ISO in brief

ISO is the International Organization for Standardization. ISO has a membership of some 160* national standards bodies from countries large and small, industrialized, developing and in transition, in all regions of the world. ISO's portfolio of over 18 600* 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, medical devices, information and communication technologies, the environment, energy, quality management, conformity assessment 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 June 2011

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International Organization for Standardization – www.iso.org

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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 mainly a macroeconomic focus.

Although each of the studies confirmed the expectation that the use of standards had positive effects and resulted in economic and other benefits, it is difficult to compare the results achieved by the different studies because each used different approaches to measure the impacts of standards.

Development of the ISO Methodology

For this reason, ISO developed, with the support of Roland Berger Strategy Consultants, a methodology for the assessment and quantification of the economic benefits of standards (the "ISO Methodology"). The objective of this methodology is to arrive at reasonable and reliable quantitative calculations of the impacts of standards on organizations. By being based on the application of the same methodology, it is expected that the results of the different studies