24 316 036
2005	241 590 857 000	96 485 896 000	0.0007	169 113 600	67 540 127
2006	179 785 166 000	74 760 979 000	0.0006	107 871 100	44 856 587
2007	205 279 292 000	67 628 858 000	0.0006	123 167 575	40 577 315
2008	251 088 540 000	79 679 890 000	0.0007	175 761 978	55 775 923
2009	260 651 054 000	87 000 829 000	0.0007	182 455 738	60 900 580
2010	278 946 844 000	103 952 767 000	0.0007	195 262 791	72 766 937
Avg:	**200 433 400 556**	**73 583 525 889**		**131 729 788**	**48 229 220**

ANNEX 4 : Bibliographic references

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Mr. Fadi Krayem, Responsible for Production (cement)

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Mr. Khoury, Head, New Projects

Mr. Eric Duflot, Responsible for Ready Mix Production Quality

Mr. Rody Abou-Naccoul, Coordinator for Safety and Environment

MAGA Engineering (Pvt) Ltd., Sri Lanka

Country : Sri Lanka

ISO member body : Sri Lanka Standards Institution (SLSI)

Project team :

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Member : Ms. Gayani Manchanayake, (Assistant Director, Scientific Standardization Division, SLSI)

ISO Central Secretariat advisor : Reinhard Weissinger, Manager, Research, Education & Strategy

Duration of the study : October 2011 – March 2012

6.1 Background, objectives, and organization of the pilot project

6.1.1 Background

The pilot project was led by the Sri Lanka Standards Institution (SLSI) — the National Standards Body of Sri Lanka. SLSI was established in 1964 under the Bureau of Ceylon Standards Act and now functions under the Ministry of Technology and Research. As a member of ISO, SLSI exchanges copies of its national standards on a reciprocal basis with other national standards bodies, and is responsible for disseminating information on standards, technical regulations and standards-related activities to the community at national level. There are several ways in which ISO and SLSI promote the development of standardization. One is to assess the most important benefits of standards by prioritizing standardization activities, raising awareness, promoting such benefits, and encouraging stakeholder participation.

6.1.2 Objectives

Even though standardization activities in Sri Lanka have contributed to trade, industry and socio-economic development over several decades, there has been no systematic study of the impacts and benefits of standards in quantitative and monetary terms. It was recognized that participation in this pilot project would help SLSI address the issue to enable private and public sector stakeholders to appreciate the economic and social impacts of voluntary consensus standards better, and raise the awareness of policy makers and business leaders of the importance of standardization. Applying the ISO methodology was an excellent means of describing and quantifying the benefits.

SLSI was selected by ISO to participate in the project, and has chosen Maga Engineering (Pvt) Ltd., one of the leading construction companies in Sri Lanka, for this study.

6.1.3 Organization of the pilot project

The ISO pilot project in Sri Lanka was conducted by SLSI under the guidance by the ISO Central Secretariat.

We would like to thank the Chairman and Managing Director of Maga, Capt. M.G. Kularatne and his team, especially Mr. Asoka de Silva, Director (Engineering), Major Derrick de Silva, Director (Administration) and Mr. Raj Wettasinghe, Manager Quality Assurance, for their enormous support and contributions enabling the project to be completed successfully.

6.2 Introduction to Maga Engineering (Pvt) Ltd.

6.2.1 Background on the selected company

The project team chose Maga because it is recognized in Sri Lanka as a model construction company due to its commitment to implementing, developing and applying national and international standards successfully. It uses a variety of product standards and test methods in its business operations, in addition to holding ISO 9001:2008, ISO 14001:2004 and OHSAS 18001:2007 certifications. **Annex 1** lists the building construction materials standards used by the company.

Maga is the first Sri Lankan construction company to be recognized as a Business Superbrand[1)], and has won the most quality awards issued by the Institute for Construction Training and Development (ICTAD). In 2003, the company won the prestigious International Federation of Asian and Western Pacific Contractors' Association's (IFAWPCA) Gold Medal for the construction of the Colombo Apollo Hospital.

1) A Business Superbrand is one that has established the finest reputation in its field, and offers customers significant emotional and/or tangible advantages over its competitors which customers want and recognize. Business Superbrands must represent quality, reliability and distinction.

Maga started business as a construction company in 1984, when it became involved with several international contractors executing projects in Sri Lanka. A dedicated group under the leadership of the present Chairman and Managing Director, Capt. M. G. Kularatne, resolved to build a model construction company by harnessing the knowledge and experience of the members of the group, gained from working with these international construction companies.

In little over 25 years Maga has made significant inroads into the local construction industry by developing strong human resources, a dedicated professional team and an extensive plant and machinery base to meet industry demands. The professional team comprises over 180 graduate engineers, including senior chartered engineers, with wide experience in the technical and managerial aspects of the construction industry, both locally and overseas.

These resources have helped Maga to reach ICTAD " M 1 "[2] status in the categories of Buildings in 1990, Highways and Bridges in 1996, Water Supply and Drainage in 1999 and " C 1 " status in all of the above in 2009. Maga has not only established itself as the most experienced contractor in Sri Lanka, but is also the market leader in volume and quality of work.

In addition to its status within Sri Lanka, Maga has been engaged in construction activities outside the country since 1987, and has successfully completed over a dozen building, civil and marine engineering projects overseas. To date it has also completed over 200 multidisciplinary projects at home and abroad. The company is the

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2) ICTAD "M 1" status: In 1989 INCTAD established a national registration and grading scheme for construction contractors — a screening process to determine the capabilities of prospective contractors to undertake different types and sizes of projects. Registration and grading is determined by evaluating a contractor mainly on financial capability, the technical ability of staff, plant and machinery, and experience gained in relevant fields. Initially under this scheme contractors were classified on financial ability under 10 grades (M1 to M10).

main contractor for the 32 000m^2 Sethsiripaya Stage II Administrative Complex for Urban Investment and Development Co (Pvt) Ltd (UNIDEP), valued at LKR 1.89 billion, and the 42 000m^2 headquarters building for Sri Lanka Customs, valued at LKR 2 589 billion.

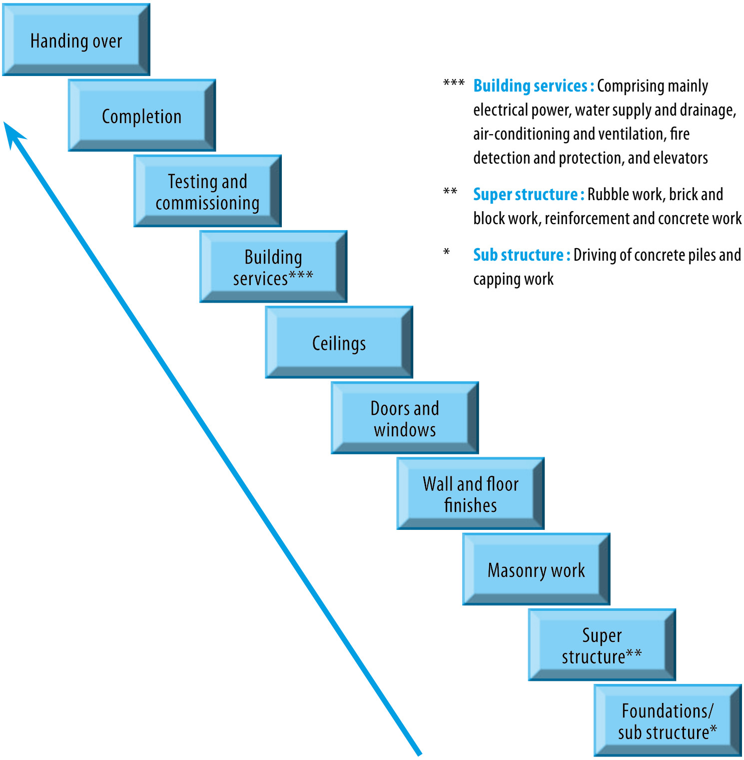
The ahead-of-schedule completion of the longest highway rehabilitation project in the country, the 158 km long Matara Wellawaya road, has won praise from its funding agent, the European Union. The company's foray into Design and Build has been exemplified by the 32-storey Fairmount Residencies building at Rajagiriya, recently completed on a structural design and build basis at a value of LKR 1.46 billion.

6.2.2 Construction management

A construction project embraces many participants and stakeholders from inception to completion. To progress a project to a successful conclusion, a contractor holds a key responsibility in facilitating and coordinating the interactions between different parties, requiring highly developed skills in project management. All construction projects demand close cooperation of the parties and processes involved, from the design and planning stages to the mobilization, material supply, construction and commissioning phases. By successfully managing their engineers, foremen, workmen, subcontractors and suppliers they strive to give their clients the desired result as the product of one entity, adhering to the project-specific conditions and quality objectives.

Overview of the building construction process

The following major steps constitute a typical building construction process :



*** **Building services :** Comprising mainly electrical power, water supply and drainage, air-conditioning and ventilation, fire detection and protection, and elevators

** **Super structure :** Rubble work, brick and block work, reinforcement and concrete work

* **Sub structure :** Driving of concrete piles and capping work

Figure 1 – Major steps in the building construction process

6.3 Company attitude towards standardization

Since its inception Maga has ensured that its operations comply with relevant standards. The main reason for selecting this company for the pilot project was its attitude in implementing standards, as demonstrated by its track record in winning numerous quality and business excellence awards.

6.4 Analysis of the value chain

A value chain describes the full range of activities required to bring a product (or service) from conception, through the different phases of production, to delivery to final consumers, and ultimate disposal after use. The simple value chain diagram in **Figure 2** shows a number of value added links and ranges of activities within each link.

6.4.1 Construction industry value chain

As the construction industry is very complex and versatile, it tends to have many links and inputs in the value chain, which are mainly two-fold :

- Material inputs
- Intellectual inputs (for example, design, specifications, consultancy, etc.)

Construction companies			
Inputs	**Company process**	**Output**	**Customers/clients**
Material inputs		Building	• Government agencies
• Cement			• Real estate companies
• Plastics			• Private clients
• Steel			
• Plumbing			
Project planning and design inputs			
• Design			
• Specifications			
• Consultants			
• Analytical design			
• Project design			

Figure 2 – Construction industry inputs and outputs

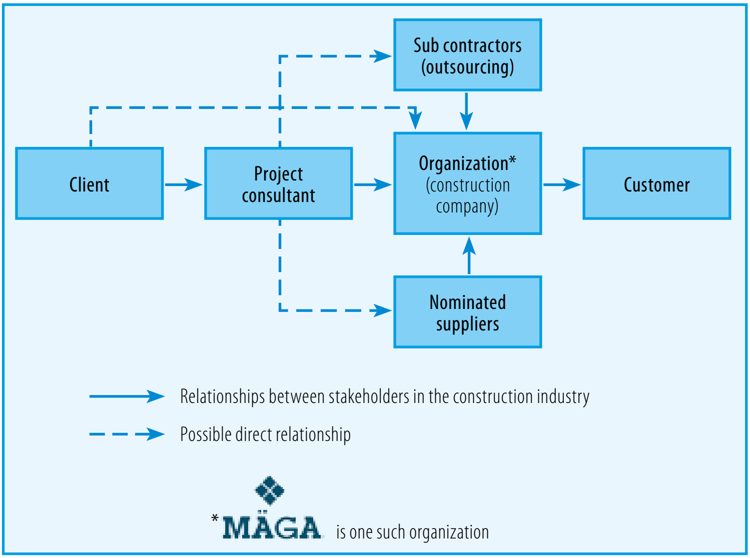


Figure 3 – Governance, organization and core process of the construction industry

As shown in **Figure 3,** a client charges a project consultant with the overall planning of a project. The project consultant, and suppliers selected by the project consultant, plan and design a construction project for delivery to the customer.

6.4.2 Company value chain

A simple value chain diagram, originally developed by Michael Porter of Harvard Business School, is shown below. The model provides an overview of a number of value added activities that are linked together. Each block in the value chain may contain a large number of activities. The model distinguishes between a certain number of primary activities, which represent the core activities of a company, and other activities that support the core activities.

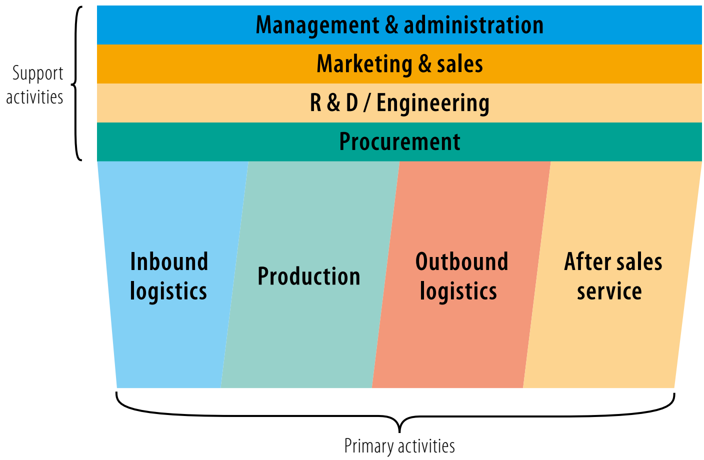


Figure 4 – Value chain model (Source : Michael Porter, Economic Benefits of Standards, ISO Methodology Guide, Version1, 2010.)

After some modifications, the model can be made to fit the building construction sector and Maga's operations. The company value chain can be described as follows, with the scope of the pilot study encompassing the activities highlighted in the model below :

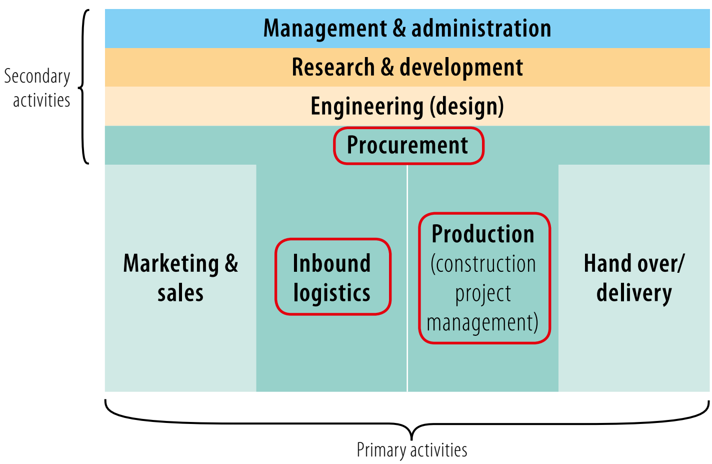


Figure 5 – Value chain model modified to reflect Maga activities (Source : Michael Porter, Competitive Advantage, 1985)

6.4.3 Key value drivers

Maga's competitive advantage lies mainly in its professional expertise and construction quality, coupled with flexibility, mutual cooperation and dedicated teamwork. As its reputation has grown, so too have the financial rewards reflected in a substantial increase in turnover, particularly over the last five years. This has enabled Maga to stay ahead of competitors and maintain its market leader status in the Sri Lankan construction industry.

Maga's extensive resource base has helped provide cost-effective design and construction management solutions as well as allowing country-wide supply of ready-mixed, asphalt and pre-cast concrete products. The company has established ten ready-mixed and asphalt concrete batching plants in different locations, and has pioneered the production of high-strength triple-blend temperature controlled concrete.

6.5 Scope of the pilot project assessment

In agreement with Maga, it was decided to limit the scope of the case study to the following key business functions:

- Procurement
- Inbound logistics
- Production (construction project management)

A further limitation was to focus the assessment only on the **building construction sector**. This means that other Maga operations, such as bridge and road construction, are not included in the scope of this study.

6.6 Use of standards in the company value chain

External standards used by the company can be divided into two main application areas:

1. Standards for raw materials (see **Annex 1)**
2. Management system standards:
    - ISO 9001:2008, *Quality management systems – Requirements*
    - ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*
    - OHSAS 18001:2007, *Occupational health and safety management systems – Requirements*

Standards identified for the selected business functions and how they support the company's value drivers are described in more detail below.

6.7 Operational indicators to calculate the impact of standards

The objective of the study is to quantify the economic impact of the standards implemented by Maga and the resulting economic benefits. To measure the impacts before and after implementation of standards, we have chosen a set of operational indicators on the basis of a series of interviews with Maga. We started initially with a set of 14 indicators, but decided then to reduce this set to a more limited one of six operational indicators (see **Table 1)**. This decision was taken jointly with Maga experts in view of the limited time available to complete the project, the lack of past data and in order to allow the project team to undertake the study in a more reliable and productive manner.

No.	Operational indicators	Business function	Relevant standards
1	Reduction in cost of raw materials testing	Procurement	SLS 26:1993 SLS 107:2008 SLS 139:2003 SLS 375:2009 SLS 1181:2005
2	Reduction in raw material rejection		
3	Preservation of raw material due to proper storage. Note : with the implementation of a First-In-First-Out (FIFO) system	Inbound logistics	ISO 9001:2008
4	Space savings due to lean construction (on time delivery to the site)		
5	Reduction in cost of rework and repairing defects	Production (construction project management)	ISO 9001:2008
6	Minimizing defective work at hand over (snag list)		

Table 1 – Final list of operational indicators selected to measure the impacts of standards

The next step was to select suitable parameters for gathering information, in order to measure the economical impact of standards associated with each operational indicator.

For the purpose of our evaluation and in deciding on suitable parameters for our study, we focused on widely used cement, steel and tiling materials. For example, consider the first operational indicator – reduction in cost of raw materials testing :

To ensure good quality output (that is, a high quality building), all inputs and processes need to be controlled from beginning to end. Therefore, before using raw materials (in this case, cement, steel and tiles), the company must ensure that the inputs for the building construction process are of high quality. A sample from each consignment of raw material is tested, and this is an extra cost to the company. However, in Sri Lanka, these products come under SLS compulsory items. Hence no manufacturer can market these products (cement, steel, etc.) without obtaining SLS certification. For example, cement carrying an SLS 107 mark implies that it conforms to the Sri Lanka Specification for Ordinary Portland Cement. Hence there is no need to test samples from each consignment, and companies can decide themselves on the frequency of testing — for example, Maga undertakes a sample test from every tenth consignment.

After further discussions with Maga experts, we identified several parameters and measures for each operational indicator as shown in **Table 2**:

No	Operational indicator	Parameter	Measures	
1	Reduction in cost of raw materials testing	Testing fees	Cement	• Number of consignments of cement • Total quantity of cement • Total number of bags • Testing fees for cement
			Steel	• Number of consignments of steel reinforcement material • Tonnage of steel • Testing fees for steel
			Tiles	• Total number of square feet tiled • Testing fees for tiles
2	Reduction in raw material rejection	Loss and delay due to raw material rejection	Cement	• Number of rejected lots
			Steel	• Number of rejected lots
3	Preservation of raw material due to proper storage. Note : with the implementation of a FIFO system	Reduction in cost of rejected cement, after the implementation of the FIFO system	Cement	• Number of rejected cement bags (after storage) • Previous project rejection (before storage) • Cost of cement
			Tiles	• Number of tile breakages (after storage) • Previous project rejection (before storage) • Average cost of a 400 mm × 400 mm tile

4	Space savings due to lean construction	Space saving	Cement	• Storage space (after lean construction) • Storage space (before lean construction) • Outside rental rate (current average)
			Steel	• Storage space (after lean construction) • Storage space (before lean construction) • Outside rental rate (current average)
5	Reduction in cost of rework and repairing defects	Cost due to rework of defects such as honeycomb, levelling and wall cracks		• Cost due to honeycomb • Cost of levelling rework • Cost of reworking wall cracks
6	Minimizing defective work at hand over (snag list)	Reduction in cost of snag list repairs		• Number of days to complete snag list repairs • Cost of snag list repairs per day

Table 2 – Operational indicators, parameters and measures used

6.8 Calculation of the economic benefits of standards

In order to calculate the economic benefits of standards, and in consideration of the specifics of the building construction industry, we had to make a number of further decisions.

6.8.1 Characteristics of building construction projects

Activities in building construction projects are different from those of mass produced products, such as foodstuffs, cars, pre-cast items, furniture and textiles. Typically, building construction projects can take over a year to complete, and some run for several years.

Building designs vary considerably depending on the type of use. For example, hospitals, office buildings, factories, schools, houses and hotels are all used for different purposes. Even buildings designed for the same purpose differ, for example, some residential houses have three storeys, whereas others have only a single storey. Other differentiating factors are climate conditions and geographical location.

6.8.2 Selection of a sample construction project

Building projects undertaken by large companies like Maga are very complex and cannot be evaluated using a simple annual framework. Because of this construction industry characteristic, it was decided to determine the impact of standards on a **single sample project**. This decision was based on the following assumptions:

- It would be possible to identify the type and range of the impacts of standards from the sample project
- Having understood the type and range of the impacts, we could arrive at generalizations from the sample project that would also apply to other projects of the same type

The **Sambuddha Jayanthi building project** was selected as our sample project for the ISO pilot study, for the following reasons:

- This project was completed recently, enabling us to obtain more reliable data and information than for some other projects
- The project duration could be considered as average compared to some other projects undertaken by Maga

It was therefore assumed that this case study project could — at least to a certain degree —represent other similar projects within the chosen scope of the building construction industry.

6.8.3 Additional assumptions

Additionally, we chose a ten-year time period from 2001 to 2011 for the purposes of the study. Based on the information obtained from Maga's management, and during our visits to the company, we were able to make the calculations of the impact of standards as shown in **Table 3.**

To do so, we assumed that no standards had been implemented by Maga for the selected business functions in 2001, but that by 2011, all standards listed in **Table 3** had been successfully implemented.

The total financial impact of implementing standards on each of the three business functions over the past ten years (based on information from Maga's Sambuddha Jayanthi building project) is given in **Table 3** [3)]:

Business functions	Standards						Financial impact
	SLS 26:1993	SLS 107:2008	SLS 139:2003	SLS 375:2009	SLS 1181:2005	ISO 9001:2008	(in LKR)
Procurement	×	×	×	×	×	-	1 054 048 00
Inbound logistics	-	-	-	-	-	×	63 600 00
Production (construction)	-	-	-	-	-	×	1 739 972 08
Total savings derived from use of standards (in LKR)							**2 857 620 08**

× = relevant for the business function
- = not relevant for the business function

Table 3 – Impact of standards across selected business functions at Maga (based on the sample case study project)

6.8.4 Generalization of the findings from the sample project

After having identified and quantified the impacts of standards as shown in **Table 3** on the basis of the Sambuddha Jayanthi building

3) 1 LKR – 0.00778 USD.

project, we can apply the findings to similar projects by making the following assumptions:

- Maga uses more or less the same standards in construction projects similar to the Sambuddha Jayanthi building
- The standards used in other Maga projects make the same percentage contributions as in the sample project. This means that if the impact of standards in the procurement process was x % in the sample project, then we assume that it is also x % in other similar projects

On the basis of these assumptions, we can calculate the annual contribution of standards for Maga's operations as follows:

There are on average eleven concurrent building construction projects at any time, each of which has an average duration of 22 months. Thus, we can calculate the **total average contribution of standards for all eleven projects over the period of twelve months (one year)** as:

(Savings/benefits for one project) × (number of projects) / (average duration of a project) × 12, that is:

(LKR 2 857 620.08 × 11) / 22) × 12 = LKR 17 145 720.48.

The **annual percentage contribution to total annual revenue**, amounting to LKR 3 174 419 723 from the use of standards for Maga's building construction projects, can then be calculated as:

(LKR 17 145 720.48 / LKR 3 174 419 723) × 100 = **0.54 %**

In **Annex 2,** more details on these calculations ca be found.

6.9 Qualitative and semi-quantitative considerations

Some of the impacts of existing standards cannot be quantified since the Sri Lankan industry, including Maga, have been using standards from the very early stages of construction. As a result, it is difficult to obtain comparative data for most of the construction processes.

However, some of the most important contributions of standards were identified during the project study, although direct quantification was not possible.

For example, most of the purchasing processes such as selection and evaluation of suppliers, and stores management processes such as sorting, stock verification and preparation of monthly bills have become more efficient following ISO 9001:2008 implementation. However, the impact of the standard cannot be quantified since a time monitoring system has not been established.

Maga has switched to alternative energy sources as a result of ISO 14001 implementation, but its impact cannot be quantified since the company does not keep comprehensive energy savings records.

The reduction in the costs of testing and rejecting raw materials and in rework and repairing defects were identified as operational indicators, and the impacts were quantified for three major raw materials only since the data required for other raw materials such as roofing sheets and pipes were not available in detail from the company. Therefore, some of those impacts were not totally quantified.

It was observed that Maga gained a significant marketing advantage in winning contracts as a result of ISO 9001 certification, but this impact was not measurable and could therefore not be quantified.

6.10 Evaluation of results

Building construction projects are different from most other manufacturing processes. They also vary greatly due to factors such as the total design (including structural and finishing work), the type of building, and the climatic and geographical influences.

Many building projects undertaken by construction companies like Maga are very complex and cannot be evaluated on an annual basis. Because of these characteristics, the single Sambuddha Jayanthi Mandiraya building project was chosen as the case study to calculate the impact of standards, for the following reasons:

- The project is typical of many, with average design, costs and project duration, and the calculation of the impact of standards can be applied in general to other construction projects. More complex projects use more structural work, concrete and finishing work. Depending on complexity, projects can vary in costs from LKR 100 million to 5 billion and in duration from one month to several years
- We were able to obtain more data on the impact of standards on the three selected business functions, since it is a more recently completed project compared to others
- There is little possibility of utilizing the same group of skilled personnel in construction projects due to heavy labour turnover. Hence, it is very difficult to find realistic data covering the operations and activities of past projects

Even with the recent Sambuddha Jayanthi Mandiraya project, data was not available for some aspects of the construction. Consequently, and after discussions with Maga management, estimated values in the sample project have been used as substitutes, as identified with an asterisk '*' in **Annex 2.**

The findings from this study cannot be applied to other types of Maga operations such as road construction, bridges and water projects. However, they can be applied to other companies engaged in building construction. Most of Maga's construction projects are located in Colombo and its suburbs. If the calculations derived from the sample project are applied to construction projects in remote areas, there may be additional costs of transport and importing skilled workers, for example, which should be considered.

6.11 Conclusions and recommendations

6.11.1 Conclusions

In Sri Lanka, large construction companies like Maga have been using standards for a long time. The key to Maga's success as a model construction company is its commitment to implementing, developing and applying both national and international standards successfully. Even though it is very difficult to quantify the impact of using standards in financial terms, after the study, we could find that there is a significant impact of standards in the building construction industry.

6.11.2 Recommendations

- Due to time constraints, we selected only three business functions for this study. However, the approach could be applied to other business functions as well
- More information could be obtained by changing or broadening the scope of such studies to include more areas or functions where the company would typically use standards, thus identifying a greater range of impacts resulting from their use
- Instead of only one company, several construction companies could be studied
- To enable this method to be more representative of the Sri Lankan construction industry as a whole, projects from different areas of the country could be selected to increase the sample size
- Previously, there was no systematic way of conducting a study to quantify the benefits of standards. In future, Maga and other

construction companies could apply this approach so that necessary data can be easily obtained. For example, many enterprises could link this methodology with their enterprise resource planning or other data management systems and relevant software.

Annex 1 : Standards for building construction materials used by Maga

Subject fields	Standards	Revision
Cement	SLS 107-1:2008, *Ordinary Portland cement – Requirements*	4th
	SLS 107-2:2008, *Ordinary Portland cement – Test methods*	4th
	SLS 1247:2008, *Blended hydraulic cements*	1st
	SLS 1253:2008, *Portland limestone cement*	1st
	SLS 515:2003, *Masonry cement*	1st
Bricks	SLS 39:2008, *Common burnt clay building bricks*	1st
Asbestos	SLS 9-1:2001, *Asbestos cement products – Flat sheets*	2nd
	SLS 9-2:2001, *Asbestos cement products – Corrugated sheets*	2nd
Pre-cast concrete products	SLS 1425-1:2011, *Paving blocks – Requirements*	
	SLS 1425-2:2011, *Paving blocks – Test methods*	
	SLS 855-1:1989, *Cement blocks – Requirements*	
	SLS 855-2:1989, *Cement blocks – Test methods*	
	SLS 452:1979, *Concrete non-pressure pipes*	
Steel (reinforced)	SLS 26:1993, *Plain steel bars for the reinforcement of concrete*	1st
	SLS 375:2009, *Ribbed steel bars for the reinforcement of concrete*	4th
	SLS 139:2003, *Mild steel wire for general engineering purposes*	1st
PVC pipes and fittings	SLS 147:1993, *Rigid unplasticized polyvinyl chloride pipes for potable cold water supplies*	2nd
	SLS 659:1993, *Unplasticized polyvinyl chloride pipe joints and fittings for potable cold water supplies*	
	SLS 1202 : 2000, *Unplasticized polyvinyl chloride pipes for soil and waste discharge systems inside buildings*	
GI pipes	SLS 1285:2006, *Unplasticized polyvinyl chloride pipe fittings for non-pressure underground drainage and sewerage*	
Paints	SLS 533:2009, *Emulsion paints for interior use*	1st
	SLS 557:2009, *Emulsion paints for exterior use*	1st
	SLS 555:1982, *Varnish for interior use*	
	SLS 556:1982, *Varnish for exterior use*	

Structural steel	SLS 907-3:1990, *Dimensions and sectional properties of hot roll structural steel sections-U Sections*	
	SLS 907-4:1990, *Dimensions and sectional properties of hot roll structural steel sections-L Sections*	
	SLS 907-5:1990, *Dimensions and sectional properties of hot roll structural steel sections-T Sections*	
	SLS 949-1:1992, *Dimensions of hot roll steel bars for structural and general engineering purposes-round bars*	
	SLS 949-2:1992, *Dimensions of hot roll steel bars for structural and general engineering purposes-square bars*	
	SLS 949-3:1992, *Dimensions of hot roll steel bars for structural and general engineering purposes-hexagonal bars*	
	SLS 949-5:1992, *Dimensions of hot roll steel bars for structural and general engineering purposes-flat*	
Tiles	SLS 2:1975, *Corrugated sheets*	
	SLS 1181:2005, *Ceramic tiles*	1st
Plywood	SLS 261-1:1991, *Plywood for general purposes – Terminology*	1st
	SLS 261-2:1991, *Plywood for general purposes – Specification for manufacturer*	1st
	SLS 261-3:1991, *Plywood for general purposes – Methods of tests*	1st
Timber	SLS 1170-1:1998, *Code of practice on identification, grading and marking of imported construction timber – Grading, marking, and guidance on usage*	
	SLS 1170-2:1998, *Code of practice on identification, grading and marking of imported construction timber – Nomenclature, identification, and general information*	
	SLS 1170-3:1998, *Code of practice on identification, grading and marking of imported construction timber – Properties*	
Glass	SLS 718:1985, *Glass mirrors for general purposes*	
Sanitary ware	SLS 568:1982, *Ceramic squatting pans and traps*	
	SLS 878:1989, *Plastic flushing cistern*	
	SLS 449:1978, *Glazed earthenware pipes*	
	SLS 377:1976, *Wash basins*	
	SLS 921:1991, *Vitreous pedestal bidets*	
	SLS 864:1989, *Ceramic flushing cistern*	

Power cables	SLS 733:2005, *PVC insulated, non-armoured cables with copper conductors, for voltages up to and including 450/750 V, for electric power, lighting and internal wiring*	2nd
	SLS 1143:2008, *Electric flexible cords rated up to 300/500 V, for use appliances and equipment intended for domestic, office and similar environments*	1st
	SLS 987:1992, *PVC insulated electric cables 600/1000V*	
	SLS 1186:1999, *600/1000V armoured electric cables having thermosetting insulation*	
Switches and sockets	SLS 948-1:*1991, Three-pin plugs socket-outlets and socket-outlet adaptors – Covers plugs and socket-outlets and fused socket-outlet adaptors*	
	SLS 948 -2:1991, *Three-pin plugs socket-outlets and socket-outlet adaptors – Plugs made of resilient material*	
	SLS 948 -3:1991, *Three-pin plugs socket-outlets and socket-outlet adaptors – Switched socket-outlets*	
	SLS 734:1996, *13A fused plugs and switched and unswitched socket-outlets*	1st
Light fittings	SLS 138:2009, *Bayonet lamp holders*	2nd
Bus bar (bus ways)	SLS 1223-1:2001, *Low voltage switchgear and controlled gear assemblies – Type tested and partially type tested assemblies*	
	SLS 1223-2:2001, *Low voltage switchgear and controlled gear assemblies*	
	SLS 1223-3:2001, *Low voltage switchgear and controlled gear assemblies – Particular requirements for low voltage switchgear and controlled gear assemblies intended to be installed in places where unskilled persons have access for their use*	
Distribution boards	IEC 60439-3:1999, *Low-voltage switchgear and controlgear assemblies –* Part 3 : *Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access for their use – Distribution boards*	
Cable trucking	SLS 1206:2000, *Cable Trucking made of insulating material*	
Ceiling/wall fans	SLS 814-1:1988, *Electric fans and regulators – Performance*	
	SLS 814-2:1988, *Electric fans and regulators – Safety requirements*	

Annex 2 : Calculation of the impacts of standards on the basis of a sample project (details)

Business function	Operational indicator	Measures			Comparison		Saving LKR
					2001	2011	
1. Procurement	Reduction in cost of raw materials testing	Cement	• No. of cement consignments • Total quantity of cement • Total number of bags • Testing fees for cement	50 246 600 kg 4932 LKR 15 680	Testing fees = $50 \times$ LKR 15 680 = LKR 784 000 **Note :** Testing was carried out on one sample from each consignment	Testing fees = $5 \times$ LKR 15 680 = LKR 78 400 **Note :** Frequency of testing is one sample for every 10 consignments *	**705 600.00**
		Steel	• No. of consignments of steel reinforcement material • Tonnage • Testing fees for steel	06 317.8 LKR 13 216	Testing fees = $6 \times$ LKR13216 = LKR 79 296 **Note :** Testing was carried out on one sample from each consignment	Testing fees = $1 \times$ LKR 13216 = LKR 13 216 **Note :** Frequency of testing is one sample for every 5 consignments *	**66 080.00**
		Tiles	• Total number of square feet tiled • Testing fees for tiles	1200 400mm×400mm tiles LKR 32 368	Testing fees = $1 \times$ LKR 32368 = LKR 32 368 **Note :** Testing was carried out on one sample from each consignment	Nil (No testing)	**32 368.00**
	Reduction in raw material rejection	Cement	• Number of reject lots (2011) • Number of reject lots (2001)	- 4*	Loss per one day delay = LKR 50 000* Loss per 4 day delay due to rejection of cement = LKR 50 000 $\times$ 4 = LKR 200 000	No rejection	**200 000.00**

Business function	Operational indicator	Measures			Comparison		Saving LKR
					2001	2011	
		Steel	• Number of reject lots (2011) • Number of reject lots (2001)	- 1*	Loss per 1 day delay due to rejection of steel = LKR 50 000 × 1 = LKR 50 000	No rejection	**50 000.00**
		Tiles	• Number of reject lots (2011) • Number of reject lots (2001)	- -	No rejection	No rejection	**-**
		Tiles	• Number of tile breakages (after storage) • Previous project rejection (2001) • Average cost of a 400mm × 400mm tile	- 1 %* LKR 300	Rejection = 1 % Number of tile breakages = (1200 × 0.01) = 12 Cost due to rejection of tiles = LKR 300 × 12 = LKR 3 600	No rejection	**3 600.00**
2. In-bound logistics	Space savings due to lean construction	Cement	• Storage space (2011) • Storage space (2001) • Outside rental rate (current average)	$200\ ft^2$ $500\ ft^2$* LKR 50 000* (per $1000\ ft^{2)}$	LKR 50 000 × $500\ ft^2$ $1000\ ft^2$ = LKR 25 000	LKR 50 000* $200\ ft^2$ $1000\ ft^2$ = LKR 10 000	**15 000.00**
		Steel	• Storage space (2011) • Storage space (2001) • Outside rental rate (current average)	$150\ ft^2$ $300\ ft^2$* LKR 50 000 (per $1000\ ft^{2)}$	LKR 50 000 × $300\ ft^2$ $1000\ ft^2$ = LKR15 000	LKR 50 000 × $150\ ft^2$ $1000\ ft^2$ = LKR 7 500	**7 500.00**

Business function	Operational indicator	Measures			Comparison		Saving LKR
					2001	2011	
3. Production (construction)	Reduction in cost of rework and repairing defects	Rework %	**a. Honeycomb** • Honeycomb (2011) • Honeycomb (2001) • Concrete cost per mt^3 • Total area concreted in mt^3	 0.004 0.008* LKR 11 669.42 2 074.43	Cost due to honeycomb = LKR 11 669.42 × 2 074.43 × 0.008 = LKR 93 35536 × 2 074.43 = LKR 193 659.16	Cost due to honeycomb = LKR 11 669.42 × 2 074.43 × 0.004 = LKR 46 677.68 × 2 074.43 = LKR 96 829.58	**96 829.58**
			b. Levelling • Levelling (2011) • Levelling (2001) - Internal area - External area • Plastering cost per m^2 - Internal area - External area	 No rework 75 m^2 25 m^2* LKR 494.61 LKR 619.63	Cost for rework LKR 494.61 × 75 + LKR 619.63 × 25 = LKR 52 586.5	-	**52 586.50**
			c. Wall cracks • Wall cracks (2011) • Wall cracks (2001) • Total wall area	 0.007 0.5* 6000 m^2	Cost for rework 0.5 × LKR 494.61 × 6 000 = LKR 1 483 830	Cost for rework 0.007 × LKR 494.61 × 6 000 = LKR 20 773.62	**1 463 056.00**

Business function	Operational indicator	Measures			Comparison		Saving LKR
					2001	2011	
	Minimizing defective work at hand over (Snag list)		• No. of days to complete snag list repair (2011) • No. of days to complete snag list repair (2001) • Cost of repair snag list per day	5 20* LKR 8 500	20 × LKR 8500 = LKR 170 000	5 × LKR 8500 = LKR 42 500	**127 500.00**
Total savings from the use of standards							**2 857 620.08**

Total savings from the use of standards, as a percentage of the total cost of the pilot project (Sambuddha Jayanthi Mandiraya building construction) :

$$= \frac{\text{LKR } 2\,857\,620.08 \times 100}{\text{LKR } 285\,000\,000.00}$$

$= 1.00\ \%$

Note:

(1) In the absence of factual data, some information has been assumed based on experience and observations

(2) * = estimated values

Dalian Shipbuilding Industry Co., Ltd, China

Country : China

ISO member body : Standardization Administration of the People's Republic of China (SAC)

Project team :

Project leader : Mr. Guo Hui, Director General, Department of International Cooperation, SAC

Members – China National Institute for Standardization (CNIS) :

Dr. Wang Yiyi, Director, Sub-Institute of standardization theory and education

Dr. Fu Qiang, Assistant to the Director, Sub-Institute of standardization theory and education

Ms. Wang Lijun, Officer, Sub-Institute of standardization theory and education

Member – Dalian Shipbuilding Industry Corporation :

Mr. Ma Yulong, Chief of Standardization Section, Engineering and Research Institute Co., Ltd.

Members – Standardization Administration of the People's Republic of China :

Mr. Guo Chenguang, Director, International Organizations Division

Mr. Li Dongfang, Standardization officer, International Organizations Division

Ms. Huang Li, Standardization officer, International Organizations Division

ISO Central Secretariat advisor : Reinhard Weissinger, Manager, Research, Education & Strategy

Duration of the study : July 2011 – April 2012

7.1 Objectives, time frame and participants in the pilot project

The objective of this pilot project was to evaluate the economic benefits for a company resulting from the use of standards. "Standards" include international, national, industry and company standards that have been implemented and may apply to all segments of the company, from research and development to production and sales. We have selected the Dalian Shipbuilding Industry Co., Ltd., a company well-known in China, to assess the impact of standards on the shipbuilding industry.

The pilot project began in July 2011 and was concluded in April 2012. The main participants were the Standardization Administration of the People's Republic of China (SAC), the China National Institute of Standardization (CNIS), the No. 704 Institute of the China Shipbuilding Industry Corporation, and the Dalian Shipbuilding Industry Co., Ltd.

7.2 Pilot company

7.2.1 Company name and address

The Dalian Shipbuilding Industry Co., Ltd., is located at No. 1, Yanhai Street, Xigang District, Dalian, Liaoning Province, China.

7.2.2 Company history

The Dalian Shipbuilding Industry Co. was founded in 1898 when Tsar Nicholas II approved the construction of a dockyard – the predecessor of the company. In April 2010, it was restructured and divided into the Dalian Dockyard Co., Ltd., a fully-funded subsidiary of the China Shipbuilding Industry Corporation, and the Dalian Shipbuilding Industry Co., Ltd., a holding subsidiary of the China Shipbuilding Industry Limited Liability Company.

7.2.3 Main products

A flagship of China's shipbuilding industry, the Dalian Shipbuilding Industry Corporation (hereinafter referred to as DSIC) is a modern final assembly company combining five major industries – shipbuilding, defence, ocean engineering, ship repair (including shipbreaking) and heavy industry. The products of the shipbuilding industry branch of DSIC are divided into oil tankers, bulk carriers, container ships and special ships. The production volume and domestic market share in the shipbuilding industry between 2006 and 2010 are given in **Table 1.**

Year	National shipbuilding production volume (in thousand tons)*	DSIC's production volume (in thousand tons)*	Domestic market share (%)
2006	14 520	2 010	13.8
2007	18 930	3 110	16.4
2008	19 940	2 970	14.9
2009	42 430	3 890	9.2
2010	65 600	5 880	9.0
Note : Since 2009, privately owned shipbuilding companies have developed quickly.			

(*) Deadweight tons

Table 1 – DSIC's production volume and domestic market share (2006 – 2010)

7.2.4 Revenue, employees and organizational structure

7.2.4.1 Revenue

Table 2 gives DSIC's total revenue, the revenue from the shipbuilding industry in China, and the revenue of the R&D business function in the shipbuilding industry, based on recent surveys.

Year	Revenue of the whole corporation	Revenue due to Shipbuilding	Revenue of the R & D business function
2006	10 460 000	9 414 000	52 450
2007	14 190 000	12 771 000	85 017
2008	18 000 000	16 200 000	113 120
2009	20 590,000	18 531 000	143 250
2010	22 750,000	20 475 000	150 820

Table 2 – Revenue 2006-2010 (Unit : thousand CNY) [1)]

7.2.4.2 Employees

DSIC employed 7598 people in 2010, of which 6 held PhDs, 106 masters degrees, 2067 bachelor degrees, 1930 junior college degrees, and 3495 were graduates from technical secondary school or lower level. In addition, more than 20 000 employees worked in supplier companies.

The Design Institute, the focus of this assessment, had 867 employees, of which three had PhDs, 83 master degrees, 524 bachelor degrees, 202 were junior college graduates and 55 had degrees from technical secondary schools or below.

7.2.5 Main construction parts and materials

Eight main categories of construction parts and materials are used in production – paints, sanitary units, cabin materials, steel doors and windows, main engines, diesel generator sets, boilers, steel plates and sectional materials.

7.2.6 Main customers

DSIC's main customers are ship-owners located in Europe, Asia, America and other regions of the world, and include Maersk of Denmark, TORM of Norway, Singapore Pacific International Lines, the IMC Group and other internationally known shipping companies that have been partners of DSIC for many years.

1) Chinese Yuan (CNY) – US Dollar : approximately 6.5 CNY – 1 USD.

7.2.7 Main competitors

DSIC's main competitors include Hyundai Heavy Industries, Samsung Heavy Industries, Daewoo Shipbuilding (all from Korea), Tsuneishi, Universal Shipbuilding (from Japan), as well as other Chinese companies such as Shanghai Waigaoqiao Shipbuilding Co., Ltd., Jiangnan Changxing and Hudong Zhonghua.

7.3 Attitude of the company towards standardization

7.3.1 Attitudes of management and employees towards standardization

The company established a standardization committee headed by the vice general manager, with members from all departments. The committee holds a standardization working conference involving the whole corporation every 14 October on the occasion of "World Standards Day".

7.3.2 Participation of the company in the development of international, national and industry standards

DSIC participates in the work of ISO/TC 8/SC 4/ WG 3 *Ships and marine technology – Outfitting and deck machinery – Outfitting*. In order to cope with requirements defined in the Energy Efficiency Design Index (EEDI) of the International Maritime Organization (IMO) and the Marine Environmental Protection Committee (MEPC), the company has participated in the "Expert working group on EEDI indexes for new ship design" since 2009. It has put forward suggestions to solve technical problems in EEDI formulae, and submitted proposals to address problems in the operation and applications of the formulae. It measures and calculates ship types, has developed a data table for calculation, and made proposals for the development of future ship types and diesel engine manufacturing supported by relevant agencies.

Up to now, DSIC has helped to develop more than 30 Chinese national standards and over 150 Chinese industry standards.

7.3.3 Application of standards in the company

Since the shipbuilding industry uses many different technologies and its processes are very complex, it uses a large number of standards. DSIC uses more than 100 000 Chinese and foreign standards that can be classified as follows :

- General conventions and rules issued by the IMO
- Specifications issued by various major classification societies and the International Association of Classification Societies (IACS)
- International Standards developed by ISO, IEC and ITU
- National and industry standards issued by various countries
- Standards developed by major companies

According to the ISO methodology, these standards can be divided into three types : product, process, and health, safety and environmental (HSE) standards.

- Product standards cover all classes of ships, ocean engineering equipment, ship support equipment and materials (see **Table 3)** and specify mainly the performance of these products, their design and structure, sizes, and product-related test methods, etc.
- Process standards cover production and processing, management and quality control, and test methods of ships and their support equipment (see **Table 4)**. They include also process, management and quality system standards, and standards for test methods

- HSE standards – the main standards used are OHSAS 18001 *Occupational health and safety management systems*, and ISO 14001 *Environmental management systems* (see **Table 5)**

Category	Field of application	Examples of key standards
Ships	Whole ship, ship structure, ship performance, basic and universal methods, etc. : 165 standards	CB 3181 ~ 3187, *Hull structure series standard*
Ocean engineering equipment	Whole ships and structures, systems and equipment, underwater units, etc. : 8 standards	GB/T 3471, *General provisions for programming, mooring and sea trials of sea going ships* CB/T 3655, *Design regulation for engine control rooms* CB 3371, *Hull node structures for oil hold area of oil tankers*
Ship support equipment	Marine power plant, including marine engine, shafting and gearing : 102 standards	GB/T 2497, *Charge air coolers for marine diesel engines* GB/T 12916, *Specification for metallic marine propellers*
	Marine machinery accessories, including auxiliary engines in cabins and engine room equipment, deck machinery, fire-fighting equipment, environmental protection equipment, pipeline fittings, hydraumatic and pneumatic elements, boilers and pressure vessels, etc. : 560 standards	GB/T 14650, *General specification for marine auxiliary boilers* CB/T 1036, *Marine plate coolers* GB/T 11035, *Marine electric two spindle screw pumps* GB/T 11864, *Marine axial flow fans* GB/T 4447, *Sea-going vessels – Windlasses and anchor capstans* GB/T 584, *Marine cast steel flanged stop valves*
	Ship's electrical systems and equipment, including generating, transformer, distribution, control and measuring equipment, lighting and other electric appliances, electrical installations, etc. : 136 standards	GB/T 3783, *General specification for low-voltage apparatus in ships* GB/T 13603, *Marine battery installation* CB/T 1001, *Marine transformers* CB/T 3871, *General specification for indicator lights in ships* CB 771, *Voltage resistant cable stuffing boxes*

Category	Field of application	Examples of key standards
	Ship navigation, communication, underwater sound equipment, etc. : 72 standards	GB/T 4301, *Marine electromagnetic logs* GB/T 11875, *Marine rate of turn indicators* GB/T 18913, *Marine facsimile receivers for meteorological charts* CB 1218, *Usual piezoceramics element of underwater sound*
	Ship outfitting, including mooring fittings, marine installation, deck fittings, survival equipment, accommodation equipment and interior decoration, marine ventilation accessories, etc. : 323 standards	GB/T 554, *Bollards* GB/T 11577, *Container securing fitting for ships* GB/T 3477, *Marine weathertight single-leaf steel doors* GB 4303, *Marine lifejackets* CB/T 295, *Mushroom ventilators for ships*
Materials	Marine materials and testing methods, etc. : 137 standards	GB/T 22641, *Wrought aluminium alloy sheet and plate for ships* CB/T 3496, *Marine cable coating* GB/T 6748, *Anticorrosive paint for ships* GB/T 7789, *Dynamic test method for performance of marine antifouling paint*

Table 3 – Product standards

Category	Field of application	Examples of key standards
Production machining	Shipbuilding technology and processes : 99 standards	GB/T 13148, *Specification for welding of stainless steel clad plates* CB/T 3190, *Hull structure welding, groove type and size* CB/T 3671, *Integrated arrangement zoning principles and code names*
	Ship manufacturing process equipment : 7 standards	CB/T 3950, *Elevating work platforms for docksides* CB/T 8521, *Design requirements for shipbuilding gantry cranes*

Category	Field of application	Examples of key standards
Test methods	Test methods for ships	CB/T 346, *Open water test methods for model propellers* CB/T 3471, *Testing regulations for floating system models under combined action of wind, waves and currents* CB/Z 215, *Test method for propeller cavitation in uniform flow carried out in a cavitation tunnel*
	Test methods for support equipment	CB/T 3254.1 ~ 3254.3, *Method for marine diesel engine bench testing*
Management and administration	Management requirements and methods : 111 standards	CB/T 14, *Numbering for general drawings and technical documents shipbuilding products* CB/T 3261, *Rules for drafting of marine standard products* CB/T 3824, *Material classification and code for electric wire and cable*
	Information technology and applications : 5 standards	ISO 16155, *Ships and marine technology – Computer applications – Shipboard loading instruments* ISO 7838, *Shipbuilding – Shiplines – Formats and data organization*
Quality control	Quality management systems, quality standards	ISO 9001, *Quality management systems* CB/T 4000, *China shipbuilding quality standard*

Table 4 – Process standards

Category	Field of application	Key standards
Health, safety	–	OHSAS 18001, *Occupational health and safety management systems – Requirements*
Environment	–	ISO 14001, *Environmental management systems*

Table 5 – Health, safety and environmental (HSE) standards

The standards in **Tables 3, 4 and 5** only include national, ship industry and some ISO standards that are applicable to ships, without listing technical standards developed by the company itself. Company standards play a vital role in facilitating design, and in guiding production and inspection.

7.3.4 Company standards

Among some 1266 company standards, there are 71 basic standards, 433 for design, 300 for process, 99 for testing, 157 for the defence industry, 122 standards for products, ship parts and auxiliary equipment, three for safety, health and environmental protection, and 81 on metering detection and information technology.

7.3.5 Relevant mandatory standards and technical regulations

The company is not only under obligation to comply with mandatory standards and technical regulations, but also with international rules and specifications that are routinely followed by the industry, and which are listed in **Table 6** and **7**.

No. Safety	Document number	Title
1.		Amendment (VI) to the criminal law of the People's Republic of China
2.		Fire control law of the People's Republic of China
3.		Production safety law
4.		Measures for the determination of work-related injuries
5.	Order No. 344 of the State Council	Regulations on safety in the administration of hazardous chemicals
6.	Order No. 493 of the State Council	Bye-law governing reporting, investigation and handling of safety-related accidents in production
7.	Order No. 549 of the State Council	Regulations on safety supervision of special equipment
8.	Order No. 13 of the State Commission of Economy and Trade	Special operations staff security training assessment procedure

No.	Document number	Title
9.	Order No. 1 of the State Administration of Work Safety	Regulations on supervisory management of labour protection articles
10.	Order No. 3 of the State Administration of Work Safety	Regulations on safety training of production and operation entities
11.	Order No. 15 of the State Administration of Work Safety	Administrative penalty method for offences against safe production
12.	Order No. 23 of by the State Administration of Work Safety	Order by the state administration of work safety
13.	Order No. 27 of the State Administration of Work Safety	Order by the state administration of work safety
14.		Regulations of Liaoning province on safe production
15.	No. 31 [2004] issued by Dalian Bureau of Work Safety	Dalian municipal regulations on security management to prevent falling accidents
16.	Order No. 23 of Dalian municipal people's government	Dalian municipal administrative provisions on safety of external labour service personnel
17.	No. 114 [2005] issued by Dalian Bureau of Work Safety	Administrative municipal provisions on enclosed shipbuilding and ship repairing spaces
18.	No. 522 [2002] issued by Dalian Commission of Economy and Trade	Dalian municipal regulations on safety management of ship painting operations
19.	No. 32 [2007] issued by Dalian port	Notice on printing and distributing " Interim Dalian provisions on safe production management for ship repairing and local shipbuilding companies "
20.	GB 6067-1985	Safety rules for lifting appliances
21.	CB/T 3969-2005	Gas safety requirement for metal welding and cutting in cabins
22.	GB 9448-1999	Safety in welding and cutting
23.	CB 3660-1997	Safety procedures for shipyard lifting operation
24.	CB 3785-1997	Safety procedures for height operation in shipyards
25.	CB 3786-1997	Safety procedures for electrical operation in shipyards
26.	CB 3787-1996	Safety procedures for inter-plant handling operations in dockyards
27.	CB 3381-1991	Safety procedures for ship painting operations
28.	CB 3515-1993	Shipbuilding security management
29.	GB 18218-2009	Identification of major hazards for dangerous chemical installations

No.	Document number	Title
30.	GB/T 18664-2002	Selection, use and maintenance of respiratory protection equipment
Health		
31.		Law of the People's Republic of China on the Prevention and Control of Occupational Diseases
32.	Order No. 27 of the State Administration of Work Safety	Management method for the declaration of occupational hazards in operational fields
33.	No. 63 [2002] issued by health, law and supervision	Classification of occupational disease hazard factors
34.	No. 142 [2003] issued by health, law and supervision	Catalogue of highly toxic substances
35.		Temporary method of Liaoning province on occupational health supervision in operational fields
36.	CB/T 3745-1995	Classification for comprehensive evaluation of degrees of occupational hazard
37.	GBZ 2.1-2007	Occupational exposure limits for hazardous agents in the workplace
38.	GBZ 188-2007	Technical specifications for Occupational Health Surveillance
39.	GBZ/T 194-2007	Hygienic engineering measures for preventing and controlling occupational poisoning in the work place
40.	GB 5044-1985	Classification of hazards of occupational exposure to toxic substances
41.	GBZ/T 193-2007	Criterion of control and prevention of occupational hazards in processing asbestos
42.	GBZ/T 198-2007	Guideline for prevention of occupational hazards in the use of synthetic vitreous fibre insulation
43.	GBZ/T 196-2007	Technical guidelines for pre-assessment of occupational hazards in construction projects
Environment		
44.		Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution
45.	Order No. 475 of the State Council	Administrative Regulation on the Prevention and Control of Pollution Damage to the Marine Environment by Coastal Engineering Construction Projects
46.	Order No. 561 of the State Council	Regulation on the Prevention and Control of Vessel-induced Pollution to the Marine Environment

No.	Document number	Title
47.	Order No. 1 of the Ministry of Environmental Protection and National Development and Reform Commission	National Catalogue of Hazardous Wastes
48.	CB 3769-1996	Regulations on labour health management in the shipbuilding industry
49.	GBZ 1-2002	Regulations on labour protection in workplaces where toxic substances are used
50.	GB 11654 ~ 11666-1989, GB 18068 ~ 18082-2000	Hygiene standards for the Design of Industrial Companies
51.		Health protection zone standards for industrial companies
Other standards		
52.		Labour law of the People's Republic of China
53.		Labour contract law of the People's Republic of China

Table 6 – Mandatory standards and technical regulations

No.	Title
1.	Requirements of the Flag Administration
2.	International Convention for the Safety of Life at Sea, 1974, its Protocol of 1988 (SOLAS) and Amendments
3.	International Convention for the Prevention of Pollution from Ships, 1973 and Protocol of 1978 (MARPOL) and Amendments
4.	International Convention on Load Lines, 1966 and its Protocol 1988 and Amendments
5.	International Convention on Tonnage Measurement of Ships (1969)
6.	Suez Canal Navigation Rules including Tonnage Measurements
7.	Panama Canal Navigation Rules including Tonnage Measurements
8.	International Regulations for Preventing Collision at Sea, 1972 and Amendments
9.	International Telecommunication Convention 1973 and Radio Regulations (Geneva 1982) and Amendments
10.	IMO Resolutions –A468 (XII) – Code on Noise Level on Board Ships, 1982
11.	ILO Convention No. 92 and 133 concerning Crew Accommodation on Board
12.	Maritime Labour Convention, 2006, concerning Crew Accommodation on Board (without certificate nor inspection)

13.	ISO 6954:1984, *Mechanical vibration and shock – Guidelines for the overall evaluation of vibration in merchant ships*
14.	USCG Regulations for foreign-flag ships operating in navigable waters of the United States, CFR Title 33 Part 155, 159 and 164
15.	Australian Maritime Safety Authority Marine Orders Part 32 " Cargo Handling Equipment " Issue 2 (requirements for cargo hold ladders and cranes)
16.	International Maritime Pilot's Association Requirement Concerning Pilot Ladders
17.	The General Harbour (Ship cargo and dock safety) Regulation 1968, amendments No.1 (New Zealand Regulation)
18.	Harbour authority requirements for cargo gear in UK, Canada, India, Pakistan, Australia, New Zealand, USA and China

Table 7 – Rules and regulations applied by the company

7.4 Analysis of the value chain

In the present period of global economic integration, ships have become irreplaceable due to their large transport capacity and low cost.

The ship industry comprises four main sections – design, manufacture, transport and auxiliary equipment.

In the last century, the world shipbuilding center shifted from Europe to Japan, Korea, and then to China. Marine technology evolves continuously and is now developing towards safer, more environmentally-friendly and energy-saving ships. In terms of manufacturing models, the industry has moved from the " integral manufacturing mode ", to a " segmented manufacturing mode ", to a " production line manufacturing mode " and finally to an " integrated manufacturing mode ". The current trend is towards a high degree of mechanization, automation, integration and modularization.

Standardization has played, and continues to play, a vital role in the shift of the centre of worldwide shipbuilding and in the progressive development of shipbuilding technology. Analyzing the characteristics of the industry is very helpful in identifying the value drivers in the industry value chain, and in understanding the benefits generated by standards.

The shipbuilding industry has three main characteristics :

1. Many product types, fast development

Modern ships can be divided into the following types, including oil tankers, bulk carriers, container ships, special vessels (such as dredgers, chemical cargo ships, liquefied petroleum gas (LPG) and liquefied natural gas (LNG) carriers), cruise ships, ferryboats and large-scale yachts. Oil tankers, bulk carriers and container ships account for 70 % to 80 % of the world's transport vessels. For this reason, these are also called the three " mainstream ship types ". In addition, the so-called " three high " ship types are characterized by high-tech content, high manufacturing difficulty and high value-added design, but account for only a small share of world markets.

In order to win markets, shipbuilding companies compete by increasing their investment in R&D. They continue to develop new ship types, optimize existing types and improve ship performance resulting in an unprecedented speed in production of new ships.

Korean shipbuilders optimize and innovate in almost all ship types in order to satisfy new maritime regulations. Japan performs advanced research into LNG, container, cruise and many other design concepts. The latest ships tend to be larger in scale, have many more safety features, a greater degree of environmental protection, are also highly automated and more energy efficient.

2. Production of single units, small volumes, long manufacturing periods

Because markets change quickly and customer demands are diverse, it is a characteristic of the shipbuilding industry that orders are received before production is started. A product is in most cases a single unit.

The industry is also characterized by the development of large ships, the focus of much of the innovation. This trend is driven by economies of scale because large-scale ships reduce the per-unit costs of the goods being transported. For example, the per ton cost of transporting oil in a 250 000 ton oil tanker is 40 % less than that for a 25 000 tanker. When the capacity of a container ship increases from 4 000 TEU (twenty-foot equivalent unit) to 8 000 TEU, transport costs per case decrease typically by 15 %. Such economics drive increases in the size of hulls and more complicated structures.

Ship building is complex, demanding many materials of construction, extensive precision instrumentation and systems, leading to higher prices and increasing time taken in manufacture. Using the three mainstream ship types as an example, the average shipbuilding process for a 170 000 ton bulk carrier from docking to delivery is around half a year, around 385 days for a 76 000 ton oil product carrier, and about 320 days for a 4250 TEU container ship.

3. High technical requirements, complex management challenges

The shipbuilding industry involves many different technologies and processes. The technical requirements are high, whether in initial drawing design, process selection or specialized machine operation. In addition, ship structures and technologies are complicated and subject to frequent changes in the manufacturing process. Repeated operations are infrequent, which makes it difficult to adopt streamlined processes or specialized tools and equipment throughout production. Shipbuilding therefore relies heavily on the professional capabilities of engineers, technical staff and workers, all of whom are of key importance.

The company management of DSIC is involved in the control of design, costs, materials, components, production, personnel and other aspects which all require solutions to complex management challenges. A shipbuilding company needs strong management capabilities and senior managers familiar with the whole shipbuilding process and its associated technologies.

7.4.1 Industry value chain

The shipbuilding industry can be sub-divided into the following segments (see **Figure 1)**:

- An upstream segment that includes iron and steel and various raw materials, and the manufacture of assorted products, components and parts
- A midstream segment that includes ship design and manufacture
- A downstream segment that includes the shipping industry, the repair service industry, ship disassembly and recycling, the leisure and entertainment industry, and exploration of ocean resources.

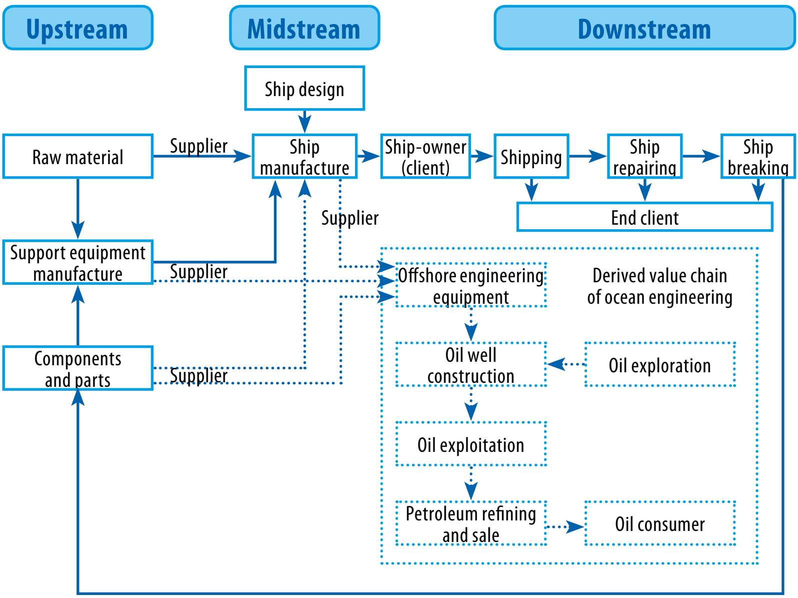


Figure 1 – Shipbuilding industry value chain

7.4.2 Position of DSIC in the shipbuilding industry value chain

Being one of the most important shipbuilding companies in China, DSIC operates across virtually the whole industry value chain. It attaches special importance to its activities in the mid- and downstream segments of the value chain in order to provide services that cover the whole life cycle of ships from development and design to construction, and eventually to repair, refitment and disassembly.

1. **Midstream segment of the value chain – ship design and manufacture**

In line with the company's overall development, its products evolved from foreign designs through joint-design to autonomous design, and increasingly towards large-scale, high-tech, high value-added products. Its output of ordinary bulk carriers, multi-purpose freight ships, medium-size and large oil tankers, ultra-large tankers and container ships has undergone continuous improvement and upgrading. Currently, DSIC puts major efforts into the development of multi-level VLCC (very large crude carriers), LNG ships and other high-end products. The company is improving its technical level in construction and has evolved the " five shipbuilding ideas " – digital, green, lean, standard and final assembly shipbuilding.

2. **Downstream segment of the value chain – repair and shipbreaking**

DSIC's repair/shipbreaking installation under construction at Changxing Island, Dalian, will become the biggest in the world with an annual average dismounting capacity of up to 75 ships of 50 000 to 300 000 tons. Costing some CNY 3 billion and with a floor space of approximately 100 hectares, the ship repair and green shipbreaking base is expected to go into production in 2013. It will operate on a green environmental protection system by channeling scrap steel from shipbreaking to steelworks to make new steel products for the construction and repair of new ships. Strategic alliances between companies in the upstream and downstream segments of the industry value chain will further promote the cyclical re-use of materials.

3. Extended value chain – offshore engineering equipment

Besides shipbuilding itself, China leads in ocean engineering manufacturing. DSIC has designed and constructed the " Dajiao III " drilling platform, gas cushion and self-elevating drilling platforms, bathypelagic semisubmersible drilling platforms, upper modular structures for ocean engineering, floating production storage offloading vessels, launching barges, ocean integrated detection ships, and anchor handling tug supply vessels, for customers in China and abroad.

The company has also enjoyed successful growth in the ocean engineering refitment and repair market, and now refits all drilling platforms in China. In addition, the JU2000 self-elevating drilling platform capable of operating at a maximum water depth of 400 ft was constructed by DSIC. It is the largest platform of its type and offers the highest degree of automation. JU2000 was also the first in China to reach an international advanced level.

7.4.3 Company value chain

By applying the value chain analysis developed by Michael Porter to the specifics of DSIC's business structure, the core activities and support activities can be described as follows :

1. Core activities

Inbound logistics : This business function covers activities related to reception, storage and distribution, such as transport, warehousing, inventory control, dispatch of vehicles and return of goods to suppliers.

Production/operation : This business function covers various activities through which inputs are transformed into final products, such as cutting, welding, sub-assembly, joining of hulls and installation, up to the handover and final acceptance by the customer.

2. **Support activities**

Management and administration : This business function covers company accounting, handling of tax payments, finance, administration, human resource management, information technology, etc.

R&D : This business function includes technical studies, product development, contract design, detailed design, production and process design, and represents a core competitiveness of the company.

Procurement : This business function includes the purchase of raw materials and equipment including steel plates, cables, outfitting items, R&D and production equipment as well as the purchase of materials. More than 60 % of company costs are incurred in this area.

7.4.4 Main value drivers

As explained earlier, the main features characterizing the shipbuilding industry are the high number of product types and their rapid development, the single unit and small scale production volumes, the long manufacturing periods, the sophisticated technical requirements and highly complex management structures. A company can improve its competitiveness by :

- Raising the level of technological R&D and expediting the development of new products
- Improving the technical qualification and work efficiency of employees, and by shortening the manufacturing period
- Improving the quality of management

Standards and standardization activities can help a company to form a competitive advantage in the following areas:

1. **Management**: A company can improve product quality and work efficiency by implementing a quality management system and product standards. In human resource management, training periods can be shortened, training efficiency can be increased and the technical qualification of employees can be improved by applying a general operations guide book, and by following the specifications of the classification societies in the conduct of training in manufacturing operations.
2. **Research and Development**: Design and R&D are key factors in company competitiveness. Only with the design of high tech and high value added products can the company be successful on the market. Implementing standards and applying the specifications and regulations of classification societies will enable a company to improve the speed of its design and development, and reduce design costs.
3. **Procurement**: This is a key area that impacts product costs and quality, and offers opportunities for reducing procurement costs and boosting competitiveness.
4. **Inbound logistics**: Through the use of component standards, it is possible to limit the variety of purchased parts, and consequently reduce expenditure and the complexity of warehouse management.
5. **Production/operation**: This is a key area with high manpower costs. Even the best design can only be transformed into products through careful organization of production. Through the application of product and process standards as well as operation guide books, it is possible to improve employee work efficiency, shorten manufacturing time and streamline production of finished products.

7.5 Scope of the pilot project assessment

The scope of the assessment is the R&D business function for shipbuilding products, with a focus on DSIC's Design Institute. As a core unit of the company, the Design Institute has one of the strongest R&D capacities in China and has been assigned the status of a " Company technical competence centre " at the national level.

It undertakes R&D, design, and development of products for the defence industry, ships for civil use, ocean engineering and non-ship products ; research projects financed by state ministries and commissions as well as scientific research trial-manufacture projects for national defence. In addition, it is responsible for integrated management of vessel construction design, technology and material quotas ; collection, application, formulation and revision of vessel standards ; application and development of computer software for the shipbuilding industry ; provision of high-quality support and services for the production and construction departments, as well as for the production control department.

The Institute employs nearly one thousand designers and assistants, with more than 700 directly engaged in engineering design. The technical performance of the products it develops directly affect the competitiveness of the whole company and has therefore a major function in its future.

The Design Institute covers 11 areas with an organizational unit for each, (see **Figure 2.**)

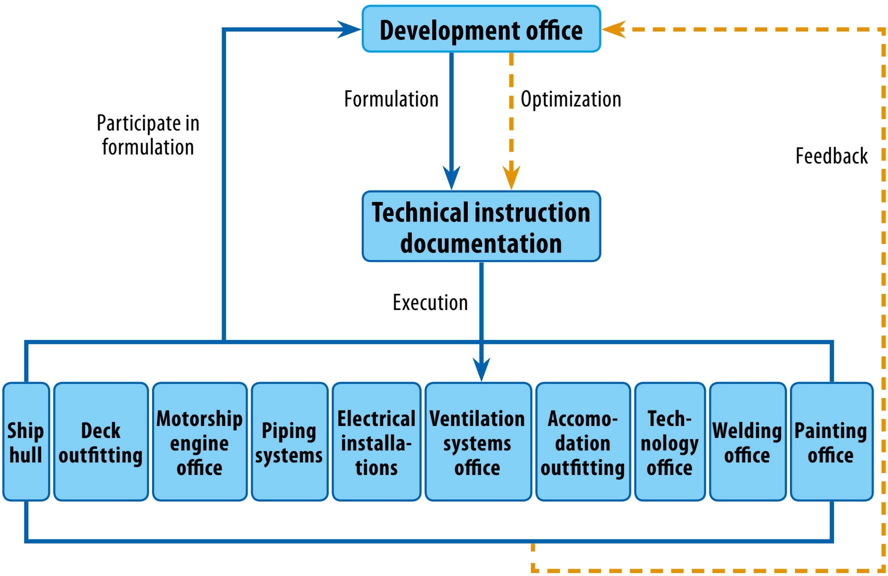


Figure 2 – Organizational structure of the Design Institute

7.6 Standards used within the scope of the assessment

To determine the economic benefits of external standards (which include international, national, industry and company standards) in the R&D business function, we start from the use of standards in the 11 work areas or organizational units of the Design Institute. The core activities performed within the 11 areas are explained in **Table 8.**

Organizational units	Core activities	Number of standards applied	Relationship between standards and core activities
Development office	Development and research of shipbuilding products, fixed price design, contract design, product stability experiments, empty ship weighing, float calculations, cruise speed tests, manoeuverability tests, etc.	32	With support of standards, it becomes easier to compile technical instructions for contracts with a higher degree of accuracy in determining technical parameters and shorter times to reach agreement with ship-owners. Compilation of test files tends towards format clauses with consequent improvement of work efficiency and design quality.
Ship hull office	Detailed design of the hull structure according to contracts ; production design of the hull structure for shipbuilding and maritime products.	11	Depending on the specifics of a field of application, hull standards focus on a common language for basics, symbols, nodes, etc., they standardize the basic elements of drawings and help improve design efficiency.
Deck outfitting office	Detailed design and production design according to contracts as well as technical services for large outfitting except engine room ; contract design, detailed design and production design of maritime work deck outfitting.	179	Outfitting is highly varied and relates to various aspects of the deck with many relevant standards. Standards facilitate the selection of designs, the manufacture and installation, and help improve work efficiency and design quality.

Organizational units	Core activities	Number of standards applied	Relationship between standards and core activities
Office for accommodation outfitting	Detailed design and production design according to contract as well as technical services of whole ship accommodation outfitting ; contract design, detailed design and production design of maritime accommodation outfitting work.	43	Standards facilitate the selection of designs, manufacture and installation, and help improve work efficiency and design quality.
Motorship engine office	Detailed design and production design according to contract as well as technical services for motorship engines ; contract design, detailed design and production design of maritime motorship engine work.	11	Most motorship engine products are approved product types. The standards applied in design contain technical requirements, specify concrete indicators and designs, and facilitate inspection and acceptance.
Piping system office	Detailed design and production design in accordance to contract as well as technical piping services ; contract design, detailed design and production design of maritime piping system work.	216	There are many types of piping systems and many standards that facilitate the selection of designs, manufacture and installation, and help improve work efficiency and design quality.
Electrical installations office	Detailed design and production design as well as support services for electrical systems ; contract design, detailed design and production design of maritime electric installation work.	64	Standards facilitate the selection of designs, manufacture and installation, and help improve work efficiency and design quality.
Ventilation systems office	Detailed design and production design as well as support services for the ship air cooling ventilation systems ; participation in contract design, detailed design and production design of maritime air cooling ventilation system work.	35	Standards facilitate the selection of designs, manufacture and installation, and help improve work efficiency and design quality.

Organizational units	Core activities	Number of standards applied	Relationship between standards and core activities
Technology office	Compiling information about construction technology, installation, debugging and delivery and acceptance of technological documents on hulls, motorship engines, electrical and piping systems etc. for shipbuilding and maritime products, designing and developing large technological equipment as well as application and dissemination of new technologies and processes.	51	Standards specify requirements for indicators, make it easier to prepare documentation, and help to improve work efficiency and design quality.
Welding office	Product bids and related preparation of welding techniques, qualification of welding technology and welding technology design, developing new materials, technology and processes, as well as application and dissemination of highly efficient welding techniques.	19	Standards specify the requirements for indicators, make it easier to prepare documentation, and help to improve work efficiency and design quality.
Painting office	Paints and related technological development design, contract design, detailed design, production design, process routes, material quotas and chemical process work for each ship berth before launch.	35	Standards specify the requirements for indicators, make it easier to prepare documentation and help improving work efficiency and design quality.

Table 8 – Core activities of the organizational units

7.7 Determination of core areas and key operational indicators to measure the impact of standards

R&D is key to the competitiveness of companies. The use of standards in R&D can provide both parties in an agreement – the manufacturer and customer – with a common language in negotiations and in formulating requirements that can reduce the time taken to reach agreement. A main objective for R&D is the improvement of designs and reduction of design costs through more efficient product research and by limiting part variety. An explanation of the impacts of standards used by the organizational units and areas of R&D is given in **Table 9.**

Organizational units	Impact of standards
Development office	The Development office is the very core of Dalian's R&D function. The competitiveness of the products it develops directly influences the future of the company. Whether technical indicators are advanced, prices are competitive and responses to customer requests are fast determines if orders are placed or not. With the support of standards, relevant technical parameters and performance indicators in technical documentation can be established. Negotiations with ship-owners can be based on common rules, development efficiency increases and development costs can be reduced. R&D teams of 60+ persons each develop and prepare price quotations for more than 30 ships annually and complete acceptance tests for approximately 40 ships. All these activities would be inconceivable without the support of standards.
Hull office	The Hull office is mainly engaged in the detailed design and production design of the hull structure as well as the design and reinforcement of large production equipment. In accordance with the requirements of standards, technical drawings are unified, node and component designs are specified, and up-to-date information is entered into a database. This ensures that unnecessary deviations from standardized parts are avoided, resulting in improvements in design efficiency, and a reduction in design errors and costs. The Hull office with 100+ employees completes the design of about 10 ships and the related tasks of approximately 40 ships annually.

Organizational units	Impact of standards
Deck outfitting office	Deck outfitting is mainly engaged in the detailed design and production design of mooring, anchoring and loading/unloading functions. Many products are involved and standards are used extensively. Time needed for negotiations is reduced through references to standards in agreements. The use of many standards reduces the need for special ship design, improves design efficiency, reduces design errors and costs. Deck Outfitting employs about 50 people, and completes the design of some 10 ships and the related tasks for approximately 40 ships annually. The contribution of standards for these tasks is evident.
Accommodation outfitting office	Accommodation outfitting is mainly engaged in the detailed design and production design of decorative and insulating materials, deck coverings, firefighting and lifesaving equipment, furniture, doors and windows. The use of standards reduces the time to reach agreement, improves the design efficiency and reduces design errors and costs. The office employs about 30 people and completes the design of about 10 ships and the related tasks for approximately 40 ships annually. Standards are an important element.
Motorship engine office	The motorship engine office is mainly engaged in the detailed design and production design of marine power plants, including the main engine, dynamo, boiler, air compressor, engine room pump, drive shaft equipment, and monitoring instruments. Many products are used, and most are type-approved. The relevant standards contain technical requirements, specify indicators and parameters, etc. The use of standards facilitates the design, reduces the time needed to reach agreements, improves the design efficiency, reduces design errors and costs. The motorship engine office employs some 50 people and completes the design of about 10 ships and the related tasks for approximately 40 ships annually. Standards play a very important role in this work.
Piping systems office	The piping systems office is mainly engaged in detailed design and production design to ensure reliable operation of oil, water and gas piping systems for the whole ship. The standards used mainly relate to materials for pipes, accessories and valves. There are numerous supplier companies, and over 90 % of products used are covered by standards. Standards contribute to reduction in variety and expansion of quantities of the parts used, to reduction of cost and time to reach agreements, improvement in design efficiency, and reduction in design errors and costs. The office for piping systems employs about 150 people, and designs around 10 ships and the related tasks of approximately 40 ships annually, and uses standards extensively.
Electric systems office	The electric systems office is engaged in the detailed design and production design of electrical systems for the whole ship, including all controls, lighting, communication, and navigation. Many products are used and most are type-approved. The use of standards has facilitated design, reduced the time to reach agreements, improved design efficiency, reduced design errors and costs. The electric systems office employs about 90 persons and designs about 10 ships and is involved in tasks related to approximately 40 ships annually.

Organizational units	Impact of standards
Ventilation office	The ventilation office is mainly engaged in the detailed design and production design of air cooling and ventilation of the whole ship including connection through air conduits, pipelines and fittings, to guarantee reliable and comfortable operation. Many different types of product are used. By adopting standards, the time to reach agreement is reduced, design efficiency is improved, design errors and costs are reduced. The ventilation office employs some 20 people and designs for about 10 ships and is involved in tasks related to approximately 40 ships annually.
Technology office	The technology office takes charge of compiling construction technology, installation, debugging, delivery and acceptance of technical documentation on hulls, motorship engines, electrical and piping systems, etc., for shipbuilding and maritime products, designs and develops large technical equipment and applies and disseminates new technology and new processes. Standards used by this office are mostly focused on test methods and quality requirements. The use of standards facilitates the compilation of files, improves design efficiency and reduces design errors and costs. The technology office employs about 40 people and completes designs for about 10 ships and is involved in tasks relating to approximately 40 ships annually.
Welding office	The welding office mainly takes charge of bids related to preparing welding techniques, qualification of welding technology and welding technology design, development of new materials, technology and processes as well as the application and dissemination of efficient welding techniques. The standards most used by this office contain welding specifications. The use of standards facilitates the compilation of documentation, improves design efficiency, reduces design errors and costs. The welding office employs about 20 people and completes designs for about 10 ships, and is involved in tasks related to approximately 40 ships annually.
Painting office	The painting office is responsible for the technological development of paint, contract design, detailed design, production design, processes, the establishment of quotas for materials and the chemical processes for each ship before launch. The standards used mostly focus on test methods and technical requirements. The use of standards facilitates the compilation of documentation, improves design efficiency and reduces design errors and costs. The painting office employs 13 people and completes designs for about 10 ships and is involved in tasks related to approximately 40 ships annually.

Table 9 – Organizational units in R&D and the impact of standards

7.8 Calculation of the economic benefits of standards

The calculation of the economic benefits of standards is based on the use of standards in the eleven areas and organizational units in the Design Institute. The data collected for the operational indicators are given for each of these units. The calculation of impacts given in **Table 10** is based on estimations by employees on the basis of their long-term practical experience, expressed as reductions in the costs for the respective unit.

Organizational units	Operational indicators	Basis for the calculations	Financial (EBIT) impacts
Development office	Technical documentation, which is part of the contract between the dockyard and the ship-owner, is the most important technological document in a shipbuilding contract. It requires that a project must comply with respective specifications, rules, general conventions, international, foreign, Chinese national, industry and company standards as a condition of obtaining the order. Standards can be used in preparing the technical documentation. Negotiations with ship-owners can be based on common rules. This results in an increase of development efficiency and a reduction in development costs of at least 5 %.	The design cost of the development office is about CNY 12 million.	CNY 12 million / (1 – 5 %) – CNY 12 million = CNY 631 600
Hull office	The use of standards and specifications improves design efficiency and reduces design errors. Design costs are reduced by at least 3 %.	The design cost of the hull office is about CNY 28 million.	CNY 28 million / (1 – 3 %) – CNY 28 million = CNY 866 000
Deck outfitting office	The use of standards and specifications reduces the time needed to reach agreement, design efficiency is improved and design errors are reduced. Design costs are reduced by at least 15 %.	The design cost of the deck outfitting office is about CNY 8 million.	CNY 8 million / (1 – 15 %) – CNY 8 million = CNY 1 411 800

Organizational units	Operational indicators	Basis for the calculations	Financial (EBIT) impacts
Accom-modation outfitting office	Standards and specifications reduce the time to reach agreement, design efficiency is improved and design errors are reduced. Design costs are reduced by at least 10 %.	The design cost of the accommodation outfitting office is about CNY 8 million.	CNY 8 million / (1 – 10 %) – CNY 8 million = CNY 888 900
Motorship engine office	Standards and specifications reduce the time to reach agreement, design efficiency is improved and design errors are reduced. Design costs are reduced by at least 5 %.	The design cost of the motorship engine office is about CNY 7 million.	CNY 7 million / (1 – 5 %) – CNY 7 million = CNY 368 400
Piping systems office	Standards and specifications reduce the time to reach agreement, design efficiency is improved and design errors are reduced. Design costs are reduced by at least 15 %.	The design cost of the piping systems office is about CNY 30 million.	CNY 30 million / (1 – 15 %) – CNY 30 million = CNY 5 294 100
Electrical installations office	Standards and specifications reduce the time to reach agreement, design efficiency is improved and design errors are reduced. Design costs are reduced by at least 10 %.	The design cost of the electrical installation office is about CNY 16 million.	CNY 16 million / (1 – 10 %) – CNY 16 million = CNY 1 777 800
Ventilation systems office	Standards and specifications reduce the time to reach agreement, design efficiency is improved and design errors are reduced. Design costs are reduced by at least 10 %.	The design cost of the ventilation systems office is about CNY 2.5 million.	CNY 2.5 million / (1 – 10 %) – CNY 2.5 million = CNY 277 800
Technology office	Standards and specifications improve design efficiency and reduce design errors. Design costs are reduced by at least 10 %.	The design cost of the technology office is about CNY 7 million.	CNY 7 million / (1 – 10 %) – CNY 7 million = CNY 777 800
Welding office	Standards and specifications improve design efficiency and reduce design errors. Design costs are reduced by at least 15 %.	The design cost of the welding office is about CNY 4 million.	CNY 4 million / (1 – 15 %) – CNY 4 million = CNY 705 900

Organizational units	Operational indicators	Basis for the calculations	Financial (EBIT) impacts
Painting office	Standards and specifications reduce the time to reach agreement, design efficiency is improved and design errors are reduced. Design costs are reduced by at least 10 %.	The design cost of the painting office is about CNY 2.5 million.	CNY 2.5 million / (1 – 10 %) – CNY 2.5 million = CNY 277 800
Total (CNY) :		**CNY 125 000 000**	**CNY 13 277 900**
Total (USD) : (basis : average exchange rate of 1 USD = CNY 6.5)		**USD 19 230 769**	**USD 2 042 753**

Table 10 – Assessment of the impact of standards on the R&D business function

As shown in **Table 10** the average annual financial impact of standards on the company EBIT in R&D amounts to CNY 13 277 900 (or about USD 2 million). Since the lifetime of standards in R&D in the shipbuilding industry is quite long, their impact has blended into routine R&D activities. If we analyze the contribution to company revenues of the standards used in R&D on the basis of the average revenues over the last five years, we arrive at the results given in **Table 11**.

Revenues / Year	Revenue of the whole corporation	Revenue from shipbuilding	Revenue of the R&D business function
2006	10 460 000	9 410 000	52 450
2007	14 190 000	12 771 000	85 170
2008	18 000 000	16 200 000	113 120
2009	20 590 000	18 531 000	143 250
2010	22 750 000	20 475 000	150820
Average annual revenue over the last five years	17 198 000	15 478 200	108 962
% contribution of standards as a percentage of annual revenues from R&D	0.08 %	0.09 %	12.19 %

Table 11 – Overall contribution of standards (unit : thousand CNY)

7.9 Evaluation of results

Table 2 shows that DSIC experienced strong development during the period of China's 11th Five-year Plan (2006-2010), which can be related to the reliance on technical progress and a boost in using standardized designs. Other factors such as the number of employees and working hours did not change, and did therefore not influence this development. Currently the slogan " Follow standards and apply procedures " is very popular. By improving development and design efficiency in R&D and reducing design errors, the contribution ratio of standards to R&D has reached a level of 12.19 %. The main reason is that standards help to raise the technology level in R&D and expedite the development of new products. At the same time, standards help to improve the technical level and the work efficiency of employees and reduce manufacturing time. The study therefore confirms the important contribution of standards for R&D.

7.10 Conclusions

7.10.1 The assessment of economic benefits of standards stimulates the development of standardization

Applying the ISO methodology to assess the economic benefits of standards, to undertake case studies in China, to compare the results with studies in other countries under different socio-economic conditions, and to study approaches and methods of improving the economic benefits of standardization can provide useful inputs for the formulation of policies. The successful application of the methodology in China facilities a better understanding among interested parties of economic benefits of standards, and improves the recognition of the importance of standards by company managers and technical staff.

Studying the economic benefits of using standards in companies, and the collection and scientific analysis of objective data can motivate company managers to achieve further progress in standardization.

7.10.2 Proposals for improving the assessment methodology

In this pilot project, it was possible to calculate the economic contribution of standards to R&D of the selected shipbuilding industry company. Such an understanding will help companies to allocate their resources effectively. However, the assessment method itself still needs to be improved and three proposals are made for this purpose :.

- The value chain concept is the key framework used in the ISO methodology to assess the economic benefits of standards. However, the biggest challenge in applying the methodology is to distinguish between the impact of standards and those of other factors. Familiarity with the subject field and the business in the scope of the study is therefore very important. In order to obtain raw data for the assessment from various perspectives, one should relate the data obtained from interviews of company staff with information obtained for the whole industry and/or from similar companies, in order to compare findings.
- China's standardization system combines mandatory and voluntary standards. For this reason, we decided, in assessing the impact of standards, to disregard whether the status of a standard was mandatory or voluntary.
- Although the methodology does not take company standards into account, company standards with technical parameters that exceed those of external standards (international, national, industry and other standards), should be included in the scope of the assessment.

7.10.3 Assessment of the economic and social benefits of standards

The positive impact of standards on economic and social development is not only expressed in measurable economic indicators, but is also visible in areas such as environmental protection, human health and in other aspects that cannot be quantified easily. Both the economic and social benefits of standards should therefore be studied comprehensively, in order to assess the impact of standards on the national economy and on social development in a scientific and objective manner. The objective of such an assessment is to provide a basis for decision-making by various government agencies, to guide detailed industry standardization strategies, and to further encourage companies to participate in standardization.

8

Xinxing Ductile Iron Pipes Co. Ltd., China

Country : China
ISO member body : Standardization Administration of the People's Republic of China (SAC)
Project team :
Project leader : Mr. Guo Hui, Director General, Department of International Cooperation, SAC
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Mr. Li Jun, Assistant Chief Engineer
Members – Standardization Administration of the People's Republic of China :
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ISO Central Secretariat advisor : Reinhard Weissinger, Manager, Research, Education & Strategy
Duration of the study : July 2011 – February 2012

8.1 Organization of the pilot project

Xinxing Ductile Iron Pipes Co., Ltd (hereafter Xinxing) was selected as the company for the SAC/ISO project to assess the economic benefits of standards. The objective of the project was to determine in a quantitative manner the benefits that a company can obtain from the use of consensus-based standards developed by standards organizations (irrespective of whether these standards are international, national or other types of standards). Such standards are also referred to as "external" standards to distinguish them from "internal" standards developed by companies themselves.

This pilot project began in July 2011, and was completed in February 2012. The parties involved were the Standardization Administration of China (SAC), the China National Institute of Standardization (CNIS), the China Metallurgical Information and Standardization Institute, Xinxing Ductile Iron Pipes Co., and the ISO Central Secretariat.

8.2 Introduction to the company

Xinxing is located in the North of Shangluoyang Village, Wuan City, Hebei Province, China. Since 1997 the company has been listed on the Shenzhen Stock Exchange and is exclusively sponsored by Xinxing Ductile Iron Pipes Group Co., Ltd (now renamed as Xinxing Cathay International Group, under the state-owned Assets Supervision and Administration Commission of China). It owns multiple production bases in the cities of Handan (Hebei Province), Wuhu (Anhui Province), Bayingol (Mongol Autonomous Prefecture, Xinjiang Province), Huangshi (Hubei Province), Taojiang (Hunan Province), and Chongzhou (Sichuan Province).

Xinxing is a large enterprise with 17 sales branches across China and 13 overseas sales agencies. It operates in several industries and integrates scientific developments, industrial manufacturing and trade.

8.2.1 Main Products

Xinxing's main products include centrifugal ductile iron pipes, hot-rolled ribbed bars, hot-rolled plain round bars, steel grading plates, bimetal (multi-metal) seamless steel pipes and steel-plastic composite pipes.

Cast pipe products are mainly used for water supply and drainage in urban and town infrastructural construction and in gas transmission.

These products are divided into composite pipes for hot and cold water and drinking water, for heating, fuels, and for special fluids (including industrial waste water, corrosive fluid, coal mine water supply, water drainage, and compressed air), water drainage and protection casing, They are extensively used in construction water supply projects, and in the communication, electric power, petroleum, chemical, pharmaceutical, food, mining and fuel gas sectors.

8.2.2 Market share of Xinxing's main products

The market share of Xinxing's main products in China is given in **Table 1.**

Product Name	Market Share (%)
Centrifugal Ductile Iron Pipe	42.5
Steel Grating Plate	40
Hot-Rolled Ribbed Bar and Hot-Rolled Plain Round Bar	3

Table 1 – Market share of Xinxing's main products

8.2.3 Income and Profit

Revenues and profits of Xinxing Ductile Iron Pipes are given in **Table 2.**

Year	Business Income (in CNY)	Business Profit (in CNY)	Total Profit Amount, incl. from other sources (in CNY)
2006	10 801 232 300	768 702 000	803 898 200
2007	14 258 104 000	920 652 300	969 427 500
2008	20 550 796 800	677 383 200	811 489 800
2009	25 188 193 400	1 294 268 900	1 350 308 500
2010	37 620 744 900	1 605 198 100	1 763 037 100

Table 2 – Income and profits – Total company (2006 – 2010) [1)]

The scope of the assessment covers two Xingxing factories in the Wuan Industrial Zone, which produce cast pipes and steel products. Income and profit for these two factories is given in **Table 3.**

Year	Business Income (in CNY)	Business Profit (in CNY)	Total Profit Amount, incl. from other sources (in CNY)
2006	6 473 633 100	541 885 800	793 054 100
2007	7 943 209 200	548 666 100	521 484 100
2008	9 771 289 000	107 030 500	359 194 800
2009	8 543 640 600	898 754 700	1 386 475 100
2010	10 063 438 000	488 292 200	569 239 000

Table 3 – Income and profits for the operations within the scope of the assessment (2006 – 2010)

1) Chinese Yuan (CNY) – US Dollar : approximately 6.5 CNY – 1 USD.

8.2.4 Employees

The company currently employees 17 499 people, with 5 276 involved in the business functions falling within the scope of the assessment. The number of employees per function is given in **Table 4.**

Functions	Xinxing (total)	Xinxing (business functions in scope of assessment)
Production staff	15 361	4 378
Sales	432	234
Engineers	531	285
Finance and accounting staff	141	
Management	1 034	379
Total	**17 499**	**5 276**

Table 4 – Functions of employees

8.2.5 Organization of the company and its branches

Xinxing's organizational structure is composed of three main levels – general managers and deputy general managers constitute the management level, the management departments and subsidiaries represent the second level, while the production units such as the coking, pelletizing, power control, steel rolling, pipe casting, and other departments are at the third level.

Xinxing has a number of subsidiaries and branch companies in different parts of China including ten companies located in North- and Southwest China as well as in China's Special Administrative Region, Hong Kong, as shown in **Table 5.**

No.	Name of branch company	Location
1	Wuhu Xinxing Ductile Iron Pipes Co. Ltd	Wuhu City, Anhui Province
2	Hebei Xinxing Ductile Iron Pipes Co. Ltd	Wuan City, Hebei Province

No.	Name of branch company	Location
3	Xinxing Ductile Iron Pipes International Development Co., Ltd (a joint-venture company between Xinxing Ductile Iron Pipes Enterprise and China Hong Kong East China Stock Investment Co. Ltd, in conjunction with Huangshi Xinxing Pipe Industry Co. Ltd)	Huangshi City, Hubei Province
4	Taojiang Xinxing Pipe Fittings Co. Ltd	Yiyang City, Hunan Province
5	Sichuan Chuanjian Pipeline Co. Ltd	Chengdu City, Sichuan Province
6	Handan Xinxing Power Generation Co. Ltd	Wuan City, Hebei Province
7	Xinjiang Jinte Iron and Steel Co. Ltd	Bayingol Mongol Autonomous Prefecture, Xinjiang
8	Xinxing Ductile Iron Pipes (Xinjiang) Resources Development Co. Ltd	Urumchi Prefecture, Xinjiang
9	Xinxing Ductile Iron Pipes Xinjiang Co. Ltd	Bayingol Mongol Autonomous Prefecture, Xinjiang
10	Xinxing Huaxin (Hong Kong) Co. Ltd	Hong Kong

Table 5 – Xinxing's regional branch companies

8.2.6 Main raw material inputs

There are 85 different types of raw material used in the company's production processes, the most important of which are silicon iron, incubator, moulding powder, silicon aluminium barium, passivated magnesium powder, silico-manganese, steelmaking iron, zinc ingot, electrolytic manganese, ferrovanadium, ferromolybdenum, zinc wire, industrial pure iron, chromium metal, molybdenum bar, vanadium-nitrogen alloy, ferro-aluminum-manganese, ferromanganese, electrolytic nickel, ferrochromium, plain silicate cement, high sulfate resistant cement, and core making sand.

8.2.7 Main customers

Xinxing's key products are divided into three main types – cast pipes, steel and steel grating plate products. Its sales network covers all of China. The domestic market share of cast pipe products is currently 42.5 %, and these products are sold in more than 90 countries and regions around the world.

8.2.7.1 Main customers for ductile iron pipe products

Customers are segmented into the following five types:

1. Customers characterized by high consumption and strong loyalty to the enterprise. These are the core customers and consist mainly of major municipal water supply and construction engineering companies operating directly for central government, provincial capitals and developed prefectural level cities in China and also overseas agencies with a relatively long history of cooperation.
2. Customers loyal to the enterprise characterized by low consumption. These are mainly dealers and re-sellers in various regions in China.
3. Customers characterized by high consumption but relatively low loyalty to the enterprise. This type of customer often switches between suppliers and tends to use competitive products.
4. Customers characterized by low consumption and a relatively low degree of loyalty to the enterprise, such as electric power, petrochemical, iron and steel, railway, and other industrial and mining enterprises.
5. Finally, there are potential customers, users of pipelines for transmitting solid or slurry in sewage treatment, and for dust removal from power plants and coal mines.

International sales are undertaken by Xinxing's international trade department, which maintains offices overseas and a sales network to support core, priority, routine and new markets, and operate on a near-middle-far three-level market basis.

8.2.7.2 Main customers for steel products

The customer groups for steel products are major companies engaged in real estate and infrastructural construction projects. Sales are channeled through Xinxing Trade Company's steel products department that directly interacts with dealers and re-sellers.

8.2.7.3 Main customers for steel grating plate products

Steel grating plate products are used mainly for municipal engineering, industrial platforms, factory and mining enterprises. Customer groups are centralized in the petroleum, chemical, port and highway construction, railway, municipal engineering, pharmaceutical, iron and steel, real estate, and mining sectors.

8.2.8 Main competitors

At present, Xinxing's main competitors are leading ductile iron pipe companies including Saint-Gobain PAM (France), Kubota Corporation (Japan), the United States Pipe and Foundry Company, the Griffin Pipe Products Company and McWane, Electro-steel Steels Limited (ESL) USA, and Jindal SAW Ltd., India. Each company has its own strengths in specialized equipment and manufacturing technology. Xinxing's core technology is at an advanced international level comparable with these competitors.

8.3 Company attitude towards standardization

All departmental levels at Xinxing attach great importance to standardization work.

8.3.1 Company standards at Xinxing

In addition to using external standards widely, Xinxing has formulated many internal operating rules and standards, including internal management and work procedures. These have been developed by managers according to their own responsibilities to guarantee continuity of the work. Internal working procedures are typically developed by the production departments, including applicable scopes, responsibilities, safety and assessment. To date, some 19 subordinate departments of the company have developed a total of 1630 internal working procedures, and there is no job position without its own operating rules.

8.3.2 Training in standards and standards-related matters

Training is given before implementation of all standards and internal operating rules, to ensure that personnel fully understand and master the requirements, and apply them correctly in their work. Training is self-organized by the respective production departments, or arranged in a unified manner by the training department. Trainees undergo exams after training is completed and further study is arranged for those who have not passed the test.

Apart from internal training, key staff members with different specializations are frequently selected and sent to attend external study and training courses, which has brought new vitality to the company. Every year, the training department holds technical competitions to assess skills in different work situations, and awards certificates and prizes to the winners. These measures encourage employees to learn about, and use standards, and to make big efforts to improve their technical skills.

Implementation of standards is closely monitored by quality administrators and process supervisors in each production department, and employees are expected to self-examine their performance. Management personnel is required to not only ensure that these routine examinations take place, but also to take part in joint audits co-organized by respective departments. The objective is to raise employee awareness of standards, and encourage initiatives in using them. This has accelerated the healthy development of the company's business operations. It should be noted that, in addition to standards, Xinxing has to meet a significant number of regulations issued by different governmental agencies in China.

In the present era of market globalization, enterprise standardization has proven to be of particular importance for the following reasons. Firstly, trade takes place with different countries and customers, and the standards required in many cases differ from customer to customer and country to country. Secondly, since the requirements of different standards are not identical, company managers must design systems to accommodate new and different requirements. Thirdly, in order for an enterprise to maintain its competitiveness, it must continually innovate and upgrade its products, which requires the support of technical standards. As a consequence, the extension and improvement of standardization systems have become important and long-term activities in Xinxing.

8.3.3 Participation in national and international standardization committees

In addition to using standards, Xinxing also participates in the development of ISO International Standards as well as those of Chinese National and Industry Standards.

8.3.4 Use of standards at Xinxing

Xinxing uses many internal and external standards. The most important external standards can be classified as shown in **Table 6** :

Type of standard	Status	Number of standards used
Product standards	compulsory	38
	voluntary	345
Process standards	compulsory	36
	voluntary	298
Health, safety and environmental (HSE) standards	compulsory	50
	voluntary	48
Total :	Compulsory standards : 124 Voluntary standards : 691	815

Table 6 – Types of external standards used at Xinxing

As a consequence of new technologies and other factors, Xinxing products are subject to regular upgrades and shorter and shorter life cycles. In response to shifts in market demands, technical developments in China and abroad, and competitive pressures, Xinxing always uses the latest editions of standards. New standards or new editions of existing standards are implemented as soon as they have been published to ensure they are up-to-date, meet customer demands and are mutually consistent. Consequently, products with specific advantages that satisfy customers and boost Xinxing's competitiveness can be delivered to the market.

In addition to standards there are also 22 technical regulations that are important to Xinxing's activities (a detailed list is given in the **Annex**).

8.3.5 System and product certification

Xinxing has eight certifications issued by international agencies as listed below:

8.3.5.1 Certification of management systems

- In October 1995, Xinxing obtained quality management system (QMS) certification from the China Quality Mark Certification Group (CQM). In July 2003, the company changed its certification service provider to Lloyd's Registered Quality Assurance Ltd, UK, and was awarded ISO 9001 QMS certification in August 2009
- In November 2000, the company first received ISO 14001 environmental management system (EMS) certification from the Huaxia Environmental Audit Center under the State Environmental Protection Administration, and was awarded Royal UKAS QMS certification. In June 2010, it obtained ISO 14001 EMS certification from Beijing Grand Honour Management System Certification Co. Ltd
- In August 2004, Xinxing gained occupational health and safety management (OHSAS) system certification from the Safety Scientific Research Certification Center, State Administration of Work Safety for the first time. In June 2010, it attained GB/T 28000 OHSAS certification from Beijing Grand Honour Management System Certification Co., Ltd
- In December 1998, its metrological management was audited by the State Bureau of Quality and Technical Supervision, and was awarded the Certificate of Competency for the Gauging and Inspection Improvement System. In May 2009, Xinxing gained the GB/T 19022 Measurement Management System Certification by the Zhongqi Measuring System Certification Center

8.3.5.2 Certification of products

- ISO 2531, ISO 7186, ISO 4179, ISO 8179-1, ISO 8179-2, EN 545, EN 598, EN 15189, EN 15655, ABNT NBR 7675 ductile iron pipe and pipe fitting product standard certifications were awarded for the first time by Bureau Veritas (Italy) and Bureau Veritas (China) in November 1999, and renewed in July 2009
- Korean KS Product Certification for ductile iron pipe and pipe fitting products was awarded for the first time in July 2003, and again in October 2009
- Australian AS/NZS 2280 product certification for ductile iron pipe and pipe fittings was awarded In March 2009
- Flat steel S 235JR and S 275JR, and round steel S 235JRUK products were accredited in May 2007 and May 2010 by Lloyd's CE Certification, UK

8.4 Value Chain Analysis

8.4.1 Industry value chain

The iron and steel sector, one of the most important raw material industries in China, is engaged in the mining, smelting, refining and processing of ferrous metals. Other production activities include mining and smelting of iron, chrome, and manganese, iron and steel making, steel processing, ferroalloy refining, and steel wire manufacture.

Iron and steel production also involves non-metal minerals mining, smelting of coking and refractory materials, and carbon products. These industrial sectors are generally classified within the scope of the iron and steel industry. The value chain is typical of a manufacturing industry, from smelting of iron ore to sales of iron and steel products as shown in **Figure 1.**

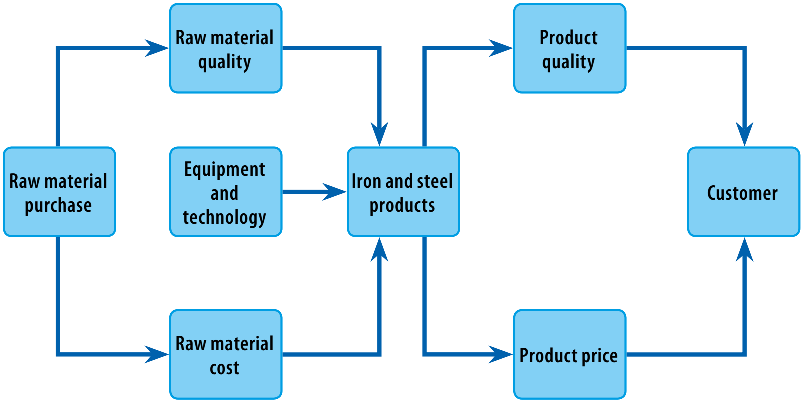

Figure 1 – Value chain of the iron and steel industry

Quality and price are the two key criteria that influence the selection of iron and steel products by customers. The first is mainly determined by the refining equipment, the applied technologies and the quality of iron ore as the chief raw material. The price of iron and steel products depends mainly on the cost of iron ore and other raw materials.

In order to maintain its competitiveness in the market for iron and steel products, to retain existing customers and win new ones, an enterprise must be able to offer products at an advantageous price and of high quality.

8.4.1.1 Iron ore

The most important element in the iron and steel industry value chain is iron ore. The price of iron ore determines to a large extent the price of the final iron and steel products, while its quality directly affects finished product quality.

The quality of iron ore itself depends on the following three factors:

1. The total iron content
2. The content of contaminants in iron ore
3. The content of harmful elements in iron ore

1. Total iron content

The total iron content for high quality iron ore must be at least 60 %. Iron ore can be divided into lump ore and ore fines. According to the future Chinese National Standard *Classification of Iron Ore Grades*, which is currently in draft stage, the total iron content can be divided into five grades, as shown in **Table 7.**

Brand	Grade	Chemical composition (in %)						
		TFe	Si02	Al20	P	S	Moisture content	Particle size
				3				
KKI	1	≥64.0	≤4.0	≤1.5	≤0.0 6	≤0.0 3		
KKII	2	62.0 ~ < 64.0	≤5.0	≤2.0	≤0.0 7	≤0.0 5		
KKIII	3	60.0 ~ < 62.0	≤7.0	≤2.5	≤0.0 8	≤0.0 7	≤4.0	−6.3 mm : ≤5.0, +31.5 mm : ≤10.0
KKIV	4	58.0 ~ < 60.0	≤7.5	≤3.5	≤0.1 0	≤0.0 9		
KKV	5	48.0 ~ < 58.0	≤15 0	≤4.0	≤0.1 3	≤0.1 1		
Note : Moisture indicator is for reference								

Table 7 – Classification of lump ore grades

Chinese National Standards for testing total iron content include :

- GB/T 6730.5 – 2007, *Iron Ores – Determination of Total Iron Content – Titanium (III) Chloride Reduction Methods*
- GB/T 6730.65 – 2009, *Iron ores – Determination of Total Iron Content – Titanium (III) Chloride Reduction Potassium Dichromate Titration Methods (Routine Methods)*
- GB/T 6730.66 – 2009, *Iron Ores – Determination of Total Iron Content – Automatic Potentiometric Titration Methods*

2. Content of contaminants in iron ore

The more contaminants the iron ore contains, the more additives will be required to treat these contaminants, resulting in higher costs. The main contaminants in iron ore are silicon (SiO_2) and aluminium (AL_2O_3). There are various Chinese standards used to test the content of silicon and aluminium.

3. Content of harmful elements in iron ore

Harmful elements in iron ore will affect the quality of iron and steel products, such as an increase in brittleness of steel, reducing its weld-ability, flexibility and corrosion resistance, and can also increase environmental pollution. The main harmful elements are phosphorus, sulphur, and arsenic.

There are various Chinese standards for testing phosphorous, sulphur and arsenic content as well as for testing moisture and particle size of iron ore.

8.4.1.2 Equipment and core technologies

At the end of the 20th century, significant funds were granted by the Chinese government, to help iron and steel enterprises undertake large-scale retrofits and upgrades of old equipment that typically consumed high levels of energy and emitted serious pollution. Such equipment was basically replaced with modern equipment of an advanced international level.

However, an important task in the early stage in the refining process was to control energy consumption to reduce cost, and increase the economic performance of the enterprise. The standards for this purpose include *Limitation for Electricity Consumption for Steel Refining of Electric Furnaces* (Draft for Approval), YB/T 4209 – 2010, Regenerative Combustion Technical Specification of the Iron and Steel Industry, Sintering and Cooling System Waste Heat Recycling Technical Specification (Draft for Approval), and *Coke Dry Quenching Energy Conservation Technical Specification* (Draft for Approval). Another important task in the refining process was environmental protection.

In recent years, enterprises have improved their environmental performance. New standards that correspond to current requirements for environmental protection are being published, as well as standards such as *Assessment of Clean Product Levels of Coking Enterprises* (exists currently as a draft), and *Assessment of Clean Production Levels of Iron and Steel Enterprises* (also in draft stage).

China is a big iron and steel-producing country with an annual output exceeding 600 million tons. At present, demand for low-end iron and steel products has fallen and supply exceeds demand, resulting in a serious overstock situation in some companies. At the same time there is an undersupply of high-end iron and steel products. It has been estimated that the yield for high-end products is three times that of low-end products, with each 1 % increase in market share of high-end iron and steel products resulting in an increase in a company's profit margin of CNY 1.5 billion. The key to the production of high-end iron and steel is access to core technologies and availability of quality iron ores.

In the structural economic adjustment currently taking place in China, industries with high energy consumption like iron and steel do not receive special support from the government, and, as a consequence, its future perspectives are not very promising. The challenge faced by Chinese iron and steel enterprises is how to increase the variety of their products and the market share of high-end products, so that they can tap into a beneficial cycle of demand-driven development.

8.4.1.3 Iron and steel products

In the iron and steel industry, high-end products manufactured by Chinese companies with independent core technologies include steel plates for the nuclear power industry, high-speed railways, urban mass transit, and high-end cars, and steel pipes for boilers, the aerospace industry and the military.

Some recently developed national standards have played a leading role in creating such a market. These standards, some of which exist currently only as draft standards, are: *Seamless Steel Pipe for High-Pressure Boilers, Seamless Steel Pipe for Low-and-Medium-Pressure Boilers, Seamless Steel Pipe for Nuclear Power Stations*; GB 3531 – 2008, *Low Alloy Steel Plate for Low Temperature Pressure Vessels*; GB 24511 – 2009, *Stainless Steel Plate, Sheet, and Strip for Pressure Equipment, Steel Plate and Strip for Welding Gas Cylinders, Seamless Steel Pipe for Gas Cylinders*; GB 19189 – 2011, *Quenched and Tempered High Strength Steel Plate for Pressure Vessels, Composite Seamless Steel Pipe for Gas Cylinders*; GB 2585 – 2007, *Hot-Rolled Steel Rails for Railways, and Hot-Rolled H-Shaped Steel for Overhead Contact Line Poles for Electrified Railways*.

Several high-priority standards for high-strength sheet steel for cars have been developed to promote innovation and extend advanced production capabilities, to guide and standardize the application of Chinese high-strength sheet steel, and to achieve domestically produced top-class automotive steel sheet. These include standards for component testing methods for *High-Strength Cold Continuous Rolling Steel Plates and Strips for Automobiles* – Part 1: *Bake-Hardening Steel, etc., and Steel – Method for Determination of Bake-Hardening Value (BH2), Welding Steel Pipe for Automobile Transmission Axles* (Draft for Approval), *High-Performance Shaped Seamless Steel Pipe for Automobile Axles*. Additionally, the publication of national standards for steel pipes in nuclear power applications has also brought new economic growth to iron and steel enterprises.

8.4.2 Enterprise value chain

Xinxing is a large enterprise positioned in the downstream segment of the iron and steel industry value chain. The company's value chain, based on the model originally developed by Michael Porter of Harvard Business School, is shown in **Table 8.**

Management & administration				
Research & development				
Engineering				
Procurement : including procurement of raw materials, fuels, and charges				
Inbound logistics	Production/ operation : iron making, steel	Outbound logistics	Marketing & sales	After-sales service
Train and truck transport	Making steel, steel rolling, and pipe casting	Train and automobile transport	Sales of cast and steel pipe and steel grating plate products	

Table 8 – Enterprise value chain of Xinxing

Xinxing uses 85 different types of raw material and fuel. According to the different transport methods, in- and outbound logistics are divided into two categories – train transportation and truck transportation. The transport department takes charge of train transport. Suppliers are generally responsible for delivering supplies if transported by trucks.

Outbound logistics using trucks is generally outsourced to transport service providers. Xinxing's production business function involves iron and steel making, steel rolling, and pipe casting. Its main products include three types of cast pipes, steel products, and steel grating plates.

Xinxing's profits in recent years have grown steadily, making it one of the more profitable enterprises in the industry. In the company value chain, the production business function is central to generating good economic results. While some Xinxing products are high-end and have therefore shown rapid development in recent years, its main products are facing fierce competition in the market.

8.4.3 Key value drivers

Since the second half of 2008, the company began to reform its internal management by establishing different departments as autonomous cost centres and legal entities, and by implementing close and efficient linkages between production, supply, marketing, transportation, and application. All of Xinxing's activities are focused on optimizing profits, and all processes have been improved in terms of cost control, working procedures and efficiency.

Xinxing has explored profit growth opportunities in procurement and production operations, as well as marketing and sales. Competitiveness in these functions has increased through innovation and changes in management approaches, and on the basis of accurate judgments and predictions of market trends. The result has been higher responsiveness to market demands, and improvements in internal management.

8.4.3.1 Procurement

In March 2009, Xinxing decided to flatten the organizational structure of the procurement department in order to adapt to market changes and requirements, and improve its responsiveness.

Based on implementation of the system of " authorized tendering and parity-rate purchasing ", Xinxing made the procurement department the centre for all procurement activities by establishing four departments and one office, and by further clarifying the scope of responsibility of the purchasing manager under the leadership of the department director. A group for purchasing raw materials and another for purchasing fuels was established. They meet almost every day to study market trends and adjust the structure of crude fuels and charges for the respective production departments. In the new structure, the production departments are responsible for implementing production processes, while groups in the procurement centre are responsible for the purchase of crude fuels.

8.4.3.2 Production/operation

In recent years, the focus of the production departments has shifted from meeting certain predefined economic indicators, to pursuing maximum profit. Market demand became the key driver, profit improvement the main objective, and attention to cost reduction – on the basis of autonomous cost centres – the main approach in the organization.

Procurement is not the only department responsive to changes in the raw materials market, the production departments also closely monitor the market and adjust their stocks and optimize raw materials on the basis of changes in prices. By broadening the types of raw materials and thereby reducing dependence on any single material, Xinxing was able to reduce its exposure to some market risks.

On the other hand, the production departments have paid special attention to increasing the proportion of high value-added products in Xinxing's product portfolio, thus ensuring stable manufacturing of the required quantity and quality of products.

Processes have been continuously improved and innovated, thus reducing overall manufacturing costs and iron and steel consumption per ton of output.

8.4.3.3 Marketing and sales

The sales departments in Xinxing have applied the vision of " Sales Volume, Price, Market Share and Capital Recovery as an organic whole ". This approach has contributed to a good balance between sales volume and profits. Through vigorous measures aimed at consolidating capital recovery and changes in its trading models, the quality of Xinxing's operations has improved. These departments continue to attach high importance to reinforcing Xinxing's position in conventional markets by stabilizing prices under normal sales conditions and volume, and by consolidating the company's leading status in the conventional domestic water supply and drainage market.

However, Xinxing has also taken an active part in opening up new markets, developing sales channels for special steel pipes, and successfully implementing preparatory measures to secure market access. As an example of its presence in new markets, X52/952 bimetal nickel-based alloy composite pipes and 2205 dual phase stainless steel tube have been successfully used in oil and gas fields.

8.5 Scope of the pilot project assessment

The scope of this project covers Xinxing operations in the Wuan Industrial Zone, and involves the production of case pipes and steel products. The impact of standards assessed cover the whole company value chain and comprise the seven business functions of management and administration, research and development, engineering, procurement, production/operation, marketing and sales, and after-sales service, represented by 16 organizational departments and groups in the company. The relationship between the business functions and the relevant organizational entities in Xinxing are shown in **Table 9.**

Business functions	Organizational entity in Xinxing
Management & administration	Quality supervision department
	Safety and environmental protection department
Research & development	Xinxing Hebei Engineering Technology Co., Ltd
	Research institute
Engineering	Engineering management department
Procurement (incl. inbound logistics)	Procurement department
Production/operations	Hebei Xinxing Ductile Iron Pipes Co., Ltd
	Second pipe casting department
	Third pipe casting department
	Steel making department
	Steel rolling department
	Pelletizing department
	First iron making department
	Second iron making department
Marketing & sales (incl. outbound logistics)	Trading company
After-sales service	Quality supervision department

Table 9 – Organizational entities assessed

8.6 Implementation of standards in the company

The standards with the most impact on the seven business functions under assessment are listed in **Table 10** below.

Business functions	Key standards used in the business functions
Management and administration	ISO 9001:2008, *Quality management systems – Requirements* ISO 14001:2004, *Environmental management systems – Requirements with guidance for use* GB/T 28001 – 2001, *Occupational Health and Safety Management Systems – Specification* GB/T 13234 – 2009, *Calculating Methods of Energy Saved for Enterprise* GB/T 15316 – 2009, *General Principles for Monitoring and Testing of Energy Saving* GB/T 2589 – 2008, *General Principles for Calculation of the Comprehensive Energy Consumption* GB/T 8222 – 2008, *The Principles for Electricity Balance of Equipment* GB 1499.1 – 2008, *Steel for the Reinforcement of Concrete – Part 1 : Hot-rolled Plain Bars* GB 1499.2 – 2007/XG1 – 2009, *Steel for the Reinforcement of Concrete – Part 2 : Hot-rolled Ribbed Bars No. 1 Amendment*
Research and development	API Specification 5LD Third edition, March 2009, *Specification for CRA Clad or Lined Steel Pipe* BS EN 545:2010, *Ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods* GB 50011 – 2010, *Code for Seismic Design of Buildings* GB 50013 – 2006, *Code for Design of Outdoor Water Supply Engineering* GB 50014 – 2006, *Code for Design of Outdoor Waste water Engineering* GB 50016 – 2006, *Code of Design on Building Fire Protection and Prevention* GB 50019 – 2003, *Code for Design of Heating Ventilation and Air Conditioning* GB 50427 – 2008, *Code for Design of Blast Furnace Iron-making Technology* GB 50491 – 2009, *Code for Design of Iron Pellet Engineering* GB 6222 – 2005, *Safety Code for Gas of Industrial Enterprises* GB/T 13295 – 2008, *Ductile Iron pipes, Fittings and Accessories for Water or Gas applications*

Business functions	Key standards used in the business functions
Research and development	GB/T 50103 – 2010, *Standard for General Layout Drawings* ISO 2531:2009, *Ductile iron pipes, fittings, accessories and their joints for water applications* All design standards and specifications (techniques, civil work, electric automation, instruments, water supply and drainage, heat ventilation, environmental protection and hydraulic pressure, etc.)
Engineering	GB 50496 – 2009, *Code for Construction of Mass Concrete* GB 50231 – 2009, *General Code for Construction and Acceptance of Mechanical Equipment Installation Engineering* GB 50303 – 2002, *Code for Acceptance of Construction Quality of Electrical Installation in Building* GB 50235 – 2010, *Code for Construction of Industrial Metallic Piping Engineering* GB 50300 – 2001, *Unified Standard for Constructional Quality Acceptance of Building Engineering*
Procurement	GB 12706.3 – 2008, *Power Cables with Extruded Insulation and their Accessories for Rated Voltages from 1kV(Um=1.2kV) up to 35kV (Um=40.5kV)* – Part 3 : *Cables for Rated Voltage of 35kV(Um=40.5kV)* GB 17930 – 2011, *Gasoline for motor vehicles* GB 252 – 2011, *Common Diesel Oil* GB/T 1996 – 2003, *Coke for Metallurgy* GB/T 2272 – 2009, *Ferrosilicon* GB/T 272 – 1993, *Rolling Bearing – Identification Code* GB/T 3649 – 2008, *Ferromolybdenum* GB/T 6516 – 2010, *Electrolytic Nickel* GB/T 7737 – 2007, *Ferroniobium* JB/T 3715 – 2006, *Bonded Abrasive Products – Depressed Centre Grinding Wheel* YB/T 5296 – 2006, *Pig Iron for Steelmaking*

Business functions	Key standards used in the business functions
Production/operations	BS EN 545:2010, *Ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods*
	BS EN 598:2007+A1:2009, *Ductile iron pipes, fittings, accessories and their joints for sewerage applications – Requirements and test methods*
	GB 12706.3 – 2008, *Power Cables with Extruded Insulation and their Accessories for Rated Voltages from 1kV (Um=1.2kV) up to 35kV (Um=40.5kV)* – Part 3 : *Cables for Rated Voltage of 35kV (Um=40.5kV)*
	GB 1499.1 – 2008, *Steel for the Reinforcement of Concrete* – Part 1 : *Hot-rolled Plain Bars*
	GB 1499.2 – 2007/XG1 – 2009, *Steel for the Reinforcement of Concrete* – Part 2 : *Hot-rolled Ribbed Bars No. 1 Amendment*
	GB 16917.1 – 2003/XG1 – 2010, *Residual current operated circuit-breakers with integral over current protection for household and similar uses (RCBO)* – Part 1 : *General rules No. 1 Amendment*
	GB/T 10044 – 2006, *Welding Electrodes and Rods for Cast Iron*
	GB/T 13295 – 2008, *Ductile Iron pipes, Fittings and Accessories for Water or Gas Applications*
	GB/T 13927 – 2008, *Industrial Valves – Pressure Testing*
	GB/T 14048.12 – 2006, *Low-voltage Switchgear and Controlgear* – Part 4-3 : *Contactors and Motor Starters – AC Semiconductor Controllers and Contactors for Non-motor Loads*
	GB/T 1412 – 2005, *Pig Iron Used for Spheroidal Graphite Cast Iron*
	GB/T 14405 – 2011, *General Bridge Crane*
	GB/T 1504 – 2008, *Cast Iron Rolls*
	GB/T 1996 – 2003, *Coke for Metallurgy*
	GB/T 2101 – 2008, *General requirement of Acceptance, Packaging, Marking and Certification for Section Steel*
	GB/T 222 – 2006, *Permissible Tolerances for Chemical Composition of Steel Products*
	GB/T 2272 – 2009, *Ferrosilicon*
	GB/T 25715 – 2010, *Sphere Nodular Cast Pipe Mould*

Business functions	Key standards used in the business functions
Production/operations	GB/T 271 – 2008, *Rolling Bearings – Classification*
	GB/T 272 – 1993, *Rolling Bearing – Identification Code*
	GB/T 4008 – 2008, *Ferromanganese-Silicon*
	GB/T 5751 – 2009, *Chinese Classification of Coals*
	GB/T 70.1 – 2008, *Hexagon Socket Head Cap Screws*
	GB/T 700 – 2006, *Carbon Structural Steels*
	GB/T 7737 – 2007, *Ferroniobium*
	GB/T 984 – 2001, *Hardfacing Electrodes for Shielded Metal Arc Welding*
	ISO 2531:2009, *Ductile iron pipes, fittings, accessories and their joints for water applications*
	ISO 262:1998, *ISO general purpose metric screw threads – Selected sizes for screws, bolts and nuts*
	JB/T 10105 – 1999, *YZR Range of Three-phase Slip-ring Rotor Induction Motors for Crane and Metallurgical Applications – Technical Specifications*
	JB/T 10391 – 2008, *Specification for Y series (IP44) Three-phase Asynchronous Motor (Frame Size 80 to 355)*
	JB/T 10563 – 2006, *Technical Specification for General-purpose Centrifugal Fans*
	JB/T 1700 – 2008, *Components of Valves – Nuts, Bolts and Plugs*
	JB/T 8853 – 2001, *Reduction Cylindrical Gear Units*
	YB/T 2011 – 2004, *Continuous Casting Square and Rectangular Blank*
	YB/T 319 – 2005, *Metallurgical Manganese Ore*
	YB/T 421 – 2005, *Iron and Sintering Ore*
	YB/T 5268 – 2007, *Silica*
	YB/T 5296 – 2006, *Pig Iron for Steelmaking*
	YB/T 2011 – 2004, *Continuous Casting Square and Rectangular Blank*

Business functions	Key standards used in the business functions
Marketing and sales	AS/NZS 2280:2004, *Ductile iron pipes and fittings*
	KSD 4311:2004, *Ductile iron pipes*
	BS EN 545:2010, *Ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods*
	BS EN 598:2007+A1:2009, *Ductile iron pipes, fittings, accessories and their joints for sewerage applications – Requirements and test methods*
	ISO 2531:2009, *Ductile iron pipes, fittings, accessories and their joints for water applications*
	GB/T 13295 – 2008, *Ductile Iron pipes, Fittings and Accessories for Water or Gas Applications*
	ISO 9001:2008, *Quality management systems – Requirements*
	ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*
	GB/T 28001 – 2001, *Occupational Health and Safety Management Systems – Specification*
After-sales service	ISO 9001:2008, *Quality management systems – Requirements*

Table 10 – Key standards used in the different business functions

8.7 Selection of operational indicators to measure the impact of standards

The key operational indicators to measure the impact of standards used in each business function are given in **Table 11** below:

Business function	No.	Operational indicators
Management & administration	1.	Possibility of obtaining production permission certificates for the production and sales of reinforcing steel bars. Without production permission certificates, production and sales are not permitted.
	2.	Reduction in energy consumption and costs, energy savings, avoidance of administrative fines imposed by government agencies.
	3.	Through the environmental protection management system, the company can ensure that smoke and dust emissions, noise, and wastewater discharge do not exceed the maximum limits, and thus avoid administrative fines from local governments for illegal transfer of hazardous wastes in accordance with relevant laws and regulations.
	4.	1. Through the OHSAS system, hazard control accounts are systemically prepared and hazards are prevented more scientifically ; emergency plans are formulated to limit personal injury and equipment loss from accidents wherever possible ; the death rate from occupational diseases and accidents can be reduced, and administrative fines due to nonconformity with state policy can be avoided. 2. Establishing files to record the occupational health of workers, organizing regular physical examinations, and application of relevant labour protection regulations can lead to fewer occupational hazards.
Research & development	5.	Improvement of design efficiency, and reduction of design faults and costs.
	6.	Greater efficiency of product research and reduction in research projects. The objective is that, through the implementation of standards, it should be possible to choose a typical specification from the group of same types and conduct fewer research programmes.
	7.	Reduction of risk in material selection for bi-metal composite pipes. Standardized material selection processes can enhance efficiency and shorten research and development time.
Engineering	8.	Reduction in construction costs and investment, simplified organization of procurement and public tenders for equipment and spare parts, and more efficient organization of construction and acceptance checks resulting from the use of relevant standards.

Business function	No.	Operational indicators
Procurement	9.	With standardized documents and specifications procurement personnel can share information more efficiently and reach agreements more quickly.
	10.	Reduction in procurement costs of raw materials including common diesel oil, automotive gasoline and metallurgical coke.
	11.	Reduced cost of procuring furnace materials.
	12.	Reduced cost of procuring equipment .
Production/ operations	13.	Reduction in mould repair costs : Standardized production may reduce the number of mould cycles required for non-standardized products, thus further reducing mould maintenance costs.
	14.	Reduce investment in, and cost of, moulds (including repair and maintenance) : Standardized production reduces the manufacture of non-standardized products and inputs in moulds, and also shortens process downtime and enhances effective operating uptime : Fewer production specifications also shorten downtime caused by modifying specifications, thus enhancing effective uptime, creating economic benefit and reducing loss caused by waste products. Fewer product specifications and modifications reduces the quantity of product rejects, thus creating economic benefit.
	15.	Reduce investment in moulds and costs : Standardized production can reduce the number of non-standardized products and inputs in moulds and can also shorten remodeling time : pipe off-specification variations are likely to increase without relevant standards ; reduction in loss caused by waste products, reduction in product specifications can reduce the quantity of technical waste products.
	16.	Implementing standards broadens the versatility of equipment parts, increases replaceability, and also establishes requirements for checking the acceptance of related parts, thus greatly reducing part costs.
	17.	Standardization of steel varieties and the external quality of casting blanks enables continuous casting production to be standardized. The entire converter steelmaking process is programmed via software, including lance position, charging time and quantity, etc., to further standardize process handling. The level of quality conformity achieved for steel water and blank has increased in recent years while waste products have decreased as a result of more efficient quality management.
	18.	The steel rolling department prefers to purchase top-quality standardized equipment and spare parts, thus strengthening interchangeability and compatibility, and greatly reducing equipment failure rate and maintenance costs.

<table>
<tr><th>Business function</th><th>No.</th><th>Operational indicators</th></tr>
<tr><td rowspan="5">Production/ operations</td><td>19.</td><td>Standardization of steel types and the quality of continuous casting blanks also enables standardization in steel production processes, including material procurement, batch numbering, heating, charging, tapping, roller wiring, on-site roller guide installation, pre-installation of standby roller guides, roll collar acceptance checks, steel shearing, selection, packaging, weighing, binding and storage (in accordance with GB/T 19001:2008). The rate of quality conformity achieved for steel water and blank in recent years has increased while waste products have decreased due to more efficient quality management.</td></tr>
<tr><td>20.</td><td>1. Lower equipment failure rate : Before the production process was standardized, product quality was often deficient and differed from the design and assembly specifications of other manufacturers. However, the failure rate has been dramatically reduced as a consequence of the standardization of the whole process of equipment from design, to procurement to installation.
2. Shorter maintenance time : In addition to the maintenance advantages of standardized tool components, standardized processes can help maintenance engineers replace parts more easily. In comparison, non-standard pieces usually require extra handling.
3. Reduce inventory of spare parts and capital needs : Standardization has greatly reduced the number of spare parts. Economic benefits have been achieved as a result of standardized components such as blowers, speed reducers, electric fans, carrier rollers and pressure gauges.</td></tr>
<tr><td>21.</td><td>Simpler, more efficient and economic operation and maintenance of equipment : The first iron-making department prefers to choose standardized equipment, spare parts and key materials, resulting in greater interchangeability and compatibility ; the introduction of competitive and goods-comparable systems can greatly reduce the inventory of spare parts and materials, and enhance their quality ; the lower costs of spare parts and materials, fewer failures and shorter maintenance time has resulted in reduced equipment operating costs.</td></tr>
<tr><td>22.</td><td>Adoption of standards for products, raw fuels and quality control has simplified the production and quality control process, making it more orderly, economical and efficient. The economic benefits of steelmaking have been increased by optimizing the structure of sintered material charging and blast furnace materials, and by using relevant adjustments and controls.</td></tr>
<tr><td>23.</td><td>The preference of the second iron-making department in choosing standardized equipment has enhanced interchangeability and compatibility, and greatly reduced equipment failure rates and maintenance costs.</td></tr>
</table>

Business function	No.	Operational indicators
Production/ operations	24.	Standardization has simplified production and quality management, reduced the number of quality and operational incidents and disputes, and lowered production costs. Simplified management has also reduced management costs
Marketing & sales	25.	By implementing in parallel standards of different regions, it is possible to open up the markets in which these standards are used and increase thereby sales volumes and achieve higher profits.
	26.	By implementing standards, it is possible to reduce negotiating time and thereby achieve greater efficiency in business negotiations.
	27.	Overseas pipeline product customers require conformity to certain standards. Special client groups and key project customers in China, accounting for 10 % of domestic sales volume, only accept products after the relevant quality and environmental protection certificates have been obtained.
After-sales service	28.	1. QMS implementation helps improve production, distribution and service quality and reduce external quality losses. 2. QMS implementation can improve the effectiveness of supervision and control in checking and accepting materials, and reduces internal losses by 10 %.

Table 11 – Operational indicators selected to quantify the impact of standards

8.8 Calculating the economic benefits of standards

Following are the aggregated impacts as shown in **Table 12** resulting from the use of the standards applied to the seven business functions in the value chain on the basis of the operational indicators defined in section 7. The principle followed in the calculation is that the impacts of the standards on each indicator are estimated as a percentage reduction in the costs of the respective activity or an increase in revenues resulting from the use of standards. Finally all of these financial impacts are summed up to arrive at the aggregated impact for the selected business functions and the whole company in the scope of the assessment.

As one example for the calculation, the standards used in procurement resulted in a general increase in the efficiency of procurement, less personnel and shorter procurement times in purchasing crude fuels, equipment and charging materials for the furnace which at an annual level contributed to savings of over 9 million CNY.

Business functions (in the value chain)	Impacts (in CNY)	% contribution
Management & administration	3 260 000	4.8 %
Research & development	5 850 000	8.61 %
Engineering	6 798 400	10 %
Procurement (incl. inbound logistics)	9 110 900	13.4 %
Production/operation	21 859 300	32.16 %
Marketing & sales (incl. outbound logistics)	19 103 100	28.10 %
After-sales service	1 991 500	2.93 %
Total	**67 973 200**	**100 %**

Table 12 – Contribution of standards to the selected business functions

As shown in **Table 12**, the total impact of standards in the scope of the assessment is nearly **CNY 68 million**, (approximately USD 10 772 700 based on May 2012 exchange rates). The contribution of standards as a percentage of the annual sales revenue of Xinxing in 2010 is 6797.32 / 10 06343.8 = **0.67 %**, while the **percentage of the EBIT is close to 14 %** (6797.32 / 48829.22 = **13.92 %**).

8.9 Evaluation of the results

8.9.1 Economic benefits of standards for Xinxing

From the seven business functions assessed, it was found that the greatest economic benefits of standards could be achieved in production. Xinxing applies the latest international, Chinese national and

Chinese industry standards in a very timely manner, with the result that production and quality control processes can be simplified and organized in an orderly, economical, and highly effective way. This has resulted in reduced moulding costs, increased machine operating uptime, less equipment downtime and fewer defective products.

Another business function that gains from standards is marketing and sales. Standards have assisted the company in opening up new markets, in reducing negotiation time and in increasing sales volumes and profits. Compared with the business functions of production/operation and marketing and sales, the contribution of external standards to other business functions, such as after-sales services, is much less. Therefore, Xinxing may consider increasing the use of standards in those other functions with the objective of further improving the quality and effectiveness of these services.

8.9.2 Principles observed in the assessment process

This project has received strong support from all levels of Xinxing management. The scope of the assessment was agreed following comprehensive and objective analysis, and frequent consultations at management and departmental level. Consequently, the impact of external standards on the company have been assessed in a comprehensive and balanced manner based on evidence. The results reflect the economic contributions of standards to the selected business functions in the value chain.

8.10 Conclusions

8.10.1 Standardization is a pillar in enhancing enterprise competitiveness

Any enterprise operating in today's globalized business environment should implement standards since they can have a positive impact on products and technologies. Following rapid economic development and scientific and technical progress, productivity in China's industries has increased significantly. Many enterprises have engaged in technical upgrades as well as mergers and reorganizations. Through participation in standardization they can engage in global competition, and upgrade the level of company standardization through technical innovation. Companies should extend standardization through system certification, and use it as the basis for developing new products related more closely to research, and also to tie the introduction of new technical equipment more closely to retrofitting existing equipment.

Chinese enterprises have many competitive advantages in manufacturing, in marketing, in research and development, in the availability of trained human resources and in some aspects of standardization. There are also significant opportunities for industrial upgrades and structural adjustments. As long as new ideas can be absorbed, guided and supported by the government, and stimulated by their own initiatives, there is no doubt that Chinese enterprises can advance their role as the key force contributing to the work of standardization in China.

8.10.2 The assessment of the economic benefits of standards can spur further company standardization

The ISO methodology for assessing the economic benefits of standards has been applied in case studies in China, and the results have been compared with those in other countries under different economic and social environments. The objective is to study approaches and methods to further enhance the economic benefits of standards, and to provide recommendations for formulating relevant policies. The successful application of this assessment method has contributed to a better understanding of the benefits for various stakeholders, and has enhanced the awareness of the importance of standards for enterprise managers and technical staff. Objective and scientific data has been gathered, and conclusions reached, which have the potential to further stimulate the initiative of enterprise managers towards standardization work, and to leverage standardization as a means to increase company competitiveness.

8.10.3 Recommendations towards further improvement of the assessment method

By using the ISO methodology, Xinxing has been able to identify the economic contributions of standards for selected business functions in the company value chain through an evidence-based approach, which is also conducive to the effective allocation of resources inside the company. However, there are still aspects of the assessment method that can be improved.

The concept of the " value chain " constitutes the basic framework of the ISO methodology. However, the biggest challenge in using this method is to differentiate the influences resulting from the implementation of standards from the influence of other factors. Such a differentiation requires that one develops a certain familiarity with the operations of the chosen company, at least for those activities that are within the chosen scope of the assessment.

In order to obtain original data for the assessment that reflect multiple perspectives, it is also necessary to relate the data from interviews with individuals responsible for different operations in the company to corresponding information representing the whole industry, or from studies about similar companies, in order to compare the findings.

Since the standards management system in China is based on a combination of compulsory and voluntary standards, it is necessary to consider the economic benefits of these standards to the enterprise, even though some of them are compulsory (which is not in line with some statements in the ISO methodology which suggest that mandatory standards should not be included in the assessment).

Although company-internal standards are not considered in the assessment methodology, those that contain technical indicators which are higher than external standards (international standards, Chinese national standards, industry-branch standards, and other standards) cannot be omitted from the assessment.

It is necessary to further refine the assessment indicators in the methodology applying to the specific characteristics of companies from different countries, to ensure that they are operable, and to reduce possible overlaps between or repetition of indicators.

8.10.4 Assessment of the economic and social benefits of standards

The impact of standards on socio-economic development is not only reflected in measurable economic indicators, but also in aspects such as environmental protection and human health that cannot be quantified easily. Therefore, a comprehensive study of the economic and social benefits of standards is required, in order to scientifically and objectively assess the functions of standards for national economic and social development, to provide a foundation for decision-making by government agencies at all levels, to guide the development of standardization strategies for industry sectors, and to further enhance initiatives that encourage enterprises to become involved in standardization.

Annex : Technical regulations relevant for Xinxing

No.	Title of regulations
1	Product Quality Law of the People's Republic of China
2	Standardization Law of the People's Republic of China
3	Metrology Law of the People's Republic of China
4	Criminal Law of the People's Republic of China
5	Law of the People's Republic of China for Countering Unfair Competition
6	Law of the PRC on the Protection of the Rights and Interests of Consumers
7	Administration Regulation for Production License for Industrial Products
8	Provisions on Labeling of Product Identification
9	Economic Contract Law
10	Provisions on Administrative Penalty for the Safety Supervision of Boilers, Pressure Vessels, Pressure Pipes and Special Equipment
11	Provisions on Administration and Safety Supervision of Pressure Pipelines
12	Provisions on Accident Management of Boilers, Pressure Vessels, Pressure Pipeline and Special Equipment
13	Qualification and Supervision Management Rules for the NDT Testing Personnel of the Special Equipment
14	Examination, Management Rules and Explanations for Welding Operators of Boilers, Pressure Vessels and Pressure Pipelines
15	Special Equipment Safety Surveillance Regulations
16	TSG Z0004 – 2007, *Basic Requirements for Special Equipment Quality Assurance System on Manufacture, Installation, Alteration and Repair*
17	TSG Z0005 – 2007, *Appraisal Guidelines for Manufacture, Installation, Alteration and Repair of Special Equipment Licensing*
18	TSG D6001 – 2006, *Examination Requirements for Safety Administrators and Operators of Pressure Pipe*
19	TSG D7002 – 2006, *Pressure Piping Components Type Test Regulations*
20	TSG D7001 – 2005, *Pressure Pipe Unit Manufacture Supervision Inspection Regulation*
21	TSG D2001 – 2006, *Pressure Piping Components Manufacture Appraisal Regulation*
22	TSG D2001 – 2006/XG1 – 2010, *Pressure Piping Components Manufacture Appraisal Regulation No. 1 Amendment*

9

Chococam, Cameroon

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Duration of the study : September 2011 – April 2012

9.1 Objectives

Cameroon is projected to become an emerging country by the year 2035. This path to economic openness must be accompanied by measures to reinforce the country's economic competitiveness, and, in particular, to support upgrading, the development of standards systems, and help businesses in their quest for certification.

A governmental organization, the Standards and Quality Agency of Cameroon (ANOR), is striving to establish an efficient quality infrastructure in which standardization has a key role, contributing to Cameroon's emergence by bringing its added-value to the creation of wealth and jobs in the medium term.

However, the importance of standards is not always easy to demonstrate, due to a lack of studies on the impact and benefits of standards in the socio-economic development of Cameroon. As a member of ISO, ANOR agreed to carry out a case study using the ISO Methodology to determine the benefits that standards have brought in terms of reduced costs and higher quality to the chocolate manufacturing company, Chococam.

9.2 Introduction to the industry and selected company

9.2.1 Introduction to the industrial sector of Cameroon

Compared to its neighbouring countries and more generally to countries of the CEMAC (Commission of the Economic and Monetary Community of Central Africa), Cameroon has a relatively diversified industrial base both in terms of variety of activity and in company size, with a large number of SMEs and informal businesses.

According to the last general census of enterprises (RGE 2009), Cameroon counts 12 154 companies in the secondary or manufacturing sector, which represent approximately 13 % of the total number of enterprises. The breakdown of manufacturing firms by sector is the following: mining (0.2 %), food industry (6.1 %), beverages and tobacco (0.3 %), electricity, water and gas (1.6 %), and others (11.3 %), including the textile, wood, metallurgical and chemical industries.

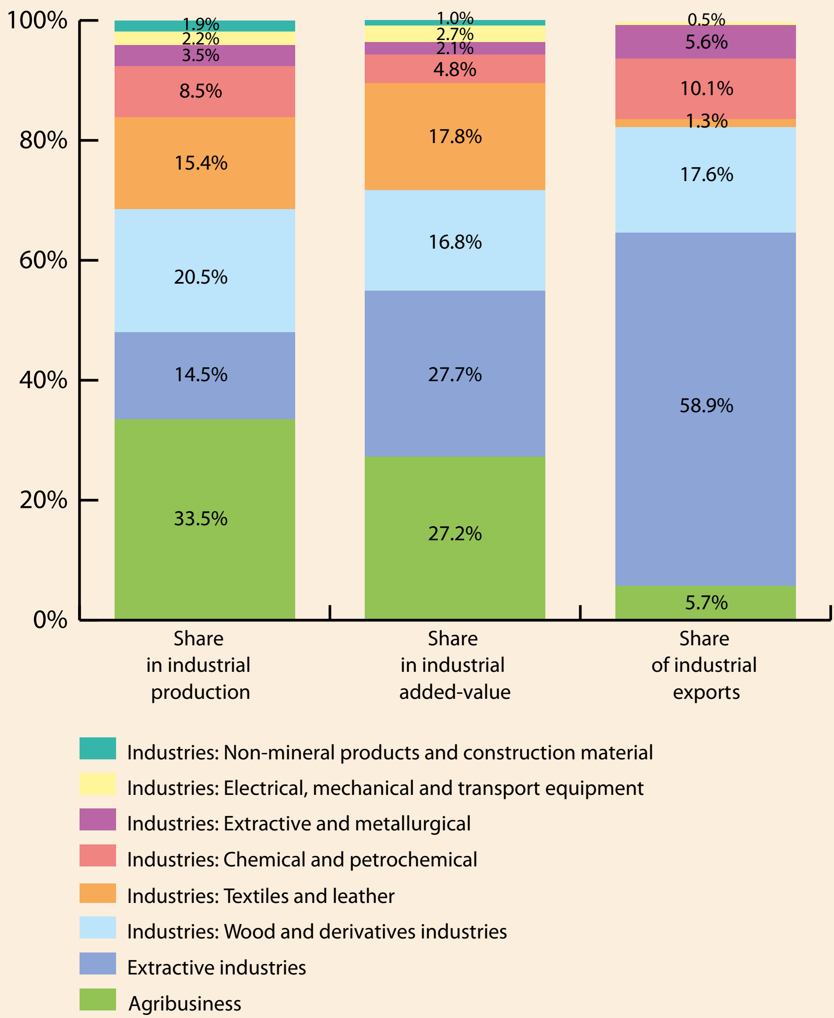
Manufacturing accounts for 22.8 % of total employment and turnover represents 34.3 % of the national total. On average, each company in this sector employs 8 people and generates an average turnover of XAF 300 million (CFA[1] Francs).

Table 1 outlines the structure of industrial activity in Cameroon according to the latest available data and proposed segmentation.

	Share in industrial production		Share in industrial added-value		Share of industrial exports	
	Bill. XAF	%	Bill. XAF	%	Bill. XAF	%
Extractive industries	622.6	14.5	552.3	27.7	707.7	58.9
Agribusiness	1433.2	33.5	541.5	27.2	68.8	5.7
Industries : Textiles and leather	657.0	15.4	355.2	17.8	15.8	1.3
Industries : Wood and derivatives industries	875.7	20.5	334.7	16.8	212.2	17.6
Industries : Chemical and petrochemical	362.4	8.5	96.7	4.8	121.2	10.1
Industries : Non-mineral products and construction material	81.5	1.9	19.2	1.0	3.3	0.3
Industries : Extractive and metallurgical	151.1	3.5	41.4	2.1	67.2	5.6
Industries electrical, mechanical and transport equipment	95.6	2.2	53.4	2.7	6.1	0.5

Table 1 – Industry structure in Cameroon (2006)

1) Fixed exchange rate with the Euro: 1 Euro is equal to XAF 655.957 (CFA Franc BEAC) and XAF 1 is equal to 0.001524 Euro.



Source : National Institute of Statistics (INS), National accounts of Cameroon 2006

Figure 1 – Composition of the manufacturing sector (2006)

According to the table and graph above, the five major industry sectors are :

- The mining sector, representing 14.5 % of industrial output, 28 % of the added-value and almost 60 % of exports
- The agro-industries sector which accounts for more than 33 % of industrial production, 27.2 % of industrial added-value and nearly 6 % of exports
- The textile, garments and leather sector accounting for 15.4 % of industrial output, 18 % of the added-value and 1.3 % of exports
- The wood industries and derivatives, representing 20.5 % of industrial output, nearly 17 % of the added-value and 18 % of exports. Wood industries come second after mining in terms of export importance
- The chemical and petrochemical industries, which account for 8.5 % of the production value, nearly 5 % of industrial added-value and 10 % of exports

Cameroonian industry is poorly integrated and produces mainly for the local market. Its exports consist mainly of low-processed products (hydrocarbon and wood) that generate little added-value. It is more geographically concentrated in the littoral region, located at the coast, and particularly in Douala, Limbe and Edea where nearly 80 % of industries are found. Other industrial units are scattered throughout the rest of the country, with a local concentration around Yaounde in the centre of the country and Bafoussam in the west. Corporate concentration in the littoral region is explained by its infrastructure (roads, energy, telecommunications) and the largest seaport of the country. Major roads connecting the regions of the littoral, centre, west and north-west as well as the expansion of electric power have, to a large extent, contributed to industrial decentralization in these other regions.

SMEs and informal sector companies are actively involved in industrial activity. They cover all sectors but are particularly prevalent in areas such as wholesale trade, household services, hospitality and catering, business services, etc. These are small-sized companies with sole ownership, characterized by :

- Weak managerial capacity
- Outdated production tools
- Low-skilled and poorly trained staff
- Lack of reliable accounting records of their activities
- Limited ability to mobilize guarantees to finance their activities

9.2.2 Introduction to the selected company

The Chococam company (Chocolate Confectionery Cameroon) was founded in 1965 and began operations in 1967.

Chococam was part of the Swiss group Barry Callebaut (the number one worldwide manufacturer of bulk chocolate) until 2008. In August 2008, the majority shares of Barry Callebaut were purchased by the Tiger Brands Group (a dynamic brand of consumer packaged goods, operating mainly in South Africa and in some emerging markets).

Chococam is a limited company with a capital of XAF 4 billion, of which 74.41 % is held by Tiger Brands and 25.59 % by national shareholders.

The company employs approximately 470 people composed of :

- Executives : 29
- Supervisors : 94
- Permanent workers : 199
- Infrequent : 168 including 121 temporary and 47 pieceworkers

Following the acquisition by Tiger Brands, the company experienced substantial changes in management and strategy. It is currently focused on operational improvement in all key business functions :

strengthening customer relationships and favouring new business opportunities (especially export markets). Further integration with Tiger Brands is expected in the short to medium term.

The cocoa industry in Cameroon is dominated by two large companies, Sic-Cacao and Chococam. Chococam is specialized in the manufacturing and marketing of confectionery products and chocolate.

Sic-Cacao produces cocoa butter, cocoa mass for industrial use and cocoa powder. Its processing capacity is around 20 000 to 25 000 tons of beans per year and production is on average 1 200 tons of butter and 22 000 tons of cocoa mass, both largely exported to France and the Netherlands. The introduction of vegetable fats in chocolate production has had a depressive effect on the production of cocoa butter.

Chococam is specialized in the manufacture of chocolate-based products and various sweets from cocoa mass. The different product lines are:

- Chocolate (chocolate bars, bars with chocolate, professional chocolates)
- Chocolate spread (chocolate paste, peanut butter)
- Pure cocoa powder
- Confectionery (unwrapped sweets, wrapped sweets and curly wrapped gum)

Chococam produces around 36 000 tons per year, sold mainly on the local market and in the CEMAC[2)] countries. Its market share is 55 %, the balance being divided between Conficam, a confectionery company, and industrial or handicraft production plants or importers.

The company's average annual turnover for the past few years is around XAF 19 billion.

2) Economic and Monetary Community of Central Africa

As one of Cameroon's largest manufacturing companies in the food sector, Chococam manufactures cocoa-based consumer products at its factory in Douala and sells these products in Cameroon, Nigeria and other countries of Central and West Africa.

9.3 Attitude of the company towards standardization

The company uses a number of product and testing standards (product specifications and analysis methods) to meet the needs of domestic and foreign markets. While it is clear that these standards effectively support Chococam's business processes, they have been in use for many years and it was not possible to make a specific assessment of the benefits they bring to the company. However, management system standards, and in particular ISO 9001, have had a key impact on Chococam's operations and it is in particular this standard which contributed significantly to the operations of Chococam which will also become apparent from the results of this report.

Chococam's certification to ISO 9001 was renewed in 2008. Since acquisition by Tiger Brands, the quality management system has been reorganized and its implementation now plays a key role in the company's focus on operational improvement. In particular, performance indicators are defined for all business processes and related business functions. They are regularly monitored and checked, and new goals are set based on a philosophy of continual improvement.

Table 2 lists the standards used by Chococam.

N°	Designation of the standard		Area of application
1	ISO 7402:1993	Microbiology – General guidance for the enumeration of Enterobacteriaceae – MPN technique and colony-count technique	Microbiological analysis

N°	Designation of the standard		Area of application
2	Modified OICC method ; ISO 4833:1991	Microbiology – General guidance for the enumeration of micro-organisms	Microbiological analysis
3	Modified OICC method ; ISO 7954:1987	Microbiology – General guidance for the enumeration of yeasts and moulds – Colony count techniques at 25 degrees C	Microbiological analysis
4	Modified group method ; ISO 6579:1993	Microbiology – General guidance on methods for the detection of Salmonella	Microbiological analysis
5	Codex 87-1981	Codex standard for chocolate and chocolate products	Specifications for types of chocolate
6	Circular ANOR 000803 of 06 October 2010	Circular relating to the certification of food products, raw material, additives and imported ingredients	Specifications for raw materials and finished products
7	Codex Alimentarius	Inspection and certification systems for food imports and exports	Specifications for raw materials and finished products
8	EC Regulation 2073/2005 of the European Commission of 15 November 2005	Concerning the microbiological criteria applicable to foodstuffs	Microbiological specifications for raw materials and finished products
9	EC Regulation 178/2002	Grand-Duchy of Luxembourg National health laboratory Microbiological criteria for foodstuffs Interpretation guidelines	Microbiological specifications for raw materials and finished products
10	Codex standard 192-1995, Rev. 7-2006	Codex general standard for food additives	Microbiological and physico-chemical specifications for raw materials and finished products
11	Codex Alimentarius and Cameroonian standard NC 30	Hygiene of food stuffs ; good hygiene and manufacturing practices	Good practices for hygiene and manufacture
12	Codex standard 107-1981	General standard for the labelling of food additives when sold as such	Microbiological and physico – chemical specifications for raw materials
	Codex standard 207-1999	Codex standard for milk powders and cream powder	Microbiological and physico – chemical specifications for raw materials
13	Cameroonian standard NC 04:2000-20	Standard for labelling of pre-packaged foods	Physico-chemical specifications for raw materials and finished products

N°	Designation of the standard		Area of application
14	Summary of EC Decree n° 2005/1928/pm of 03 June 2005	Establishing the metrological specifications for pre-packaged or similar products and the procedures for their metrological control	Physico-chemical specifications for finished products
15	Internal standard	Standard on the smoothness of chocolate pastes and chocolate spread	Physico-chemical specifications for finished products
16	ISO 9001:2008	Quality management systems – Requirements	Improvement of company performance

Table 2 – List of standards used by Chococam

9.4 Analysis of the value chain

9.4.1 Industry value chain

Three stages determine the competitive advantage of Cameroon's agro-industrial sector on the market : raw material supply, production and distribution, and consumption. Raw materials are supplied both by the local and international markets. Indeed, the agricultural potential provides a good basis for the development of the agribusiness which, by tradition, has always been one of the most important within the national manufacturing sector. The domestic market provides raw materials such as cocoa, peanuts, and sugar.

However, other important raw materials come from the international market through imports. These are products such as milk, oil, glucose.

The industry value chain is described as follows in **Figure 2** :

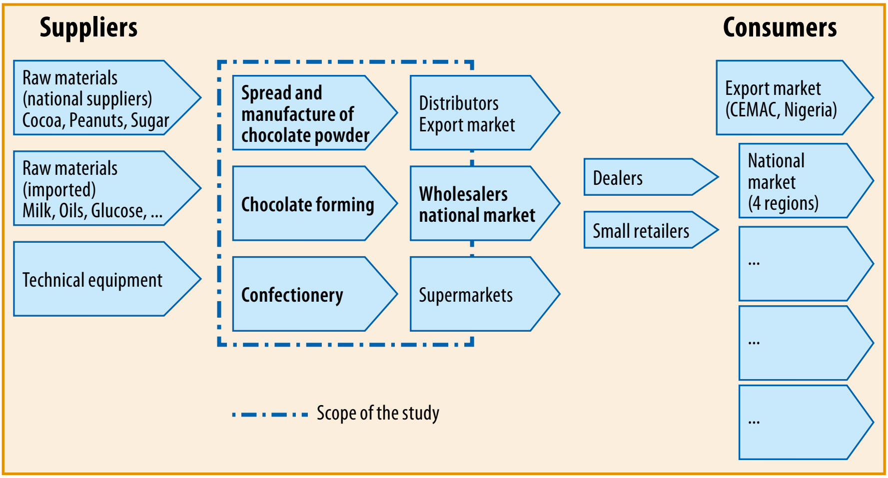


Figure 2 – Industry value chain

9.4.2 Company value chain

The concept of the value chain has enabled the analysis of Chococam's various activities, and how each contributes to create value for the company.

Thirteen activity clusters have been identified: eight primary functions, four supporting activities and one management activity. Supporting activities are horizontal and can affect one or more basic or productive activities.

Primary activities

- Marketing (makes finished products known to the customer)
- Sales (collects, stores and distributes the finished product to the customer and enables the customer to purchase the product)
- Planning (defines and ensures the planning of production and the necessary raw material supplies)
- Procurement and logistics / raw material warehouse (reception, stockage and distribution of raw materials)

- Manufacture of confectionery (transforms raw materials into finished confectionery products)
- Manufacture of chocolate spread and chocolate powder (transforms raw materials into semi-finished chocolate products
- Manufacture of chocolate forming (transforms raw materials into finished chocolate and pure cocoa powder)

Supporting activities

- Maintenance (ensures the maintenance and availability of equipment)
- Information technology (ensures the organization's management system, information and communication)
- HSE (Health and safety – ensures the implementation of GHP – Good Hygiene Practices –and compliance with safety at work regulations)
- Human resource management (provision and optimization of the workforce)

Management activities

- Quality management (establishes, documents and coordinates the implementation and continual improvement of the quality management system)

The activities comprising Chococam's value chain are described in **Table 3**:

Type of activity	Selected business functions	Missions
Primary activities	Marketing	Management and development of Chococam's brands and products
	Sales	Sale and delivery of Chococam products to local market customers
	Planning	Define and ensure the production schedule and necessary raw material supplies
	Procurement	Purchase of raw materials, packaging, services, engineering, spare parts and other

Type of activity	Selected business functions	Missions
Primary activities	Raw material warehouse	Ordering of raw materials and packaging, receipt of raw materials and packaging, storage of raw materials, making available raw materials for use
	Confectionery	Management and packaging of confectionery products, compliance with product and quality standards, management of workforce, optimal management of raw materials and resources, compliance with the production schedule
	Chocolate spread and powder making	Manufacture of semi-finished production for chocolate forming, manufacture and packaging of finished products (spread, chocolate powder and peanut butter), compliance with product and quality standards, management of the workforce, optimal management of raw materials and resources, compliance with the production schedule
		Moulding and packaging of chocolate products, compliance with product and quality standards, management of the workforce, optimal management of raw materials and resources, compliance with the production schedule
Supporting activities	Maintenance	Ensure the maintenance and availability of equipment
	Information technology	Ensure the organization of the management system, information and communication
		Ensure the operation and optimal management of IT supplies, of the information system and make correlated management applications available
	HSE (Health and Safety)	Ensure the implementation of GHP (good hygiene practices) and compliance with safety at work regulations
	Human resource management	Provision and optimization of the workforce
Management activities	Quality management	Establish, document and coordinate implementation and continual improvement of the quality management system

Table 3 – Activities in Chococam's value chain

9.4.3 Key value drivers

On the basis of information gathered through interviews and documents (audit report 2010, Chococam's quality manual, etc.), four major value drivers have been identified:

- Quality and product safety
- Effectiveness and efficiency of processes (particularly manufacturing and sales)
- Attractiveness of Chococam products for the customer and for customer satisfaction
- Training and motivation of the workforce

Most objectives and corrective actions can be linked to the four value drivers mentioned above. Product quality and safety constitutes the key driver at this stage. Significant efforts are made to reduce nonconformities in order to improve product quality and ensure that it is the best, most stable and consistent.

9.5 Scope of the pilot project assessment

The scope of the evaluation is limited to those business functions for which quantifiable benefits, arising from those operational improvements supported by the implementation of the quality management system, are the most significant (operations and supply) and to the management function responsible for coordination (quality assurance).

In other words, the analysis focuses on the functions of marketing, sales (including planning), procurement, operations (including raw material warehouse, confectionery, chocolate spread and powder making).

9.6 Use of standards in the company value chain

Selected business functions	Related activities	Value drivers	Standards used
Marketing	Management and development of Chococam brands and products	Products attractive to the customer and for customer satisfaction	ISO 9001:2008
Sales	Planning Sales forecasts	Process effectiveness and efficiency	ISO 9001:2008
Procurement	Purchasing of raw materials	Quality and safety of products Process effectiveness and efficiency	Codex standard 207-1999 (Codex standard for milk powders and cream powder) Codex standard 192-1995, Rev. 7-2006 (General Codex standard for food additives) NC 04:2000-20 : Cameroonian standard on the labelling of prepackaged foodstuff (Physico-chemical specifications of raw materials and finished products) ISO 9001:2008
Operations	Management of raw materials warehouse : • Ordering of raw materials and packaging • Receipt of raw materials and packaging	Process effectiveness and efficiency	Codex standard 207-1999 (Codex standard for milk powders and cream powder) Codex standard 192-1995, Rev. 7-2006 (General Codex standard for food additives) NC 04:2000-20 : Cameroonian standard on the labelling of prepacked foodstuff (Physico-chemical specifications of raw materials and finished products) ISO 9001:2008

Selected business functions	Related activities	Value drivers	Standards used
Operations – Chocolate spread and manufacture of chocolate powder	• Manufacture of semi-finished products for chocolate forming • Manufacture and packaging of finished products (spread, chocolate powder and peanut butter)	Product quality and safety Process effectiveness and efficiency	Internal standard on the smoothness of chocolate pastes and spread (Physico-chemical specifications of finished products) Codex standard 87-1981 (Codex standard for chocolate) Codex standard 192-1995, Rev. 7-2006 (General Codex standard for food additives) Codex Alimentarius and Cameroonian standard NC 30 (Hygiene of foodstuff, good hygiene and manufacturing practices) ISO 7402:1993 (Microbiology – General guidance for the enumeration of Enterobacteriaceae) ISO 4833:1991 (Microbiology – General guidance for the enumeration of micro-organisms) Method OICC modified ; ISO 7954:1987 (Microbiology – General guidance for enumeration of yeasts and moulds) Group method modified : ISO 6579:1993 (Microbiology – General guidance on methods for the detection of Salmonella) ISO 9001:2008

Selected business functions	Related activities	Value drivers	Standards used
Operations – Chocolate forming	• Moulding and packaging of chocolate products	Product quality and safety Process effectiveness and efficiency	Internal standard on the smoothness of chocolate pastes and spread (Physico-chemical specifications of finished products) Codex standard 87-1981 (Codex standard for chocolate) Codex standard 192-1995, Rev. 7-2006 (General Codex standard for food additives) Codex Alimentarius and Cameroonian standard NC 30 (Hygiene of foodstuff, good hygiene and manufacturing practices) NC 04:2000-20 : Cameroonian standard on the labelling of prepackaged foodstuff (Physico-chemical specifications of raw materials and finished products) ISO 7402:1993 (Microbiology – General guidance for the enumeration of Enterobacteriaceae) ISO 4833:1991 (Microbiology – General guidance for the enumeration of micro-organisms) OICC Method modified ; ISO 7954:1987 (Microbiology – General guidance for enumeration of yeasts and moulds) Group method modified : ISO 6579:1993 (Microbiology – General guidance on methods for the detection of Salmonella) ISO 9001:2008

Selected business functions	Related activities	Value drivers	Standards used
Operations – Confectionery	• Manufacture and packaging of confectionery products	Product quality and safety Process effectiveness and efficiency	NC 04:2000-20 : Cameroonian standard on the labelling of prepacked foodstuff (Physico-chemical specifications of raw materials and finished products) Codex Alimentarius and Cameroonian standard NC 30 (Hygiene of foodstuff, good hygiene and manufacturing practices) Codex standard 192-1995, Rev. 7-2006 (General Codex standard for food additives) ISO 7402:1993 (Microbiology – General guidance for the enumeration of Enterobacteriaceae) ISO 4833:1991 (Microbiology – General guidance for the enumeration of micro-organisms) OICC Method modified ; ISO 7954:1987 (Microbiology – General guidance for enumeration of yeasts and moulds) Group method modified : ISO 6579:1993 (Microbiology – General guidance on methods for the detection of Salmonella) ISO 9001:2008
Operations – Maintenance	Ensuring equipment maintenance and availability	Product effectiveness and efficiency	ISO 9001:2008
Human resources (with all business functions concerned)	Provision and optimization of the workforce for greater efficiency	Training and motivation of the workforce	ISO 9001:2008

Table 4 – Standards used by Chococam's business functions

9.7 Selection of operational indicators to measure the impacts of standards

Not all the performance criteria contained in Chococam's quality manual were applied in this assessment. Only indicators related to the business functions selected, relevant to the policy of continual improvement and measurable on the basis of information received from the interviews, were retained.

Operational indicators selected to quantify the impact of standards used within the Chococam company are listed in **Table 5.**

Selected business functions	Related activities	Value drivers	Indicators
Marketing	Management and development of Chococam brands and products	Attractiveness of Chococam products for the customer and for customer satisfaction	• Degree of customer satisfaction • Recognition rate
Sales	Planning Sales forecasts	Process effectiveness and efficiency	• Gap between forecasts and orders • Availability of the forecast for the following month during the third week of the current month
Procurement	Raw material purchases	Quality and safety of products Process effectiveness and efficiency	• Nonconformity of raw material supplies • Stock disruption • Purchase costs • Internal customer satisfaction
Operations	Management of raw materials warehouse : • Order of raw materials and packaging • Receipt of raw materials and packaging	Process effectiveness and efficiency	• Stock disruption • Stock turnover

Selected business functions	Related activities	Value drivers	Indicators
Operations – Chocolate spread and manufacture of chocolate powder	• Manufacture of semi-finished products for chocolate forming • Manufacture and packaging of finished products (spreads, chocolate powder and peanut butter)	Product quality and safety Process effectiveness and efficiency	Number of : • Returns • Contaminations • Product defects • Amount of temporary work in relation to production volume • Degree of raw material conversion • Energy consumption
Operations – Chocolate forming	Moulding and packaging of chocolate products	Quality and safety of products Process effectiveness and efficiency	Number of : • Returns • Contaminations • Product defects • Amount of temporary work in relation to production volume • Degree of raw material conversion • Energy consumption
Operations – Confectionery	Manufacturing and packaging of confectionery products	Quality and safety of products Process effectiveness and efficiency	Number of : • Returns • Contaminations • Product defects • Amount of temporary work in relation to production volume • Degree of raw material conversion • Energy consumption
Operations – Maintenance	Ensure maintenance and availability of equipment	Process effectiveness and efficiency	• Maintenance costs • Rate of smooth operation • Energy consumption

Selected business functions	Related activities	Value drivers	Indicators
Human resources (with all relevant business functions)	Provision and optimization of the workforce for greater efficiency	Training and motivation of the workforce	• Review of workers' activities and profiles • Objectives/bonus policy • Operator awareness of compliance with good hygiene and manufacturing practices and of the food safety risks of Chococam products

Table 5 – Value drivers and operational indicators

9.8 Calculation of the economic benefits of standards

Owing to lack of data, it was not possible to find financial data for all the above indicators. The analysis is focused on those for which it was possible to obtain company data and estimates from the company management.

9.8.1 Economic benefits in the selected business functions

9.8.1.1 Procurement

1. Purchasing cost of raw materials

Chococam's expenditures on goods and services cover raw materials, spare parts and purchasing services, which account, respectively, for 60 %, 30 % and 10 % of the total. The declarations of the quality of raw materials are occasionally double-checked.

The improvements driven by the implementation of the quality management system for this function were identified in a reduced number of noncompliances and stock shortages, optimization of purchasing costs, faster treatment of spare parts, and improved rate of completion of corrective actions.

The number of cases of nonconformities recorded decreased from ten in 2010 to seven in 2011, an improvement of 30 %.

The number of raw material shortages decreased from 14 in 2010 to eight in 2011, an improvement of 42 %.

The completion rate of corrective and preventive actions improved from 60 % in 2010 to 85 % in 2011, increasing the level of internal customer satisfaction.

The objective of the procurement department for the year 2011 was to achieve a saving of XAF 300 million compared to 2010. This was not possible to achieve due to the drastic increase in the price of cocoa. However, improved purchasing techniques enabled the department to maintain expenditures at the 2010 budget level, whilst production increased. The value created through improved purchasing techniques was estimated at around XAF 300 million.

2. Better stock management

Between 2010 and 2011, the total mean value of stock decreased from XAF 400 million to XAF 60 million due to better stock management of raw materials and consumables. More detailed data could not be obtained in time for the publication of this study, therefore, to estimate the benefits deriving from this improvement, the following assumptions have been made:

a) 50 % was attributed to the reduction of waste (50 % of XAF 340 million = XAF 170 million)

b) 50 % was attributed to improved stock rotation with decreased capital immobilization. Considering an average annual cost of capital[3)]

3) Source: Architecture de la tarification des services bancaires dans la CEMAC, Secrétariat Général de la Commission Bancaire de l'Afrique Central, Avril 2010.

of approximately 10 %, this generates additional cost savings of 10 % of XAF 170 million = XAF 17 million.

The creation of value due to this change can be estimated at XAF 170 million + XAF 17 million = XAF 187 million.

9.8.1.2 Operations

As mentioned above, significant efforts were made to reduce non-conformities in order to ensure continual improvement and a consistently high and stable level of product quality. Increasing company productivity is also a key objective.

Product and test standards are used to evaluate the product, that is, the conformity of the various categories of products to properties and quality criteria set by the standards – for example, for chocolate, properties such as texture (granularity of the chocolate paste), weight (in particular, fluctuations in weight), fat, wrapping.

Management system standards are used as the basis on which to structure the description of processes and activities, define indicators, measure performance, and define and monitor corrective and preventive actions.

The operations business function is actively pursuing a number of initiatives aimed at increasing the productivity of the company, the most important of which are:

- The production process improvement programme (which is concerned with the elimination of maintenance breaks to achieve a *continuous line of production* and the optimization/acceleration of working time, through more efficient shifts and other measures)
- The human resource programme (revision of profiles and personnel responsibilities, and motivation – through bonus and reward policies and by enhancing awareness of the importance of quality and safety at work, accomplished by dedicated training and on-the-job coaching)

The philosophy of continual improvement is supported by the annual ISO 9001 audit, and by safety audits (work and site).

The managers interviewed consider the implementation of ISO 9001 a very important tool, which contributes in particular to:

- The objective definition and clarification of activities and roles
- Better understanding of activities and organization by personnel
- Defining specific performance objectives (for the various groups and individuals)
- Developing a greater sense of employee responsibility
- Spreading the philosophy of continual improvement

The main results achieved so far by the operation function are summarized below.

1. Reduction in the contamination level (noncompliance at the micro-biological level)

Between 2010 and 2011, the number of nonconformities owing to contamination decreased from 68 cases to 29, a reduction of 57 %. The cost of recycling due to nonconformance is estimated at XAF 5 million. The value creation of this reduction is therefore XAF 195 million.

2. Production costs

In 2010, a ton of production cost XAF 200 000. This decreased to XAF 185 000 in 2011. On average, the company produces 15 050 tons per year and the value created through this reduction amounts to XAF 225 750 000.

3. Reduction in maintenance costs

Better maintenance techniques have led to a reduction in costs of XAF 360 million for a production total of 10 000 tons in 2010, to XAF 276 million for a production level of 15 000 tons in 2011. This reduction in maintenance costs has created an absolute value amounting to XAF 84 million.

The rate of smooth running of the machines increased from 78 % in 2010 to 92 % in 2011.

9.8.1.3 Sales

In 2011, Chococam's sales increased 5 % over 2010. Process improvements for this business function are underway (focused on the indicators presented in **Table 6)** and to some extent they have been influenced by the implementation of the quality management system. However, it was not possible to quantify this contribution. In conclusion, the economic benefits of standards for Chococam are summarized below.

9.8.2 Financial impact of standards on business functions assessed

Selected business functions	Indicators	Financial impact on the operational indicators (in XAF)
Marketing	Customer satisfaction survey	N/A
	Recognition rate	N/A
Procurement	Stock management – nonconformity of the raw material supplied	187 000 000
	Purchasing costs	300 000 000
Operations – spread and manufacture of chocolate powder **Operations – Chocolate forming** **Operations – confectionery**	Contamination	195 000 000
	Amount of temporary work in relation to production volume	225 750 000
Operations – Maintenance	Maintenance costs	84 000 000
Total contribution to the company EBIT (in XAF)		**991 750 000**
Total contribution to the company EBIT (in EUR) **(there is a fixed exchange rate with the Euro : 1 000 XAF equal 1,53 EUR)**		**1 517 377**
Contribution to EBIT as a percentage of total sales		**5.2 %**

Table 6 – Financial impact of standards on business functions assessed

9.9 Qualitative and semi-quantitative considerations

Additional considerations on the qualitative benefits of standards identified by the analysis are outlined below.

1. **Marketing**

Key indicators are the customer satisfaction survey and the recognition rate. The survey covered more than one million consumers and was first conducted in March 2010. The main consequence has been the improvement in product quality and the purchase of new equipment.

2. **Sales**

The main value indicators for the marketing and sales services are the variations between forecast and order, and availability of the forecast for the following month during the third week of the current month.

Despite its position of market leader, Chococam does not yet cover the total Cameroonian market. In addition, the company aims to reduce the ratio of returns, generated by a variety of factors.

Improved sales planning and optimal management of the sales calendar would allow the company to serve the market more efficiently, extend its outreach, and reduce the product return ratio.

3. **Operations**

More efficient energy consumption is another important driver of value creation. Some results have been achieved, but further improvement needs to be pursued.

9.10 Evaluation of results

The application of the ISO Methodology for assessing the economic benefits of standards at Chococam has indicated a contribution to the company EBIT of XAF 991 750 000 (about USD 1 814 902) which represents 5.2 % of the company's total annual turnover.

It should be noted that the results are influenced by the fact that it was the first time that an analysis of this kind was undertaken by the company and, in several cases, the persons interviewed have clearly identified qualitative benefits of standards but were not able to quantify them.

This seems to indicate that, while already significant, the economic benefits of standards for Chococam are most probably underestimated.

9.11 Conclusion

Standards help Chococam to produce more efficiently and be more competitive on the market. In particular, the study has demonstrated that the use of standards contributes to the creation of value for Chococam, with an estimated contribution to the company EBIT of XAF 991 750 000, representing over 5 % of the company's total annual turnover.

This value is very significant and is strongly related to a thorough implementation of ISO 9001 in support of the company's operational improvement.

The value assessed by this study can be further increased, following the continual improvement philosophy that Chococam has adopted.

10

Water Senegal, Senegal

Country : Senegal
ISO member body : Standardization Association of Senegal (ASN)
Project team :
Project leader : Mr. El hadji Abdourahmane Ndione, Head, Chemistry Office, ASN
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Member : Mr. Abdourahmane Ba, Manager, Quality, Safety and Environment, SDE
ISO Central Secretariat advisor : Daniele Gerundino, Strategic Advisor to the Secretary-General
Duration of the study : July – December 2011

10.1 Objectives

The assessment of the economic benefits of standards is extremely important for tracking and prioritizing standardization activities. It aims to raise awareness and improve communication, while promoting the use of standards and encouraging stakeholder participation. The assessment of the economic benefits of standards is designed to:

- Allow stakeholders from private and public sectors to better appreciate the economic and social impact of voluntary consensus standards
- Sensitize policy makers and business leaders to the importance of standardization

This report presents the result of a project that took place from July to December 2011 with the collaboration of la *Sénégalaise des Eaux* (SDE), the Polytechnic School of Thièse, the ISO member for Senegal – the Senegalese Association for Standardization (l'Association Sénégalaise de Normalisation (ASN), and ISO.

10.2 The selected company

10.2.1 SDE in summary

Recognized internationally, SDE is a reference in Africa for the management of drinking water services. Its successful performance has greatly contributed to the viability of Senegal's urban drinking water.

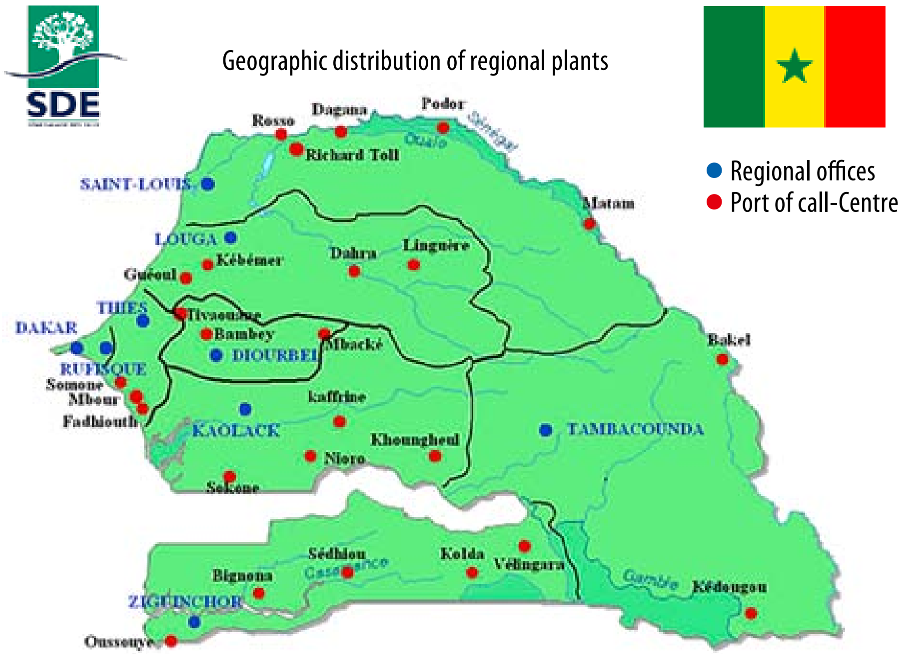


Figure 1 – Geographic distribution of regional plants

SDE operates in the institutional framework described below :

- The State of Senegal defines the global policy
- The National Water Company of Senegal (SONES) is responsible for asset management, for project management of renewal and extension works on the infrastructure, and for quality control operations
- SDE is responsible for operations
- The National Sanitation Office (ONAS) is responsible for sanitation operations

Founded in December, 1995, and situated in Dakar, Senegal's capital, SDE is a private limited company with a capital of XOF 3 billion (CFA [1] Francs), distributed as follows:

- 58 % for the company *Finagestion*, a subsidiary of the French group Bouygues
- 32 % for private Senegalese investors
- 5 % for the State of Senegal
- 5 % for company staff

As a national company, SDE is composed of regional offices across the country that report to the head office in Dakar.

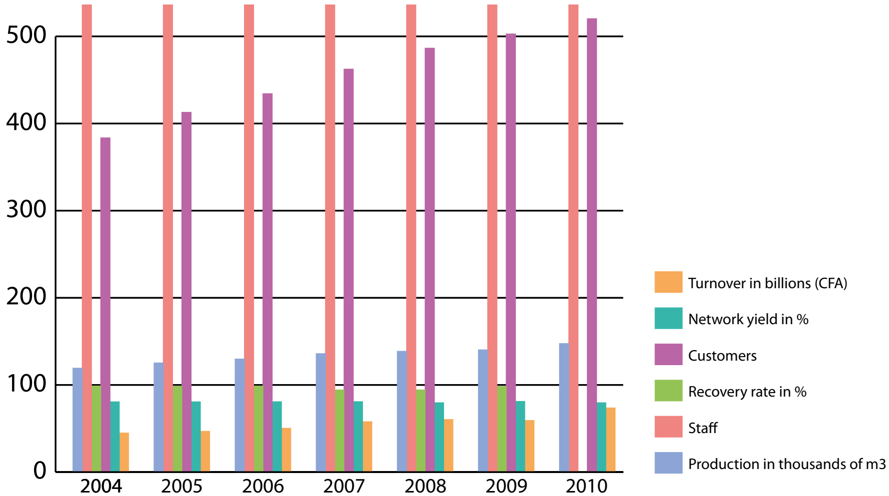
SDE is responsible for:

- Operations and maintenance of infrastructure and equipment
- Renewal of operational equipment
- Contractual renewal of networks, connections, meters and electromechanical equipment
- Network extensions financed by third parties
- Study and justification of renewal work and infrastructure expansion
- Billing and receipt of payment for drinking water and sanitation
- Communication and customer relations

SDE has managed the production and distribution of drinking water for Senegal's 56 largest urban sites since April 1996. In 2010, its turnover was XOF 73.1 billion on production of 146 million cubic meters of drinking water, an increase of 5.3 % compared to 2009. It serves 520 000 customers representing 5 million people, and has 1 139 employees (as at 31 December 2010).

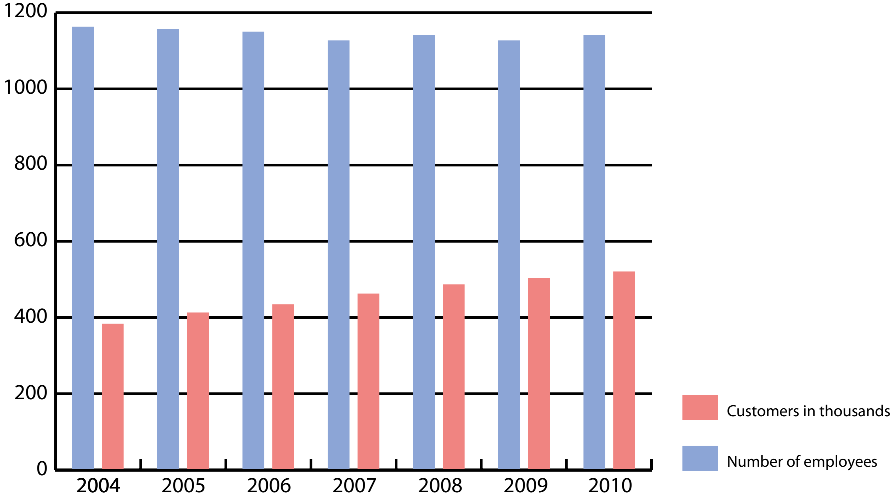
Some key SDE statistics are given in **Figure 2** and **Figure 3**:

1) Fixed exchange rate with the Euro: 1 Euro is equal to XOF 655.957 (CFA Franc BEAC) and XOF 1 is equal to 0.001524 Euro.



	2004	2005	2006	2007	2008	2009	2010
Production in thousands of m³	118 71	124 72	129 218	135 39	138 081	139 733	146 973
Number of staff	1 161	1 155	1 148	1 125	1 139	1 125	1 139
Recovery rate in %	98.3	97.86	98.2	93.73	93.73	97.6	n/a
Customers	383 008	412 304	433 675	461 887	485 921	502 238	519 756
Network yield in %	80.1	80.1	80.2	80.3	79.06	80.58	79.05
Turnover in billions (CFA)	44.3	46.3	49.8	57.3	59.8	58.7	73.1

Figure 2 – Statistical evolution of SDE in key indicators



	2004	2005	2006	2007	2008	2009	2010
Number of employees	1161	1155	1148	1125	1139	1125	1139
Customers in thousands	383	412	434	462	486	502	520

Figure 3 – Evolution of SDE customers and employees

10.2.2 SDE and its partnerships

SDE maintains a corporate citizen profile by conducting numerous activities at the national level. An approach integrating drinking water, education, health and sanitation is typical of the projects that fit within its framework of sustainable development.

At the international level, specific partnerships are established with African water companies to improve benchmarking measures and support in specific areas. Agreements with French companies exist to support the implementation of new tools and the development of staff skills.

SDE is bound to SONES by a performance contract concerning the technical and financial performance to be achieved. The contract aims to improve the public water sector through:

- Quality of service
- Continuity of service
- Quality of water
- Transparency of billing
- Reduction in water losses
- Recovery rate performance from all subscribers

The performance contract is reviewed at intervals with a view to finding solutions that safeguard the interests of each entity and of shareholders.

Technical meetings are routinely held between managers of SDE and the staff of SONES to deal with specific subjects such as production orders, the contract renewal programme, the five-year plan, the annual fee, billing, collecting of payments, etc.

10.2.3 SDE and consumer organizations

SDE favours good relations with consumer organizations and has established a permanent dialogue with these organizations and with its clients in order to efficiently manage quality of service, requests and claims.

10.2.4 SDE and its suppliers

Special conditions are applied to the purchase of products, services and outsourcing that have a direct impact on service quality. SDE evaluates its suppliers/service providers and subcontractors, and selects and defines specific terms to be fulfilled before purchasing.

For outsourced services SDE has designed strict rules to be applied for the control of its activities, tailored to the risk involved.

Moreover, SDE aims to develop the skills of its sub-contractors in the fields of safety and the environment through awareness of its QSE (quality, safety, environmental) policy and by encouraging them to comply with statutory and regulatory requirements, particularly with regard to markup, wearing of personal protective equipment (PPE), etc.

10.3 Attitude of the company towards standardization

10.3.1 Commitment towards standardization

SDE has become a driver for standardization by helping ASN to popularize the use of standards and to educate people through increased training. The attitude of SDE to standardization is illustrated by its certifications :

- ISO 9001:2008, *Quality management systems – Requirements*, providing a model for quality assurance in design/development, production, installation and servicing for its entire area and activities
- ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*, providing specifications with guidance for use for its entire area and activities (with the exception of the factory at Khor)
- OHSAS 18001, *Occupational health and safety management systems – Requirements*, covering its entire area and activities.

SDE encourages its sub-contractors to comply with standards for the occupational safety of their employees (compliance with PPE equipment, vehicles, prevention plans, certification to OHSAS 18 001) and this requirement is gradually being introduced into new contracts.

10.3.2 The strategic role of the quality policy

After a successful start in 1996, SDE faced numerous problems in 2000 :

- Despite a rapid increase, performance did not meet contractual targets, and penalties were imposed in line with its performance contract with SONES
- Customer requirements changed, focusing mainly on quality of service (zero water shortage)
- Employees had high expectations
- Work volume increased considerably
- The performance contract became increasingly demanding

To adress these challenges, SDE implemented a project designed to be :

- Motivating for staff
- Generating rapid productivity gains, significant in all areas, particularly in operations and works
- Innovative in terms of listening and meeting the new demands of the consumer
- Enhancing for national expertise (institutional customers and suppliers) and to allow the signing of a contractual amendment.

The setting up and success of this project led SDE to adopt a highly structured quality approach including clear links between the strategic lines of the company and their implementation " by process " and business function.

In this respect, the annual " Public letter of engagement", issued by the CEO at the beginning of the year, has an essential role : it sets the key objectives and policies of the company and is used as a basis for defining the specific objectives and tasks for each organizational unit.

SDE's vision and values are summarized in **Figure 4,** along with an extract of the public letter of commitment for 2011 :

Vision
- Satisfy customers and become an international reference in water services

Values
- The quest for performance
- Respect of our commitments
- Equity in all our actions
- A permanent team spirit
- Protection of men and the environment

Extract of the public letter of commitment 2011
- Biological-chemical quality of water 99.5 % compliant
- Network performance at 80 %
- Customer complaints answered 100 % within the limits of the contract
- Bill recovery rate of 98.3 %
- Ordinary connections made within 15 days

Figure 4 – SDE's vision and values

The main objectives for 2011 were defined in four areas of which customer satisfaction had top priority. These were :

- Customer satisfaction
- Health and safety of colleagues as well as their professional development
- Protection of the environment
- Optimization of processes

10.4 Analysis of the value chain

10.4.1 Industry value chain

In Senegal, the water industry is structured around three functional areas of responsibility or sub- sectors represented by **Figure 5** below:

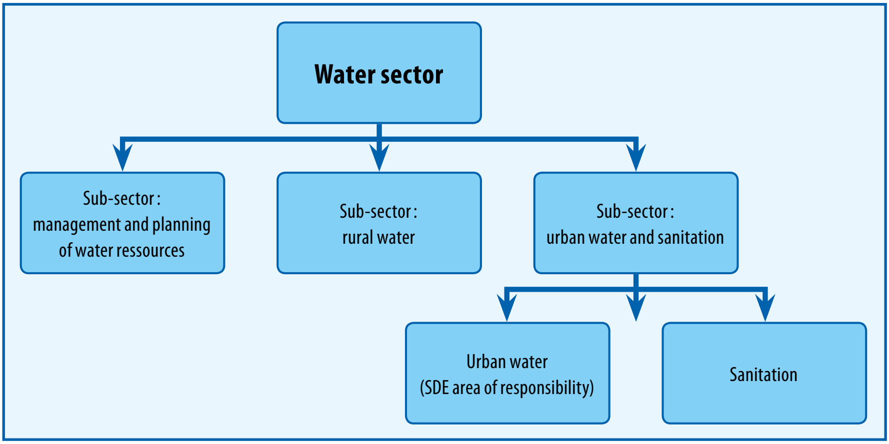


Figure 5 – Senegal's water industry structure

Operating in the urban water sector, SDE is responsible for the technical and financial management of state owned assets in this sector. SDE and ONAS have the monopoly of the Senegalese urban water market, and so far they remain the only companies specialized in water supply and sanitation.

10.4.2 Company value chain

With respect to the collection, treatment and distribution of water, SDE has a structured management. Just like any business, its value chain consists of main functions (refer to as " strategic process ") and support functions (" process support ") as represented in **Figure 6** :

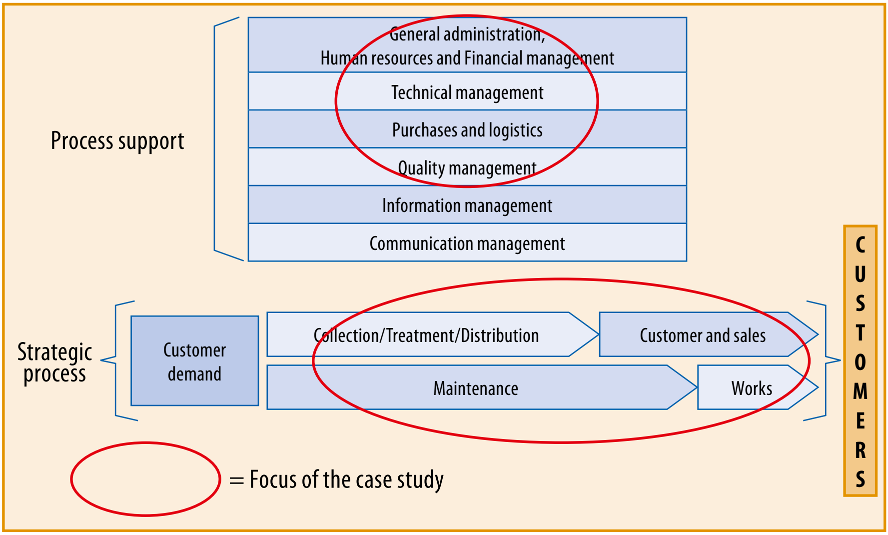


Figure 6 – SDE's company value chain

10.4.3 Key value drivers

SDE's key value drivers concern the improvement of Senegal's urban water sector, and are directly linked to binding elements in the performance contract with SONES.

The list of value drivers and associated operational indicators are given in **Table 1.**

Value drivers	Operational indicators
Quality and quantity of water	• Respect of the production plan : 100 % • Rate of bacteriological and physico-chemical compliance > 98.7 % • Rate of pressure below 1 bar (every 4 months)
Maintenance – electromechanical and network	• Response time for return to service (dosage pumps, chlorine meters and rain water management) : 100 % • Rate of availability of an emergency generator on critical sites : 100 % • Rate of work requests classified C1 (direct impact on service continuity or staff safety) completed within time limits : 100 % • Rate of leakage isolated and repaired within time limits : 100 % • Hydraulic efficiency of the network : 80.5 %
Efficient billing, recovery and customer relations management	• Rate of increase in sales >= 1.7 % • Rate of estimated billing <= 1.5 % • Rate of recovery : 98.3 % • Rate of cancellation <= 1.5 % • Customer satisfaction >= 85 %
Performance of engineering projects (re : the network's expansion)	• Rate of achievement of connections within time limits • Rate of road repairs within 15 days for Dakar and 30 days for the region • Turnover of engineering works

Table 1 – List of value drivers and associated operational indicators

It should be emphasized that customer satisfaction is a key factor for the renewal of SDE's contract with the State and that, in 2010, the customer satisfaction survey gave a result of 86 %, above SDE's stated objectives.

10.5 Scope of assessment of the pilot project

The scope has been limited to those functions where the use of standards is particularly visible, and to those activities more closely related to the company's value drivers.

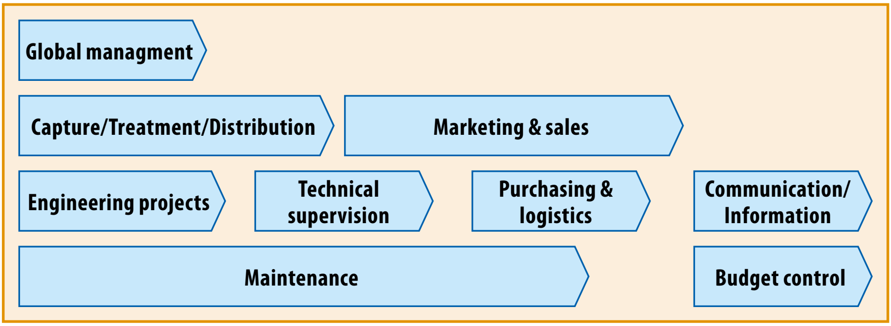


Figure 7 – Scope of assessment of the pilot project

10.6 Standards used in the company value chain

Functions	Standards used	Comments or definitions
General administration	ISO 9001 ISO 14001 OHSAS 18001	ISO 9001 is the most relevant
Purchasing & logistics	ISO 9001 ISO 14001 OHSAS 18001	No specific product or testing standards are used for checking products
Production	Afnor XP T 90-401 Afnor NFT 90-414 Afnor XP T 90-416 ISO 9001 ISO 14001 OHSAS 18001 WHO standards : Quality of drinking water	Note : • AFNOR XP T 90-401 : Testing water – Enumeration of micro-organisms revivable at 37 degrees celsius – Pour-plate technique • AFNOR NF T 90-414 : Water quality – Detection and enumeration of Escherichia coli and coliform bacteria – Part 1 : membrane filtration method • AFNOR XP T 90-416 : Testing water – Detection and enumeration of enterococci – General method by membrane filtration • WHO standards in the form of Directives related to water quality are used for water treatment and disinfection

Technical supervision (Research & development)	ISO 9001 ISO 14001 OHSAS 18001 Fascicule 71	Fascicule 71 is a technical regulation of the French governmental Ministry of Ecology, Sustainable development and Energy giving the general technical conditions for the supply and installation of aqueducts and water distribution applicable to civil engineering works
Maintenance	ISO 9001 ISO 14001 OHSAS 18001 NF C 15-100 NF X10-601 NEMA standards	Note : • Some NEMA standards (National Electrical Manufacturers Association of the USA) are used (more detailed information not available) • AFNOR NF C 15-100, Low-voltage electrical installations • AFNOR NF X10-601, Centrifugal, mixed flow and axial pumps – Code for acceptance tests – Class C
Engineering	ISO 9001 ISO 14001 OHSAS 18001 Fascicule 71	Fascicule 71 is a technical regulation of the French governmental Ministry of Ecology, Sustainable development and Energy giving the general technical conditions for the supply and installation of aqueducts and water distribution applicable to civil engineering works
Customer service Marketing & sales	ISO 9001 ISO 14001	Customer services and sales do not use any specific standard
Quality management	ISO 9001 ISO 14001 OHSAS 18001 NS 05-061 : water discharges NS 05-062 : air pollution	Note : NS stands for " Norme Senegalaise " • NS 05-061, Management of water discharges (this standard is an adjunct to the Environmental Code of Senegal) • NS 05-062, Air pollution. Discharge standards

Table 2 – Standards used in the company value chain

10.7 Selection of operational indicators to measure the impact of standards

Functions	Related activities	Value drivers	Standards used	Operational indicators	Definitions of indicators
General administration	Global management, global accounting and finance		ISO 9001 ISO 14001 OHSAS 18001	Tax administration	Respect of payment dates for monthly tax installments at a rate of 100 %
	Human resources	Control of costs related to staff		Control of number of staff	Reduced staff costs
Production	Capture-discharge-distribution	Quality of production processes	AFNOR XP T 90-401 AFNOR NFT 90-414 AFNOR XP T 90-416 ISO 9001 ISO 14001 OHSAS 18001 WHO standards : quality of drinking water	Respect of yield rate and production plan	Failure to meet the yield rate leads to penalties such as those specified in the contract binding SDE and SONES
	Treatment and disinfection	Quality of processes and treatment of products		Bacteriological and physico-chemical compliance	Failure to comply leads to penalties
Sub-maintenance (centralized function)	Maintenance	Compliance with maintenance schedules, curative and preventive alike	ISO 9001 ISO 14001 OHSAS 18001 NF 15-100 Electromechanical NEMA standards NF X 10-601 on pumps	Response time and equipment availability (in working order)	The control and reduction of response time is key to compliance with the company's production plan

Functions	Related activities	Value drivers	Standards used	Operational indicators	Definitions of indicators
Marketing & sales	Billing		ISO 9001 ISO 14001 OHSAS 18001	Sales	Increase in sales
	Recovery			Meeting the defined recovery rate	Meeting or excceeding the recovery rate allows the company to increase its turnover and financial performance
	Listening to customers			Claims processed on time	Efficient management of customer complaints reinforces the quality policy
Engineering	New works and renewal works		ISO 9001 ISO 14001 OHSAS 18001 Fascicule 71	Connections completed on time	Execution of on-time connections helps increase sales and contributes to customer satisfaction
Technical supervision	• Studies • Surveillance • Internal monitoring		ISO 9001 ISO 14001 OHSAS 18001 Fascicule 71	Savings on energy costs	Energy costs are most significant

Table 3 – Operational indicators to measure the impact of standards

10.8 Calculation of the economic benefits of standards

10.8.1 Economic benefits quantified during the assessment

Business functions (BF)	Operational indicators	Financial impact (XOF)	Comments
Purchasing and logistics	**Staff control**		By using ISO 9001, managerial staff has been reduced by 19 %, and work volume has increased. This reduction is explained by a better control of processes. The result could be better if the company had higher performing data management software in place. Spreading this reduction over a five year period gives a yearly average (19 %/5) of 3.8 %. Therefore the impact of the use of standards can be calculated as follows : XOF 1 477 636 336 × 21 % × 3.8 % = XOF 11 791 538
	Management expenses	1 477 636 336	
	% of staff costs	21 %	
	Effects of the use of standards (19 % reduction in staff over 5 years)	3.8 %	
	Total impact for this BF	**11 791 538**	
General administration	**Staff control**		Through the consistent implementation of ISO 9001, this function has been able to improve productivity – leading to an approximate 10 % reduction in staff in 2010. Because staff costs represent 70 % of the function's expenditure, the impact of the use of standards can be calculated as follows : XOF 945 419 532 × 70 % × 10 % = XOF 66 179 367
	Accounting and finance expenses	945 419 532	
	% of staff costs	70 %	
	Effects of the use of standards (10 % reduction in staff)	10 %	
	Total impact for this BF	**66 179 367**	
Customer and sales	**Policy to reduce paper consumption**		Application of ISO 14001 has enabled paper consumption to be reduced by 8 %. This reduction is mainly due to a policy of two-sided printing. Spreading this reduction over a six year period (2005 to 2011) gives annual average savings of 1.33 %. Therefore the impact of the use of standards can be calculated as : XOF 37 820 516 347 × 9 % × 1.33 % = XOF 45 271 158
	Management expenses	37 820 516 347	
	Share in paper supplies	9 %	
	Reduction in paper consumption in respect of the environment by applying ISO 14001.	1.33 %	
	Impact 1 (of 3)	**45 271 158**	

Business functions (BF)	Operational indicators	Financial impact (XOF)	Comments
Customer and sales	**Increase in sales**		An increase in sales of 4.8 % has been achieved in 2010 over 2009. Part of it (about 3.5 %) is due to a rise in the number of customers (increased demand). The other share (1.3 %) is due to increased consumption. The use of standards (primarily ISO 9001) has significantly contributed to this performance by : • Ensuring permanent water quality through the modernization of tools for technical surveillance, and customer relations management using ESRI (a mapping software integrating the call centre and cockpit) and the planning of interventions • 100 % commitment to the plan for monitoring water quality The impact of standards can therefore be estimated as follows : XOF 73 100 000 000 × 1.3 % = XOF 950 300 000
	m3 turnover in sales	73 100 000 000	
	Increase in sales	4.8 %	
	% attributable to standards	1.3 %	
	Impact 2 (of 3)	**950 300 000**	
	Improved recovery rate		A monitoring process for billing (setting up of two remote meters resulting in more accurate billing) enabled the recovery of over 200 000 m^3 at end 2010. The impact resulting from the application of this process is thus estimated at : XOF 73 100 000 000 × 0.17 % = XOF 124 270 000
	Total sales	73 100 000 000	
	Increase in sales owing to the number of m^3 recovered	0.17 %	
	Impact 3 (of 3)	**124 270 000**	
	Total impact for this BF	**1 119 841 158**	
Technical supervision	**Control of energy consumption**		Better control of planning and operations and in particular a stricter control of kWh/m^3 – actions undertaken since 2007 in the framework of the quality management implementation (including the set-up of an energy savings committee in charge of reviewing the use of energy) have led to 1.54 % savings in energy costs. The resulting impact in 2010 is estimated as follows : XOF 13 100 000 000 × 1.54 % = XOF 201 740 000
	Annual electricity costs	13 100 000 000	
	Savings in energy achieved through the application of a management system	1.54 %	
	Total impact for this BF	**201 740 000**	

Table 4 – Economic benefits quantified through the assessment

The **Table 5** recapitulates the impacts expressed per department and finally the total impact as a percentage of total sales revenues:

Functions	Financial impact of standards
Purchasing and logistics	11 791 538
General administration	66 179 367
Customer and sales	1 119 841 158
Technical supervision	201 740 000
Total contribution to the company EBIT (in XOF)	**1 399 552 063**
Total contribution to the company EBIT (in EUR) (There is a fixed exchange rate with the Euro : 1.000 XOF equal 1,53 EUR)	**2 133 600**
Contribution to EBIT as percentage of total sales	**1.91 %**

Table 5 – Impacts expressed per department and total impact as a percentage of total sales revenues

10.8.2 Another advantage of standards : Improved control of the network

In addition to the impacts mentioned above, a significant improvement in performance has been achieved through the actions below:

- The cutting off of water supply when populations move (this has solved the problem of significant leakages in flooded areas)
- Reconfiguration of the Afia area of the network
- 85 pipe and pipeline leakages repaired in time, saving 260m3/h water loss

These actions led to an increase in network performance of 5.15 % between 2000 and 2010, a yearly average of 0.51 %. The current performance (between 79 % and 80 % in the past few years) is not yet at the 85 % level required by the contract with SONAS. However, it should be noted that 85 % is a very ambitious target (even for industrialized countries).

While the actions mentioned in relation to improved control of the network have been undertaken and monitored in the framework of SDE's quality management system (and the latter has clearly contributed to achieving these results by supporting a continual improvement philosophy), it has not been possible to estimate the relative contribution of the use of standards in this area as compared to other factors.

10.9 Qualitative and semi-quantitative considerations

10.9.1 Summary by business function

The rigorous implementation of ISO 9001 and other management system standards has contributed to improving the monitoring and control of all the SDE departments analyzed throughout the study.

A summary of the most important qualitative benefits indicated by each business function is given below:

General administration

- A steady stabilization over time of costs related to maintenance, caretaking, auditor fees and telephone
- Efficient monitoring of operational costs (electricity, diesel and staff) responsible for 60 % of expenditure, according to a policy of improved productivity and more efficient management of electricity

Purchasing and logistics

Improvement in the supply of SDE's vehicle fleet through:

- Improved product conformity due to collaboration with suppliers having integrated their management systems
- Shorter delays in reaching contractual agreements because products are based on clearer specifications

- More accurate forecasts due to the controlled consumption of spare parts and products

Production

Improvements in activities related to water capture, discharge and distribution, such as:

- Staff performance in the measurement and analysis of results
- Implementation of a corrective action system as well as more efficient monitoring of the execution of action plans
- Better control of production through the use of scoreboards and management by objectives

Improvements in activities related to water treatment:

- More efficient organization
- Greater reliability of the results of water testing and analysis
- Faster response of staff in addressing water quality problems

Technical supervision

Improvements in activities related to studies, surveillance and internal monitoring:

- Better management of staff resources
- Better administrative management
- Easier exploitation of notice of tenders since the adoption of a quality management system by SONES
- Better management of energy resources

Marketing and sales

- Improved planning and deployment of staff
- Better organization, increasing SDE's capacity to meet demands without extra staff
- More efficient communication system
- Significant improvement in the response time for replacing meters

- Continual progress in customer satisfaction – the total number of customers satisfied with tap water delivered by SDE grew from 45 % in 2005 to 86 % in 2010

Engineering

- Improved monitoring of supply planning
- Improved conformity of engineering works by following specifications and keeping data files on supplies received and on nonconformities
- Setting up of a system allowing the assessment of engineering works immediately after completion
- Better administrative and technical organization through the development of procedures

Maintenance

- Setting up of a critical analysis system for certain practices
- Establishment of a more transparent organization with a more balanced distribution of workload
- Greater visibility of staff activities resulting in increased productivity

Between 2004 and 2010, SDE made significant efforts to ensure the smooth operation of all its facilities. Positive results were confirmed by a maintenance audit conducted in 2010, showing a 95 % rate of availability of equipment.

10.9.2 Specific considerations about work accidents

A safety, quality and environmental initiative enabled SDE to achieve improvements in the rate of accidents. The record covered 14 years (1997 to 2010) and, despite an atypical peak in 2000 (31 accidents) and 2001 (29 accidents), the number of accidents has steadily declined.

Year	Accidents	Lost workdays	Frequency rate	How serious
1997	24	510	8.8	0.2
2010	9	160	3.76	0.07

Table 6 – Number of accidents

This situation shows the positive impact of SDE's commitment to OHSAS 18001and certification against this standard.

Evolution of productivity

The quality management system has also enabled SDE to analyze and monitor key productivity rates. As can be seen from **Table 7,** productivity has steadily increased.

	2006	2007	2008	2009	2010	Improvement 2006/2010
Turnover/agent (M XOF/agent)	41.18	47.75	49.69	52.38	69.26	**68.19 %**
Number of subscribers/agent	372.6	404.7	425.6	446.2	456.5	**22.51 %**
M^3 sold/agent (Km^3/agent)	90.6	96.03	97.1	98.43	100.9	**11.36 %**

Table 7 – Productivity 2006-2010

10.10 Evaluation of results

The application of the methodology for assessing the economic benefits of standards for SDE has revealed a contribution to the company EBIT of XOF **1 399 552 063** (about USD 2 700 000) corresponding to 1.91 % of the company's total annual turnover in 2010.

This result was influenced by the following factors:

- The information from persons interviewed was mainly qualitative and therefore difficult, and sometimes impossible, to quantify
- The difficulty of determining precisely which part of a given impact was attributable to the use of standards

- The adoption of a prudent approach based on always assuming the lower value of a given range (for example, in the case of the accounting and financial management business function, costs attributed to staff were estimated between 70 % and 80 %, in which case the 70 % figure was used)

This indicates that, while already significant, the impact of standards for SDE is most probably underestimated. Information gathered through the interviews has also indicated that there is still potential for further process and performance improvements.

Some examples are given below :

- Corrective actions can be taken to increase the network yield, especially in flooded areas where the main connections are not systematically cut off when populations move, thus causing significant and continual leakage. This can make it impossible to access the areas to read meters or locate leakages
- The rate of recovery can be further increased by educating populations about certain detrimental practices such as, among others, damaging the network to bring water to cattle
- A new payment system, such as by Internet or mobile phone, would help to further increase customer satisfaction

It should be emphasized that, for SDE, the benefits of using standards have primarily been derived from a coherent and comprehensive application of the ISO 9001 and ISO 14001 philosophy. This has resulted in well-structured processes, in the use of indicators to monitor efficiency and effectiveness, and in the ability to undertake corrective or improvement actions – all of which have contributed to performance improvement.

10.11 Conclusions

The study has demonstrated that the use of standards contributes to the creation of value for SDE, with an estimated contribution to the company EBIT of XOF 1 399 552 063 (about USD 2 700 000) corresponding to nearly 2 % of the company's total annual turnover.

Use of standards is sometimes perceived as costly and therefore an obstacle to economic development. However, this assessment demonstrates that compliance with, and effective use of, standards is often accompanied by an improvement in productivity, a better customer satisfaction policy and enhanced economic performance.

This study has shown the positive impact of standardization for SDE. It provides a concrete example that can help to better inform Senegalese businesses of the advantages offered by standardization and, hopefully, to promote a proactive attitude towards standards.

While the result of applying the ISO methodology to a private company like SDE is convincing, it should be taken into account that SDE operates in an industry where competition is non-existent and, from a purchasing perspective, where customers do not have much choice. It would be interesting to carry out other studies of private companies operating in a " normal" competitive environment.

Finally, the adaptation and application of the assessment methodology to the public sector (non-profit enterprise) remains a necessity for developing countries like Senegal.

Mapei, Italy

Country : Italy
ISO member body : Ente Nazionale Italiano di Unificazione (Italian National Standards Body - UNI)
Project team :
Project leader : Mr. Ruggero Lensi, Director, External relations, New business and innovation, UNI
Consultant : Mrs. Adarosa Ruffini, Lawyer, Professor, University of Pisa
Member : Mrs. Clara Miramonti, Technical Officer, International Standardization, UNI
Member : Mr. Massimo-Maria Barbato, Student, Faculty of Management Engineering, University of Pisa
Member : Ms. Vanessa Valiani, Student, Faculty of Management Engineering, University of Pisa
ISO Central Secretariat advisor : Daniele Gerundino, Strategic advisor to the Secretary-General
Duration of the study : September 2011 – June 2012

Overview

The possibility of describing and quantifying the economic benefits of standards is of great importance in monitoring and addressing standardization activities, and for improving the awareness, the communication and the promotion of the use of standards. It also encourages the participation of interested parties in technical work in support of standards development.

For this reason, ISO developed and made available to its members, a study to support organizations in assessing the impact derived from the application of standards, or from the development of new standards.

Called the ISO Methodology, it is based on the value chain approach, consisting of a systematic representation of all the activities of an organization, including the suppliers' value chain, and on the principle of collecting data related to those business functions on which the impact of standards is evident, in order to convert them into business values for each single function and for the whole organization.

For the application of methodology in Italy, UNI, the national standardization body of Italy, assigned competent internal human resources and strengthened collaboration with the Faculty of Management Engineering of the University of Pisa. The Mapei Group was selected as the organization to be studied, representing the construction products and buildings sector of the chemical industry.

11.1 Objectives and organization of the pilot project

The scope of the project is to assess quantitatively the economic benefits derived from the application of International, European, national and other "external" standards by Mapei.

The project is based on the comparison between the situation before and after the application of specific standards over a period of time by selected business functions, and the successive assessment of benefits in terms of reduced costs, improvement in company and product quality, increased sales, income and profit, and growing market share.

11.2 Introduction to the company

Founded in Milan in 1937, Mapei was established to produce rendering and plastering mortars and wall coverings, and in particular, varnishes and waterproofing products. Later, Mapei diversified into the production of adhesives for floorings and wall coverings.

During the 1960s, in parallel with the growth of the Italian flooring and ceramic tile industry, Mapei recognized the need for adhesive materials that would make tile installation faster and more secure. As a result, the company developed products that provided its customers with timesaving processes, more reliable installations and better yields.

Following the world ceramic tile industry boom in the 1980s, Mapei implemented an internationalization strategy based on the development of new manufacturing plants and the acquisition of new companies in Europe, North America and elsewhere, to serve the needs of local markets and to reduce shipping costs to a minimum. The range of products became wider and included admixtures, parquet, resin floor coverings, textiles, waterproofing agents, thermal and acoustic insulation and sealants, and other building products.

Mapei developed an extensive technical-commercial network in the most important countries of the world, with a strong focus on logistics, fast product delivery (80 % of orders are delivered within 48 hours of receipt) and an efficient on-site technical assistance service, highly appreciated by designers and installers.

Today, the Mapei Group is the world's leading manufacturer of mortars, adhesives, grouts, sealants, waterproofing agents, additives for concrete and other specialty products for the building industry. The group comprises 68 subsidiaries, 18 main research and development centres, and 60 production facilities in operation in over 27 countries on the five continents, each with its own quality control laboratory. Total group revenue in 2010 was over EUR 1.8 billion.

Mapei has always placed great emphasis on research and development, aiming at improving the quality, safety and ease of use of its products. Today, the company's main R&D efforts are directed at developing eco-sustainable and environmentally friendly products.

Standardization, both at the European (CEN) and International (ISO) level, has been very important for Mapei, and its industrial processes have evolved in sync with the development and use of CEN and ISO standards for the sector (the importance of standards is paramount in Europe where CE marking of construction products is mandatory).

Standards are extensively used by several business functions of the company (that is, technical assistance, marketing, quality assurance and laboratories) and are considered as an assurance of customer care.

Since 1994, Mapei has implemented a quality system in conformity with ISO 9001, later integrated with ISO 14001 and OHSAS 18001. Management systems standards have played a very important role for Mapei, as described in the following sections.

11.3 Company attitude towards standardization

Mapei is a company strongly engaged in standardization, both in terms of application of standards and of participation in standards development.

The company rigorously applies existing voluntary standards relevant to its products (mainly EN and ISO, (as shown in **Table 1,** see 11.6) in the framework of its core business processes and functions, particularly in relation to quality control and compliance.

Mapei also participates actively in the development of standards within UNI's specialized Italian national mirror committees, and often represents Italy in CEN and ISO technical bodies (covering the field of adhesives for ceramic tiles).

Standards for terminology, testing and product properties are considered important tools that help to harmonize and streamline the company's design and manufacturing processes.

Moreover, product standards are seen by Mapei as strategic tools that support its value proposition and its perception by customers, because :

- By defining broadly accepted parameters to determine product characteristics and performance, standards help to clearly differentiate products on the market
- In such a way, standards contribute to spreading a " culture of quality", making it easier for customers to understand the benefits of higher quality products. This contributes to strengthening Mapei's competitive advantage, resulting from the company's focus on product quality and innovation

Management system standards also play a very important role at Mapei.

The company has thoroughly implemented ISO 9001 and other management system standards that have supported it in its fast but sustainable international expansion (between 1994 and 2012, the number of Mapei manufacturing plants around the world grew from six to 60).

11.4 Value chain analysis

11.4.1 Industry value chain

Italy is the third largest chemical producer in Europe, following Germany and France. The chemical industry sector comprises some 3 000 companies and 115 000 employees, and had a production value of EUR 52.6 billion in 2010 (pharmaceutical industry excluded).

Mapei is the third largest Italian chemical group and is specialized in the construction sector. The company makes use of raw materials – mainly non-organic such as cements and sands – operates batch manufacturing processes and, as final products, delivers chemical specialties to the construction sector (such as mortars and adhesives), as well as consumer products (such as sealants and varnishes).

The company is significantly integrated upstream, having acquired over time a number of suppliers of strategic raw materials, such as Gorka Cement in Poland (supplier of aluminous cement), and VAGA. (high quality sands) and Vinavil (vinyl acetate polymers) in Italy. Mapei also has a significant international network of suppliers of key raw materials such as aluminous cement and sands. Given the relatively low cost and high incidence of transport for such raw materials, the suppliers' proximity to the manufacturing plants serving local markets is very important.

Mapei operates through a diversified network of distribution channels including retailers of construction and building material products, contractors (typically for large scale projects) and a variety of associated professionals (such as architects, quantity surveyors, structural engineering consultants, installers). Helping distributors and installers to get the most from Mapei's products is a company priority – information services, on-site assistance and vocational training for retailers and professionals are strong and distinctive elements of Mapei's value proposition.

As a specialty supplier to the construction industry, the company is primarily connected to the dynamic of this sector. The global recession has led to a sharp downsizing of several important construction markets (including, in particular, Italy) over the last five years. This has clearly had an impact on Mapei's performance. However, by pursuing a strategy oriented towards product innovation, quality of service and internationalization strategy, the company has been able to continue to grow and maintain its profitability.

11.4.2 Company value chain

Since 1994, Mapei has implemented and continually upgraded a quality management system in conformity with ISO 9001. This system, designed and operated to meet customer needs, was then improved and integrated with other management systems in accordance with international standards (see **Figure 1)**.

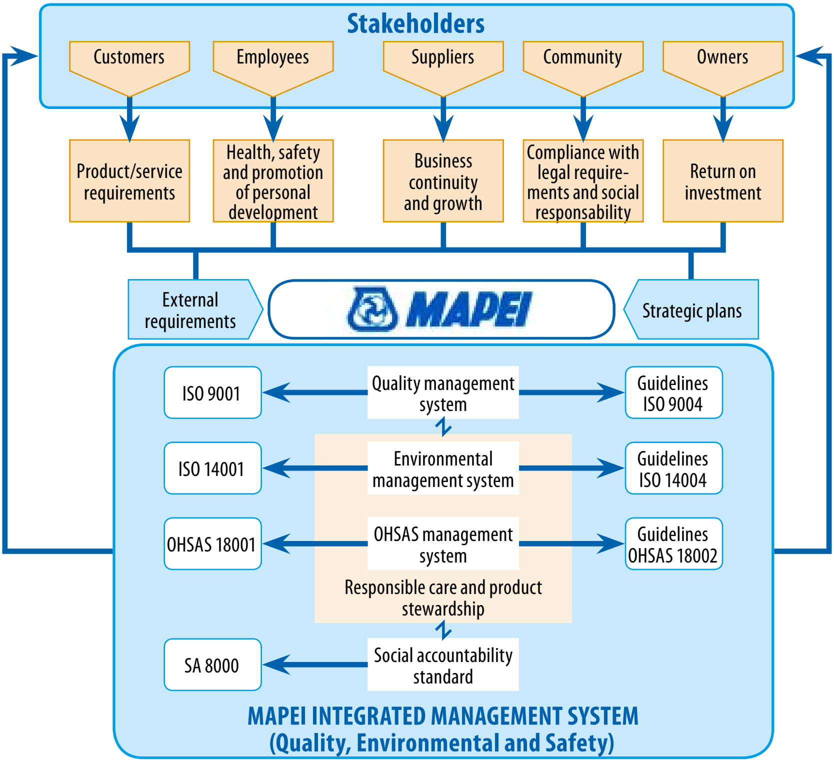


Figure 1 – Interaction among interested parties and the integration of management systems

The integrated management system has a prominent role in Mapei's strategy and operational culture. The company value chain and core business processes (with related business functions) are represented using as a reference the P-D-C-A (Plan-Do-Check-Act) framework adopted by all ISO management system standards (see **Figure 2)**.

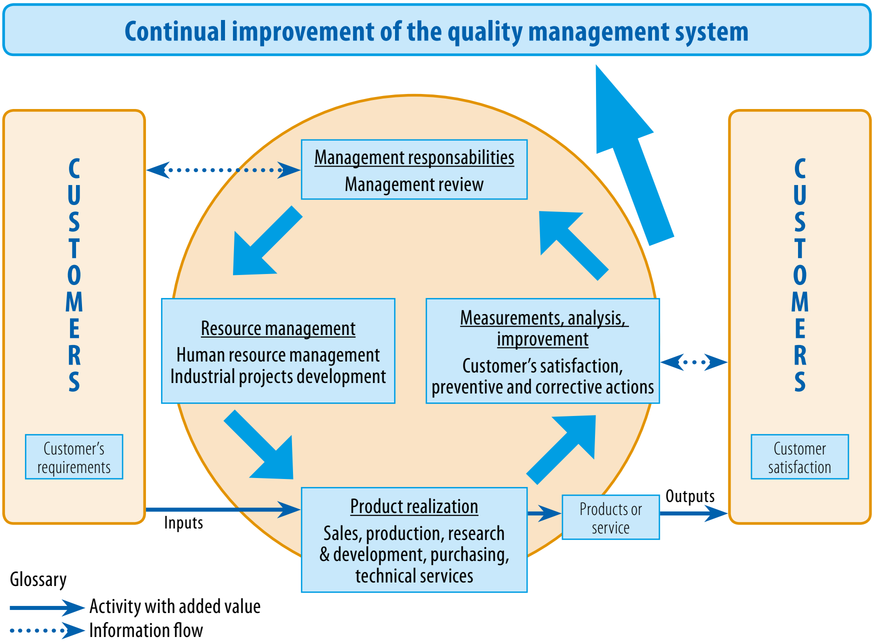


Figure 2 – Management system business model based on processes

From Mapei's documentation, it is clear that particular attention is given to customers and to building sector professionals.

Mapei's business processes are structured on the notion that the company's success strongly depends on its capacity to understand and meet the needs of its customers and final users, offering them competitive solutions with high added value, both in terms of product performance and service.

Analysis and planning of customer requirements is at the basis of the sales process, which comprises the following activities :

- Pre-sale, when objectives and dedicated budgets are defined and offers to existing and potential customers are made
- Order processing
- Product delivery

- Analysis of sales results (including profitability) with a view to defining future corrective actions. The outcome of this analysis becomes part of the input of subsequent sales processes, aiming at continual improvement of the process

During the different phases of the sales process, the technical assistance service is always at the customer's side, providing prompt and effective responses to avoid any technical problems in the use of products and, in this way, contributing to customer loyalty.

Production amounts to some 16 000 tons of finished products per day, and more than 1 000 different types of products. Total production is over 3.7 million tons per year. Just in time logistics enables Mapei to process 80 % of orders within 48 hours (both packaged and bulk products).

The efficiency of the logistics process is another key element of Mapei's success.

11.4.3 Key value drivers

Four key value drivers have been identified on the basis of information gathered through interviews and official company documents (quality manual and others):

- **Product innovation**, that is, the capacity to transfer the results of research and development into commercial products, thus continually improving the company portfolio
- **Product quality and reliability**
- **Customer service**, in particular, technical assistance to guarantee the optimal use of company products, and an efficient delivery service to provide products with minimum possible delay
- **Health, safety and environmental protection**, ensuring that the performance of Mapei's products and processes exceed legal requirements for compliance.

It is important to emphasize that these value drivers, strongly rooted in a quality-oriented, continual improvement philosophy, have been clearly recognized and confirmed by all the staff members interviewed during the study. In other words, it seems clear that they effectively guide the company's strategy and operations.

11.5 Scope of the assessment

It was decided to focus the analysis on Mapei's adhesives for ceramic floor and wall tiles business, since 40 % of sales are derived from this single product line, while the remaining 60 % is covered by other eight product lines.

It was also decided to investigate the issue of Volatile Organic Compounds (VOCs). VOCs are emitted as gases from certain solids or liquids, and include a variety of chemicals that may have short- and long-term adverse health effects. They are present in various products, especially resins, and are of growing concern in relation to health and safety. They also raise environmental concerns associated with substances used for construction.

It should also be noted that questions regarding the impact of Mapei's integrated management system could not be restricted to the adhesives business line alone, and estimates have been calculated for the whole company.

Standards define an " adhesive" as a non-metallic substance capable of joining materials by surface adhesion and cohesion. Adhesives for tiles are defined on the basis of the chemical nature of their binders. They present specific characteristics in terms of applicability, properties and final performance, and, according to ISO 13007 (or European EN 12004), they are classified as cementitious, dispersion and reaction resin adhesives.

Cementitious adhesives, designated as " type C", are a mixture of hydraulic binding agents, aggregates, and organic additives (for example, latex polymers, moisture retention additives, etc). These adhesives are mixed with water or a liquid admix just before use.

Dispersion adhesives, designated as " type D", are ready-to-use mastic type mixtures of organic binding agents in the form of an aqueous polymer dispersion, containing organic additives and mineral fillers.

Reaction resin adhesive, designated as " type R", are single or multi-component epoxy or urethane based mixtures of synthetic resin, mineral fillers and organic additives in which curing occurs by chemical reaction.

ISO 13007 requires that an adhesive pass certain minimum performance tests before it may be accredited with a Performance Classification. This classification is expressed as letters and numbers in an easy-to-use and understand code. For each type of adhesive, it is possible to have one of two classes, and different optional characteristics of the adhesive based on performance (fast-setting/drying, slip-resistance, extended open time, exterior glue plywood, deformability). The designation of the adhesive consists of the letter for the adhesive type (C, D or R), followed by the number of the class (1 or 2), and/or the corresponding letter for the characteristic(s) of the adhesive (F, T, E, P and S).

Mapei's primary offer consists of cementitious adhesives (type C adhesives). The manufacturing process is managed by computerized numerical control (CNC) machines that mix and transfer raw materials and components from storage systems and silos to mechanically packaged boxes. Output is in the order of 70 bags per minute, which means, for standard packaging of 25 kg per bag, a production rate of 36 kg per second.

11.6 Use of standards in the company value chain

Four Mapei business functions have been identified as primary standards users:

- Technical assistance (11.6.1)
- Sales department (11.6.2)
- Research and development (11.6.3)
- Quality assurance (11.6.4), in particular Production and logistics.

The following table lists the standards used by the Mapei Group, with a focus on ceramic tile adhesives and volatile organic compounds (VOC).

Management system standards
EN ISO 9000:2005, *Quality management systems – Fundamentals and vocabulary*
EN ISO 9001:2008, *Quality management systems – Requirements*
EN ISO 9004:2009, *Managing for the sustained success of an organization – A quality management approach*
EN ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*
ISO 10001:2007, *Quality management – Customer satisfaction – Guidelines for codes of conduct for organizations*
ISO 10002:2004, *Quality management – Customer satisfaction – Guidelines for complaints handling in organizations*
EN ISO 19011:2011, *Guidelines for auditing management systems*
OHSAS 18001:2007, *Occupational health and safety management systems – Requirements*

Product standards

European Standards	International Standards
EN 12004:2008, *Adhesives for tiles – Requirements, evaluation of conformity, classification and designation*	ISO 13007-1:2010, *Ceramic tiles – Grouts and adhesives* – Part 1 : *Terms, definitions and specifications for adhesives*
EN 1308:2007, *Adhesives for tiles – Determination of slip*	ISO 13007-2:2010, *Ceramic tiles – Grouts and adhesives* – Part 2 : *Test methods for adhesives*
EN 1323:2007, *Adhesives for tiles – Concrete slabs for tests*	
EN 1324:2007, *Adhesives for tiles – Determination of shear adhesion strength of dispersion adhesives*	
EN 1346:2007, *Adhesives for tiles – Determination of open time*	
EN 1348:2007, *Adhesives for tiles – Determination of tensile adhesion strength for cementitious adhesives*	
EN 12002:2008, *Adhesives for tiles – Determination of transverse deformation for cementitious adhesives and grouts*	
EN 12003:2008, *Adhesive for tiles – Determination of shear adhesion strength of reaction resin adhesives*	
EN 1347:2007 Adhesives for tiles – Determination of wetting capability	
EN 13888:2009, *Grouts for tiles – Requirements, evaluation of conformity, classification and designation*	ISO 13007-3:2010, *Ceramic tiles – Grouts and adhesives* – Part 3 : *Terms, definitions and specifications for grouts*
EN 12808-1:2008, *Grouts for tiles* – Part 1 : *Determination of chemical resistance of reaction resin mortars*	ISO 13007-4:2010, *Ceramic tiles – Grouts and adhesives* – Part 4 : *Test methods for grouts*
EN 12808-2:2008, *Grouts for tiles* – Part 2 : *Determination of resistance to abrasion*	
EN 12808-3:2008, *Grouts for tiles* – Part 3 : *Determination of flexural and compressive strength*	
EN 12808-4:2009, *Grouts for tiles* – Part 4 : *Determination of shrinkage*	
EN 12808-5:2008, *Grouts for tiles* – Part 5 : *Determination of water absorption*	
EN 14891:2007, *Liquid applied water impermeable products for use beneath ceramic tiling bonded with adhesives – Requirements, test methods, evaluation of conformity, classification and designation*	ISO/NP 13007-5, *Ceramic tiles – Grouts and adhesives* – Part 5 : *Liquid applied waterproof membranes for the installation of ceramic tiles*

VOC standards
EN 13999-2:2007, *Adhesives – Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application* – Part 2 : *Determination of volatile organic compounds*
EN ISO 16000-9:2006, *Indoor air* – Part 9 : *Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method*
EN ISO 16000-10:2006, *Indoor air* – Part 10 : *Determination of the emission of volatile organic compounds from building products and furnishing – Emission test cell method*
EN ISO 16000-11:2006, *Indoor air* – Part 11 : *Determination of the emission of volatile organic compounds from building products and furnishing – Sampling, storage of samples and preparation of test specimens*

Table 1 – The most important standards used by Mapei

11.6.1 Technical assistance (Milan headquarters)

The department is composed of 20 people, assisting clients by providing advice over the phone or, for more complex cases, intervening directly on site. The department is also involved in at least four major construction projects (worldwide) per year.

Its main activities are :

- To prepare and handle the technical product documentation
- To assist the customer in choosing and using the product suitable for the intended use
- To organize courses for final users, mainly installers and designers
- To handle complaints, in accordance with ISO 10002

The main benefit resulting from the use of standards, as indicated by the departmental managers, is their contribution to bringing clarity on the level of performance of the various types of products available on the market.

Another significant benefit is the simplification of the procedures for certifying conformity in different countries.

11.6.2 Sales

The activity of this department is focused on product sales, performed primarily through the company's worldwide network of retailers. Major construction projects covered directly by Mapei represent approximately 20 % of total sales (half of which are ceramic tile adhesives). In these cases, the sales department collaborates with the technical assistance department to support customers in preparing specifications, and in discussing all sales details directly on site.

The sales department is also responsible for analyzing the market situation and monitoring variations to help meet customer needs, and to examine the products offered by competitors (this activity is undertaken in cooperation with the R&D function).

The main benefits resulting from the use of standards, as outlined by the departmental managers, are the same as indicated by the heads of technical assistance – although the impact perceived by sales is lower.

One point underlined by the sales department is that, in certain markets, the lack of an effective system of market surveillance capable of verifying the conformity of certain products delays the development of a quality-oriented culture.

Finally, the department underlined the important role played by the quality management system in improving customer relationship tasks, and particularly in better management of complaints.

11.6.3 Research and development (into ceramic tiles, cementitious adhesives and other underlayer products)

Centralized in Milan, the R&D department is responsible to the Mapei Group for:

- The development of new products, and improvement of existing products

- The definition of product specifications and testing
- The definition of raw material requirements and their approval
- The development of formulas used in production

In addition, R&D is involved in the certification of new products (CE marking, etc.).

Recently, the laboratory also introduced an important programme to determine the release of VOCs from products, thanks to air and test chambers which allow preliminary verification of conformity to standards, the definition of new testing methods, and the evaluation of existing methods/schemes (EN 13999, ISO 16000 – Parts 3 to 6).

Standards are considered very important by the R&D department. In line with the view of the technical assistance department, R&D believes that standards are essential in providing clear and objective information about product quality to markets and customers.

In more general terms, R&D confirmed that the use of product and testing standards had been embedded in Mapei's business processes and practices for a long time, and that while the company believes such standards to be helpful, it is difficult to assess their precise contribution.

Some specific advantages (in cost savings) were identified in relation to:

- The selection and testing of raw materials during the start-up of new manufacturing plants (standards bring clarity in the dialogue with suppliers, and reduce transaction costs)
- The development of new products (standards, and in particular international standards, enable greater reliance on laboratory testing, reduce the need for field trials, and support more efficient production scale-up).

11.6.4 Quality assurance

A quality management system was introduced by Mapei in 1994 and has been continually upgraded since. The system was initially focused on manufacturing, and was gradually extended to cover sales and marketing activities. It was then complemented by environmental and safety management systems, and combined into an integrated system. This integration of several management systems into a single corporate model and its certification by internationally recognized accreditation and certification bodies, is an important element of Mapei's business strategy.

This approach, through the harmonization of activities and corporate procedures, has significantly contributed to the internationalization of the company and its ability to target and serve new markets in an efficient and effective way.

The integrated management system has allowed Mapei to rationalize and replicate its business development model in different countries, based on a gradual "take-up" through the introduction of simple products, followed by an upgrading of the market by progressively widening the product range.

11.7 Selection of operational indicators to measure the impact of standards

As indicated in the previous section, product and testing standards have been embedded for a long time in Mapei's business processes and practices, and it was considered difficult to quantify their impact on specific company activities – especially in relation to cost reductions associated with operational improvements. The company does not have mechanisms in place to measure the impact of standards in a structured way. At this stage, any analysis should have been performed through " what if" assumptions (assessing how different activities would be if standards were not available).

Bearing in mind that the perception of the most important benefits of standards related to their contribution to company growth – a perception shared by all those interviewed – it was decided to focus on two key indicators (as shown in **Table 2)** that could be clearly connected to the company's value drivers:

Value drivers	Operational indicators
Product innovation	Financial impact of the transition to a new generation of products of higher quality (a transition partly driven by standards)
Product quality and reliability	Contribution of Mapei's integrated management system to its international expansion
Customer service	
Health, safety and environmental protection	

Table 2 – Operational indicators used to assess the economic benefits of standards

The analysis regarding the first indicator ("Transition to a new generation of products") was restricted to the product line " Cementitious adhesives (type C adhesives) for ceramic tiles" on the Italian market. The analysis regarding the second indicator ("Contribution of Mapei's integrated management system") concerned the whole group.

11.8 Calculation of the economic benefits of standards

11.8.1 Transition to a new generation of higher quality products

In the last decade, sales of adhesives for higher quality ceramic tiles – the so called " improved concrete adhesives" (class C2, according to

ISO 13007) – have continually increased in comparison to the lower range "concrete adhesive with normal setting" (class C1) products.

Consequently the decade from 2002 to 2011 was chosen as the basis for quantifying the economic benefits of standards, along with two factors – the increase in profitability resulting from the changing mix of sales between class C2 and class C1 products, and the contribution of standards to the transition process.

The analysis was not straightforward due to the dynamics of the ceramic tile market, and this had to be factored in, as described below.

The sales trend in ceramic tiles was taken as a reference since there is a logical link between sales of ceramic tiles, and the sales of adhesives.

Figure 3 indicates that sales had grown moderately in the period 2002-2007, with a sharp decline from 2008-2011 due to the economic recession.

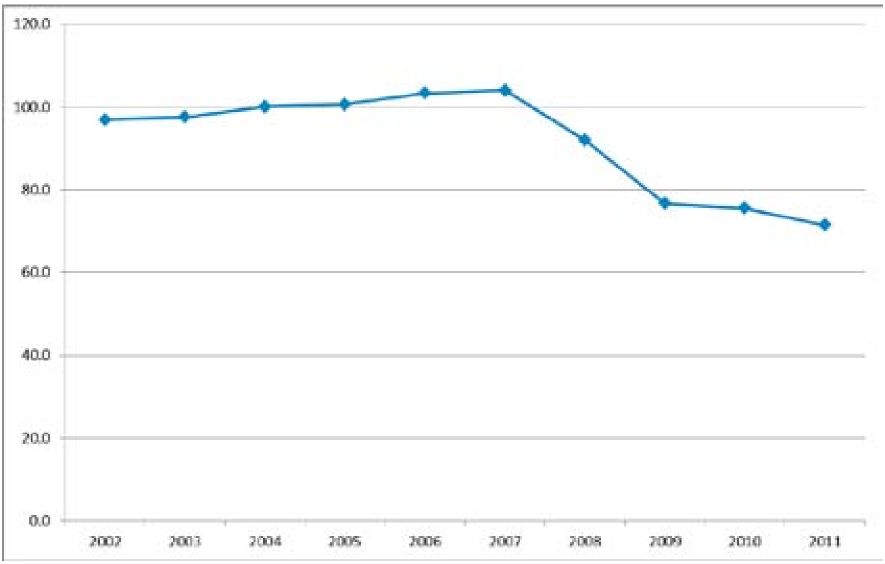


Figure 3 – Total sales of ceramic tiles in Italy

Over the same decade, Mapei's sales of adhesives for tiles (classes C1 and C2 combined) grew substantially during 2002-2007, declined between 2007 and 2009, and remained stable in 2010 and 2011. **Figure 4** compares the ceramic tile sales trend with that of Mapei's adhesives.

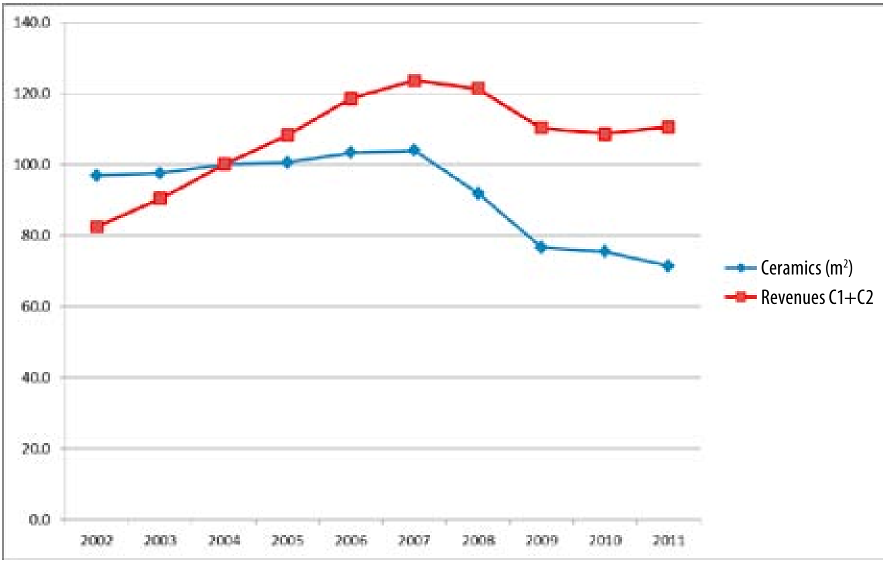


Figure 4 – Trends in sales of ceramic tiles and Mapei's class C1+C2 adhesives in Italy

The distribution of sales revenue between Mapei's class C1 and C2 adhesives product lines over the decade is shown in **Figure 5.**

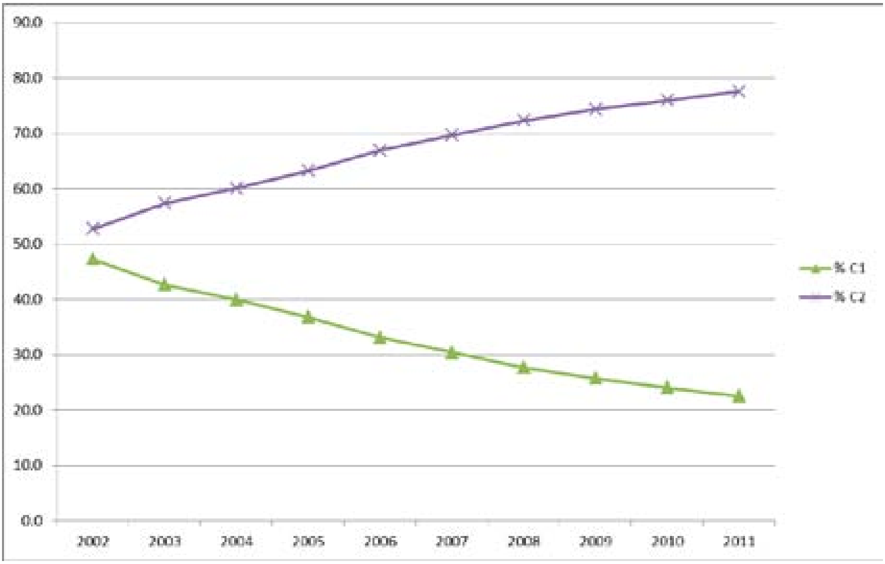


Figure 5 – Distribution of sales revenue between class C1 and C2 product lines (%)

Class C2 products have grown steadily from slightly over 50 % of the mix in 2002, to nearly 80 % in 2011.

Product standards and the European CE marking practice have contributed to disseminating clear and objective information on product performance, and have facilitated the transition toward higher quality products (which provide considerable user benefits in terms of ease and speed of installation and better handling of installations of different tile surfaces, including large format tiles).

By comparing the total sales of Mapei's adhesives with those of ceramic tiles, it is possible to evaluate the differential in relative annual growth. For the 10 year period analysed, this corresponds to an average annual differential equal to $\Delta m = 5.72\,\%$ (see **Figure 6)**.

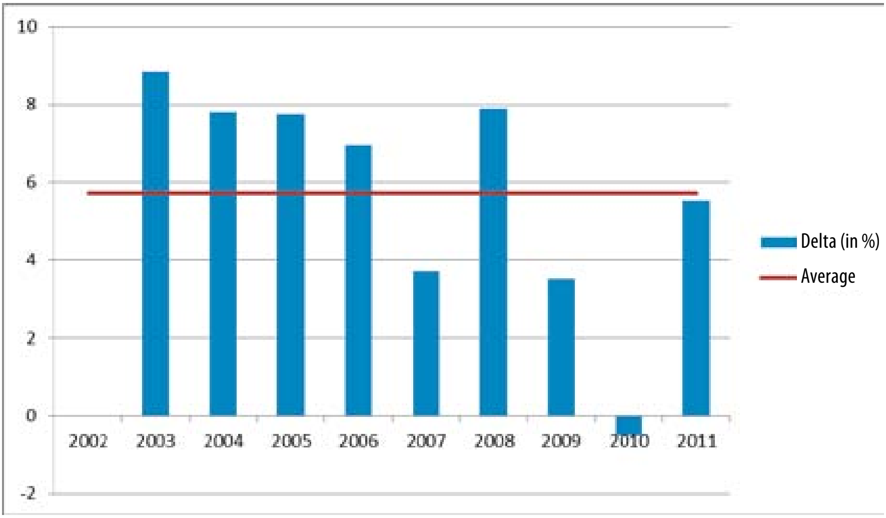


Figure 6 – Differential in sales growth between ceramic tiles and adhesives

Based on input provided by the Mapei managers interviewed (and taking a median value between the figures provided by those in charge of the departments concerned), it was estimated that technical product standards and CE marking have contributed about 35 % of this result. It is therefore possible to estimate that over the last 10 years standards have contributed to an annual growth equal to $5.72 \times 0.35 = 2.002\,\%$ of total adhesives sales.

In the same period, Mapei's turnover in Italy increased from EUR 272 million in 2002 to EUR 510 million in 2011. The available financial and consolidated statements for the four years 2007-2010 indicate an average annual EBIT (earnings before interest and taxes – gross profit) equal to 9.3 %. Projecting this data across the whole decade, and considering that in the first five years the company achieved higher profitability, it is reasonable to assume a conservative overall average EBIT of 10 %.

The average annual turnover of ceramic tile adhesives over the same period was EUR 121.4 million. Assuming profitability for this product in line with the company's average profitability, its annual contribution to Mapei's EBIT would be about EUR 12 million. It is therefore possible to estimate that the use of technical product standards has contributed at least $12 \times 2\,\% = 0.24$ or EUR 240 000 per year directly to Mapei's EBIT in Italy.

In view of the fact that the average EBIT of the Mapei Group is nearly double that of Mapei Italy, the extrapolation of the previous estimate on a global scale would lead to a total contribution of standards to group EBIT of about EUR 480 000 per year.

11.8.2 Implementation of Mapei's integrated management system on a global scale

The Mapei strategy of internationalization is based on two fundamental objectives – proximity to local needs and reducing to a minimum the cost of transporting raw materials and finished products. Mapei aims at being as close as possible to its customers, and believes that it is a major strength to be able to understand the specific needs of customers from each country, and to trust local management and personnel.

As stated in section 11.6.4, the implementation of an integrated management system (covering quality/safety/environmental aspects) has been a core element of Mapei's strategy, facilitating the structuring and harmonizing of business processes with market growth objectives, and combining specific local requirements with knowledge and experience acquired on a global scale.

Mapei's senior managers believe that this approach has significantly contributed to Mapei's ability to target and serve new markets in an efficient and effective way.

Figure 7 highlights the correlation between the development of new plants and the number of certified Mapei subsidiaries, focusing on quality management systems based on ISO 9001 (the first standard implemented by Mapei, initially applied to manufacturing).

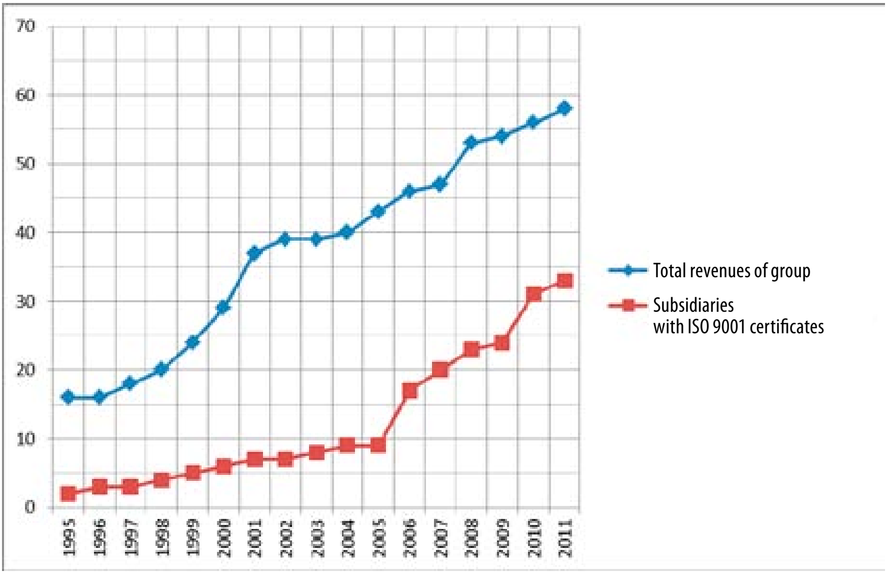


Figure 7 – Number of new Mapei manufacturing plants and ISO 9001 certifications worldwide

Mapei's management sees a causal correlation between the growth of its industrial plants globally, based on a certified quality management system, and the rapid sales growth achieved. Over the 10 years from 1995 to 2006, there has been a clear link between the number of group subsidiaries certified and total group turnover, as highlighted in **Figure 8.**

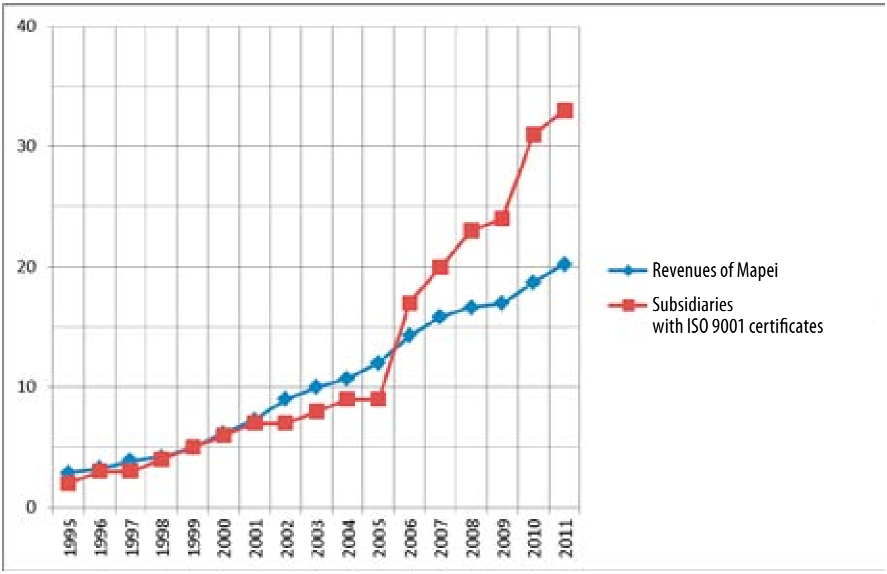


Figure 8 – Number of ISO 9001-certified Mapei subsidiaries and group revenue (×100 EUR million)

The Compound Annual Growth Rate (CAGR) of Mapei Group sales in the period 2002-2011 was 11 %, with an average annual turnover increase of about EUR 130 million. In the opinion of the senior managers interviewed, the company's management system has played a critical role in supporting group profitability and its rapid international expansion. The most conservative valuation has indicated the contribution of management system standards in the order of 20 %. On the basis of this valuation it is possible to estimate the contribution of standards to the growth in company turnover at about EUR 26 million per year.

According to consolidated balance statements, the average EBIT of the Mapei Group for the period 2007-2010 was equal to 6.3 % of total consolidated group turnover. Assuming conservatively the same figure for the whole decade, it is possible to make a rough estimate that management system standards have contributed directly to the EBIT of the Mapei Group at a rate of EUR 1 638 000 per year ($26 \times 6.3\,\% = 1\,638$).

11.8.3 Summary of results

The conclusions reached under sections 11.8.2 and 11.8.3 take two different aspects into consideration. It is possible that there might be some overlap between the two contributions to company gross profit resulting in some double counting.

However, considering the very different nature of the contributions (in one case regarding a specific product sales dynamic, in the other a systemic process of international expansion), it is considered reasonable to ignore possible overlaps and combine the two impacts.

The final results are summarized in **Table 3.**

Operational indicators	EBIT impact (EUR)
Impact of the transition to a new generation of products of higher quality (a transition partly driven by standards)	480 000
Contribution of Mapei's integrated management system to its international expansion	1 638 000
Total impact	**2 118 000**
Impact as a % of Mapei Group EBIT (2010)	2.9 %
Impact as a % of Mapei Group consolidated sales (2010)	0.14 %

Table 3 – Summary of results

11.9 Qualitative and semi-quantitative considerations

Participation in standards development

The analysis has shown that Mapei places great importance on active participation in standards development. While quantitative benefits linked to such a participation are difficult to demonstrate, the company nevertheless clearly identifies important qualitative advantages.

According to Mapei, there are three key advantages of participation in standards development:

1. The possibility of influencing the content of standards in a direction coherent with the knowledge and good practices applied by the company, and of elevating the minimum level of performance/quality (based on reasonable compromises acceptable to the producers of the least expensive products). The definition of test methods with all the related details and implications represents a particularly important example
2. The opportunity to acquire better knowledge of the needs, behaviour and strategies of producers active in markets for which Mapei has limited experience
3. The possibility for laboratories participating in standards development to have immediate access to new test methods during the steps in the standards development process, thus reducing technological development cycles and time-to-market.

These advantages must always be balanced with the potential disadvantages of sharing company know-how with competitors (a particular sensitive issue for a market leader). However, the extensive experience acquired so far indicates a positive trade-off for Mapei.

Use of standards

In addition to the benefits quantified in Section 11.8, many other benefits resulting from the use of technical standards have been identified by the study, although they can only be described, at this stage, in qualitative terms. Some of the most important are summarized below by business function:

Research and development

Advantages provided by use of product and technical testing standards include:

- The selection and testing of raw materials during the start-up of new manufacturing plants – standards bring clarity in the dialogue with suppliers, and reduce transaction costs
- The development of new products – standards, and in particular international standards, enable greater reliance on laboratory testing, thus reducing the need for field trials, and support more efficient production scale-up.

Logistics

The application of management systems to the logistics chain has supported the rationalization of processes that have a direct influence on customer satisfaction and loyalty. For example, the implementation of environmental management systems has helped promote the use of rail transport, particularly which has reduced the loss of aluminous cement due to ruptured bags in transit.

The consistent application of continual improvement practices has helped to better control the loading and circulation of trucks, and reduce the time taken. Moreover, further improvements in scheduling have led to the effective management of lower volume shipments, helping dealers to reduce stocks without affecting delivery times.

Production

The optimization of processes and environmental management has led to a significant improvement in waste management at the Mediglia production unit close to Milan – the company's most important manufacturing plant.

To reduce the potential for nonconformities, the production process has been adapted to favour maximum recovery of powder products (easier to re-use than liquids), thus reducing the impact and cost of disposal operations. Similar measures have been taken to manage other waste materials, thus reducing the amounts for disposal, leading to economic benefits and increased environmental respect.

11.10 Evaluation of results

Mapei is a market leader with a long-standing tradition of interest and involvement in standardization.

The analysis has shown that:

- Standards are part of the company culture and are extensively used by many business functions. Their contribution to supporting operational efficiency is clearly recognized by the company, although, being part of consolidated business practices, is very difficult to quantify
- Standards are also perceived as strategic tools that support the company's business development. Today this seems to be the most important aspect for Mapei, and the main effort of the study has been dedicated to identifying specific examples of this kind, with a view to quantifying the direct economic benefits created by standards
- The active involvement in standards development is clearly related to the two items above – participation is indeed seen as a way

to strengthen technical and business knowledge, with a positive effect on operational efficiency and on the possibility of gaining competitive advantage.

The economic benefits of standards quantified by the study are significant, particularly considering that the analysis has been restricted to two business cases and that many impacts of standards identified by the study could not be quantified.

11.11 Conclusions

The outcome of the study confirms that standards have an impact on Mapei's value drivers:

- Product innovation
- Product quality and reliability
- Customer service
- Health, safety and environmental protection.

The economic value generated by standards in support of Mapei's business development has been estimated in relation to two specific business cases, resulting in a contribution of over EUR 2 million to group EBIT (about 3 % of the total group EBIT in 2010, corresponding to 0.14 % of consolidated group sales).

These results are encouraging and indicate that standards generate a direct economic benefit that is possible to quantify through dedicated analysis.

It is important to underline that it is difficult to determine precisely which part of a given impact is attributable to the use of standards as opposed to other factors. The results of the study are based on best estimates made by the persons interviewed (business managers and technical experts from the selected business functions), and on assumptions and extrapolation made by authors of the report on the basis of official company data. A conservative approach has been followed, using lower or medium-end estimates.

The benefits that have been quantified relate to a very interesting and important role of standards for the company – how they support its business development. However, it is also important to recall that standards bring significant additional benefits, in most cases identified at a qualitative or semi-quantitative level.

Annex: The ISO Methodology to assess the economic benefits of standards

A.1 The ISO Methodology

The ISO Methodology provides a consistent framework of criteria, guidelines and tools to assess the economic benefits of standards from the perspective of individual organizations. The organizations addressed are mainly companies (for-profit organizations), but it is also possible to apply the methodology to analyze other types of organizations (e.g. from the public sector).

This practical introduction gives an overview of the methodology and its objectives, describes the key stages of the assessment process, and contains references to some of the tools which should be applied. It is intended to provide an easy, condensed presentation of the key methology elements and concepts, including practical advice on steps in the assessment process and on methods to calculate the benefits of standards.

A.2 Who is interested in applying the ISO Methodology ?

Many organizations and individuals are potentially interested in applying the ISO methodology, including ISO and its members, the National Standards Bodies, other standards development organizations (SDOs), companies and academic institutions.

ISO and National Standards Bodies (and possibly other SDOs) are interested because the application of the ISO Methodology will help them to systematically assess the economic benefits of standards :

- To enable stakeholders in private and public sectors to appreciate better the economic and social impact of voluntary consensus standards
- To raise the awareness of policy makers and business leaders about the importance of standardization

Companies and other standards users are interested because application of the methodology can help them to understand better the activities and processes of the organization related to the use of standards, with a view to improving performance and maximizing the benefits derived. Companies can use the same approach and tools provided by the methodology to investigate the impact of company-internal standards.

Academic institutions are interested because the application of the ISO Methodology will help them develop original case studies and capture information which can be used to support education and research activities related to standards.

A.3 Key questions addressed by the methodology

The methodology addresses the following **core question** :

- *What is the contribution of standards to corporate value creation ?*

" Standards " in the ISO Methodology are not limited to those developed and published by ISO, but comprise all consensus-based standards developed outside an organization through an open process. This includes International Standards, regional and national standards, standards developed by other standards development organizations, and also consortia standards if the consortia are open to participation by interested parties. Company-internal standards are excluded from the assessment, although the impacts from such standards can also be assessed using the same approach and the same set of tools.

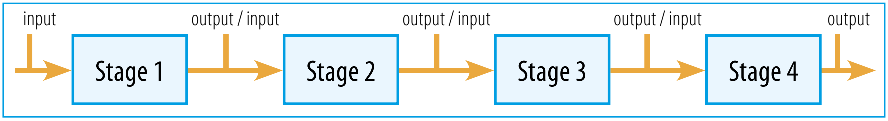
Other questions that can be addressed together with, or as a result of, the core question are :

- **Context question :** How do industry and company specifics impact corporate value creation arising from standards ?
- **Capability question :** How can companies maximize the value contributed by standards ?

A.4 Basic analytical approach of the methodology : the value chain

The methodology is based on the value chain approach.

A value chain is a chain of activities related to the generation of a certain output, product or service. The output of the work passes through all the activities of the chain in a given order, which adds value at each stage. The stages may be organized inside one company or they may be spread over different companies which cooperate with each other in supply chain networks.



Note : The "stage" of the chain can be organized as part of one organization ("company value chain") or linking different organizations ("supply chain" or "industry value chain").

Figure 1 – A simple value chain

A.4.1 Company value chain

A company value chain represents the chain of activities conducted inside a company. The operations of the company are subdivided into a number of key business functions (see **Figure 2** showing nine business functions A to I). Each of these functions is associated with a set of specific value chain activities. For example, the activities concerning the production of components and the assembly of final products are undertaken within the " production/operations " business function.

The functions which are displayed horizontally (functions E to I) are named *primary functions*, while those displayed vertically (functions A to D) are *support functions*. In principle all products of a manufacturing company are processed through the primary business functions. Some of these functions may be quite complex and composed of stages, whereas others may be simpler. The support functions influence the primary functions and assist in their execution.

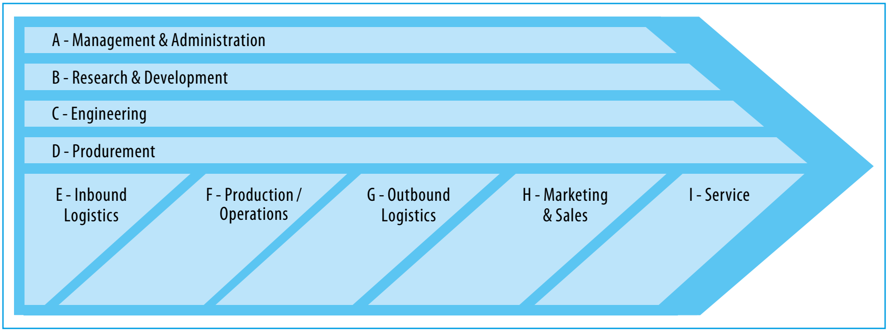


Figure 2 – Company value chain (manufacturing company)

The company value chain shown in **Figure 2** is generic, but is derived from the manufacturing company model. The value chain model can also be applied to other types of organization (e.g. service companies or social institutions), but may require adaptation to reflect their specific type of operation. As an example, **Figure 3** below shows how the value chain model has been adapted to the operations of a hospital.

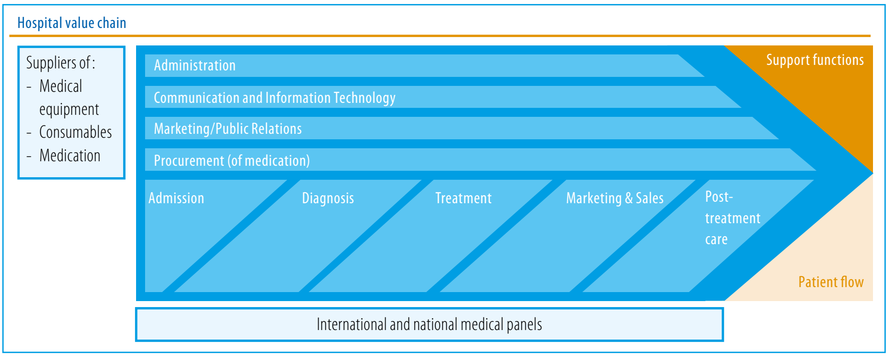


Figure 3 – The value chain of a hospital

A.4.2 Industry value chain

The company value chain approach can be applied to a single company (see **Figure 2)**. However, it can also be extended to an industry sector (or beyond), in which case the network of suppliers and customers of a company are included in the perspective. This is referred to as the "industry value chain" (see **Figure 4** giving an example of the *oil and gas engineering industry*).

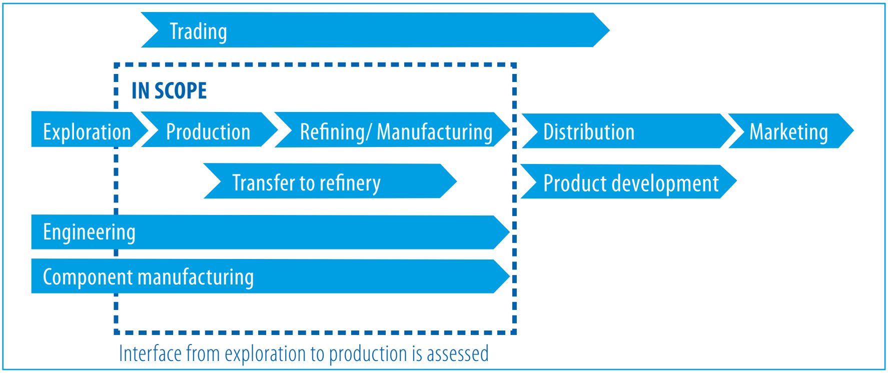


Figure 4 – Oil and gas engineering industry value chain and scope (example)

Generally, after having identified an industry value chain, it is possible to place a particular company from that industry into one or more segments of the chain depending on which segments are covered by the activities of that company (see **Figure 5)**. Such an approach helps to understand better the functions of a company within the context of its industry.

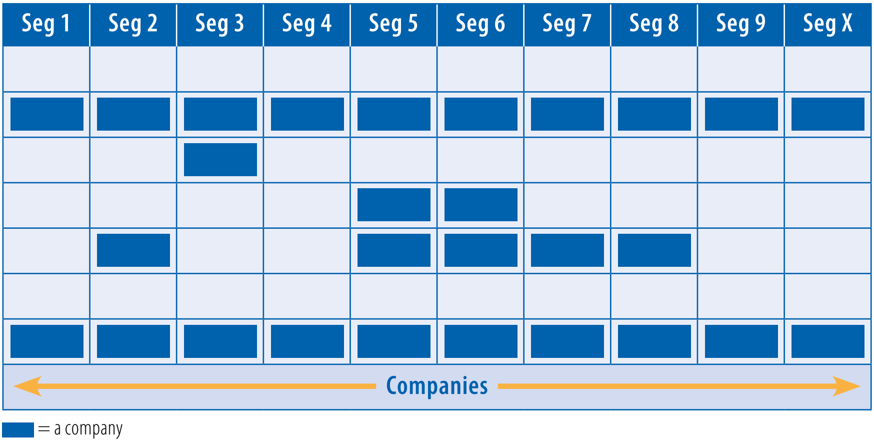


Figure 5 – Placement of companies into their industry value chain segments

A.5 Key steps in the assessment methodology

The assessment proceeds in accordance with the steps below. It may be necessary to repeat certain steps and refine the analysis.

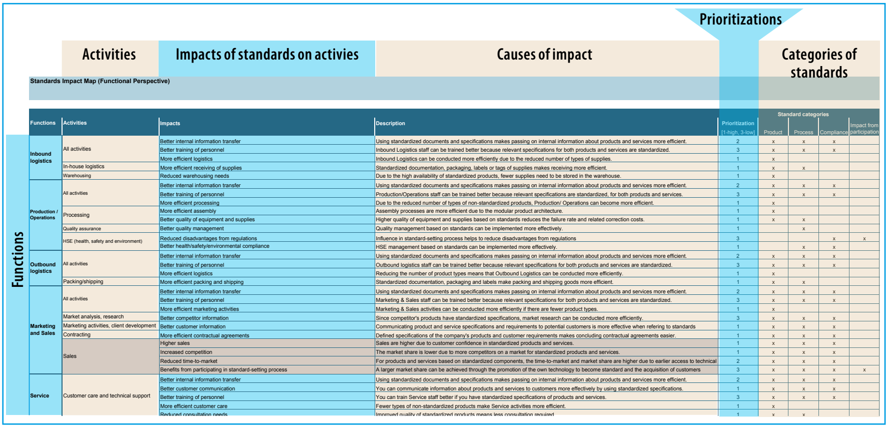
Step 1 : Understand the value chain of the industry and the company

To focus the analysis correctly, the first step is to determine the value chain of an industry and to locate a company in the context of that value chain. Secondly, the value chain of the company should be understood.

A decision of key importance concerns the **scope of the assessment** : Should it cover the whole company or should it be limited to one or more of its individual business functions ? It may take several adjustments to the analysis until the scope can be finally established. The decision on the scope is dependent on factors such as the size and complexity of the company, the available resources for the assessment project, the access to key information, and the experience of the project team members.

Step 2: Identify the impacts of standards

The comprehensive **Standards Impact Map** (see **Figure 6)** is applied to identify those areas of the value chain where standards may perform a significant role, and to determine the impacts resulting from standards. The map shows the impacts that can be traced back to the use of standards in the main business functions in the chain and their associated activities (**Figure 7** which gives examples for the production/operations function).



Functions	Activities	Impacts	Description	Prioritization [1-high, 3-low]	Product	Process	Compliance	Impact from participation
Inbound logistics	All activities	Better internal information transfer	Using standardized documents and specifications makes passing on internal information about products and services more efficient.	2	x	x	x	
		Better training of personnel	Inbound Logistics staff can be trained better because relevant specifications for both products and services are standardized.	3	x	x	x	
		More efficient logistics	Inbound Logistics can be conducted more efficiently due to the reduced number of types of supplies.	1	x			
	In-house logistics	More efficient receiving of supplies	Standardized documentation, packaging, labels or tags of supplies makes receiving more efficient.	1	x	x		
	Warehousing	Reduced warehousing needs	Due to the high availability of standardized products, fewer supplies need to be stored in the warehouse.	1	x			
Production / Operations	All activities	Better internal information transfer	Using standardized documents and specifications makes passing on internal information about products and services more efficient.	2	x	x	x	
		Better training of personnel	Production/Operations staff can be trained better because relevant specifications are standardized, for both products and services.	3	x	x	x	
		More efficient processing	Due to the reduced number of types of non-standardized products, Production/ Operations can become more efficient.	1	x			
	Processing	More efficient assembly	Assembly processes are more efficient due to the modular product architecture.	1	x			
		Better quality of equipment and supplies	Higher quality of equipment and supplies based on standards reduces the failure rate and related correction costs.	1	x	x		
	Quality assurance	Better quality management	Quality management based on standards can be implemented more effectively.	1		x		
	HSE (health, safety and environment)	Reduced disadvantages from regulations	Influence in standard-setting process helps to reduce disadvantages from regulations	3			x	x
		Better health/safety/environmental compliance	HSE management based on standards can be implemented more effectively.	1		x	x	
Outbound logistics	All activities	Better internal information transfer	Using standardized documents and specifications makes passing on internal information about products and services more efficient.	2	x	x	x	
		Better training of personnel	Outbound logistics staff can be trained better because relevant specifications for both products and services are standardized.	3	x	x	x	
		More efficient logistics	Reducing the number of product types means that Outbound Logistics can be conducted more efficiently.	1	x			
	Packing/shipping	More efficient packing and shipping	Standardized documentation, packaging and labels make packing and shipping goods more efficient.	1	x	x		
Marketing and Sales	All activities	Better internal information transfer	Using standardized documents and specifications makes passing on internal information about products and services more efficient.	2	x	x	x	
		Better training of personnel	Marketing & Sales staff can be trained better because relevant specifications for both products and services are standardized.	3	x	x	x	
		More efficient marketing activities	Marketing & Sales activities can be conducted more efficiently if there are fewer product types.	1	x			
	Market analysis, research	Better competitor information	Since competitor's products have standardized specifications, market research can be conducted more efficiently.	3	x	x	x	
	Marketing activities, client development	Better customer information	Communicating product and service specifications and requirements to potential customers is more effective when refering to standards	1	x	x	x	
	Contracting	More efficient contractual agreements	Defined specifications of the company's products and customer requirements makes concluding contractual agreements easier.	1	x	x	x	
	Sales	Higher sales	Sales are higher due to customer confidence in standardized products and services.	1	x	x	x	
		Increased competition	The market share is lower due to more competitors on a market for standardized products and services.	1	x	x	x	
		Reduced time-to-market	For products and services based on standardized components, the time-to-market and market share are higher due to earlier access to technical	2	x	x	x	
		Benefits from participating in standard-setting process	A larger market share can be achieved through the promotion of the own technology to become standard and the acquisition of customers	3	x	x	x	x
Service	Customer care and technical support	Better internal information transfer	Using standardized documents and specifications makes passing on internal information about products and services more efficient.	2	x	x	x	
		Better customer communication	You can communicate information about products and services to customers more effectively by using standardized specifications.	1	x	x	x	
		Better training of personnel	You can train Service staff better if you have standardized specifications of products and services.	3	x	x	x	
		More efficient customer care	Fewer types of non-standardized products make Service activities more efficient.	1	x			
		Reduced consultation needs	Improved quality of standardized products means less consultation required	1	x	x		

Figure 6 – Standards Impact Map, business functions and associated activities

Function	Activities	Impacts	Description
Production/ operations	All activities	Better internal information transfer	This section of the Impact Map contains more detailed descriptions of each impact ; a prioritization of the impacts, and an assignment of the impacts to three types of standards
		Better training of personnel	
		More efficient processing	
	Processing	More efficient assembly	
		Better quality of equipment and supplies	
	Quality assurance	Better quality management	
	HSE (health, safety and environment)	Reduced disadvantages from regulations	
		Better health/safety/environmental compliance	

Figure 7 – Extract of the Standards Impact Map – Production/operations business function

Step 3: Analyze the value drivers

Value drivers are crucial organizational capabilities that give a company a competitive advantage. It is clear that if impacts of standards on company operations can be assessed in relation to value drivers, the impact on value creation may be much higher than in other areas where no company value drivers exist. One should therefore consider those activities which are crucial to value creation in order to identify whether standards have an impact. If this is not the case, other areas of company operations can be considered as a secondary choice.

As described in Step 2, impacts related to the use of standards can be selected from the Standards Impact Map. However, it should be noted that the map is generic and should be used as a check list. If appropriate, the map can be extended to cover the specifics of a company. Also, some impacts may not be relevant to the specific case, or may be outside the scope chosen for this assessment.

To assess impacts resulting from standards in detail, one or more operational indicators should be identified to quantify such impacts.

The form shown in **Figure 8** may be used to document the relationship between the business functions and the applied standards.

Please note that the set of indicators may not cover all the impacts of standards on the selected business functions. Nevertheless, if chosen carefully, the identified and quantified impacts per indicator may be significant enough to prove the degree to which standards have an impact on company operations.

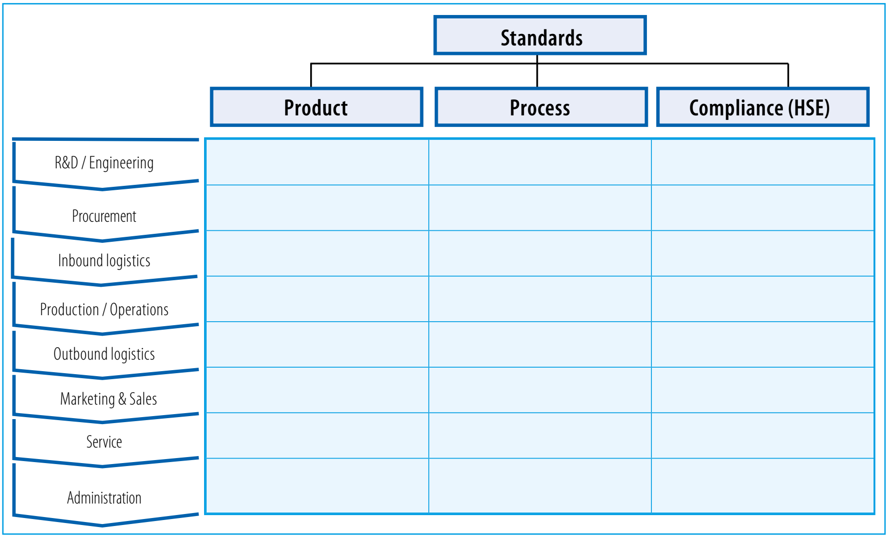


Figure 8 – Relating business functions and impacts from standards

Examples of operational indicators include manpower needed to perform a given task, cost of materials and processes, rate of failure in product manufacturing, and customer satisfaction ratios.

The key point is to collect information on operational activities at a level as close as possible to that where standards are actually used. Leading questions could be " has the use of standards had an impact on the manpower needed to perform a given task (e.g. the testing of materials) ? " – if yes, "to what extent has the number of people used in this task changed due to the use of standards ? "

Step 4 : Assess and consolidate results

The purpose of the assessment process is to determine the impact from the use of standards – as measured through the operational indicators – in a quantitative manner. This is achieved in this final assessment step by quantifying the impacts of standards in financial terms.

The use of standards is expected to lead to a change in the selected indicators in such a way that the value created by the company is enhanced through reduced costs, by contributions to higher revenues, or a combination of both.

Depending on the operational indicators, the financial impact may be directly measurable, or may be determined on the basis of other company data.

For example, " cost savings " for the procurement of materials and components is an operational indicator measured directly in financial terms. On the other hand, the reduction of " manpower needed to complete the design of products " is an operational indicator that should be converted into estimated cost savings on the basis of other company data, such as the average cost of personnel, number of projects, and so on.

The change in value is expressed in financial terms using EBIT (**E**arnings **B**efore **I**nterest and **T**axes) as the key indicator. EBIT expresses the gross profit of a company, i.e. revenue *minus* cost, at a given point in time (see **Figure 9)**.

Finally, all relevant impacts are aggregated to give an overall EBIT impact from the use of standards for the company or the business function(s) being assessed.

If there is insufficient data available or the data is not considered to be reliable enough for such a calculation, the methodology outlines several approximation methods to fill such gaps based on data obtained from assessments of similar functions in other organizations.

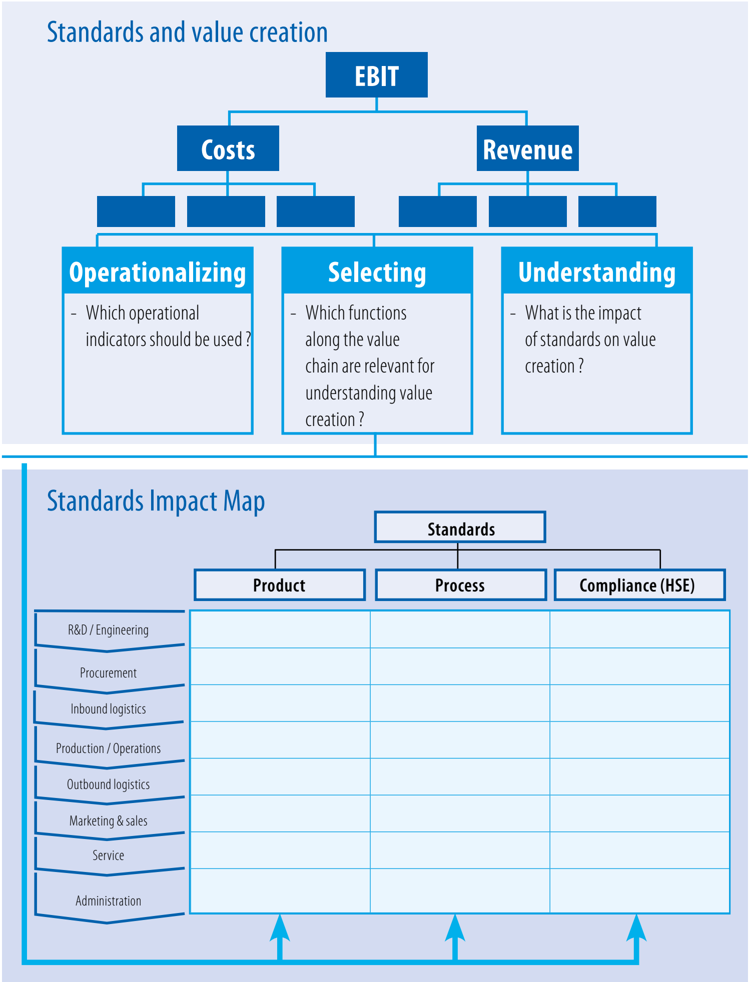


Figure 9 – Relating standards to business functions and calculating their impact on company value creation

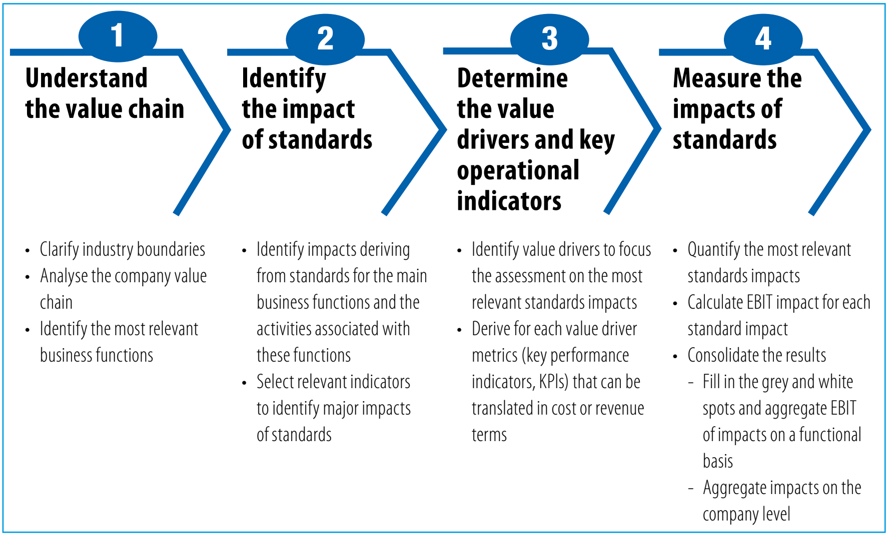


Figure 10 – Key steps in the impact assessment

The methodology contains a set of tools that support the assessment process, data capture, and the calculation of the impacts of standards. **Figure 10** provides an overview and summarizes the key steps in the assessment process.

A.6 Use interviews and workshops to obtain data

The data needed for the assessment is obtained through desk research and available industry data (**Step 1**), and interviews and workshops with company representatives (mainly **Steps 2 and 3**). For interviews, preference should be given to heads of business functions or managers at similar operational levels. Information obtained in individual interviews should focus on the industry and similar companies. Inputs are combined to calculate the overall value created by the use of standards in the chosen company (**Step 4**).

A.7 Extensions of the methodology

The methodology can be used to assess an individual company or an industry sector (see **Figure 11**). Such an analysis is based on the selection of typical companies from different segments of the industry value chain. Assessments are conducted for each company to determine the company-specific contribution to EBIT resulting from the use of standards.

The outcome of the selected company assessments, combined with industry information collected from desk research, is then aggregated to calculate the total contribution of the use of standards to the overall EBIT of the industry sector.

A pilot study of the global automotive industry has been conducted to test the methodology.

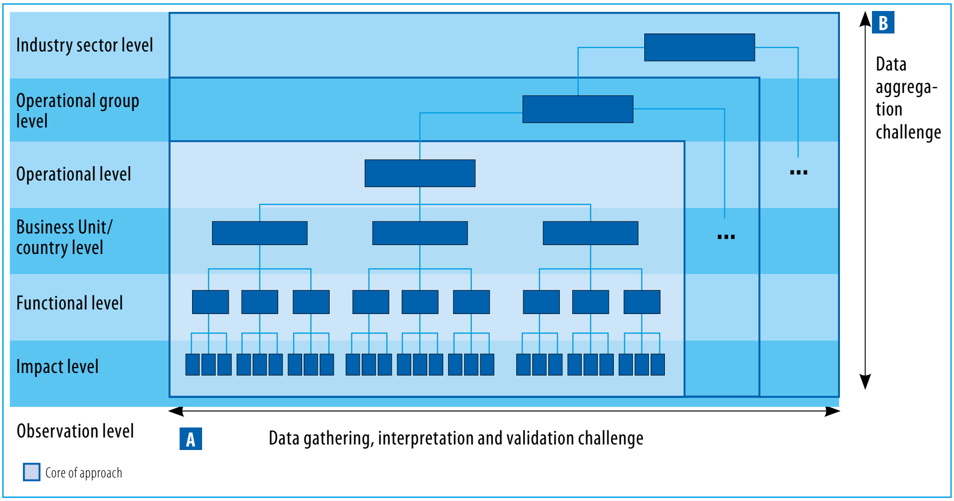


Figure 11 – Different levels of the impact assessment approach

The methodology has also been applied in a preliminary study of non-profit organizations in the public sector, such as hospitals, etc., with some adjustments, for example, in the configuration of the business functions forming the value chain.

Resources

- **ISO's Website**
  www.iso.org
  (in English and French, with top levels in Russian and individual publications in other languages)

- ***ISO Focus*+ magazine**
  www.iso.org/iso/home/news_index/iso-magazines/isofocus-plus_index/isofocusplus_2012.htm
  (10 editions annually in English and French)

- **ISO videos**
  www.youtube.com/PlanetISO

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- **Case studies on the economic benefits of standards:**
  www.iso.org/benefits_of_standards

- **ISO/IEC inventory of studies on the economic and social benefits of standardization :**
  www.iso.org/benefits

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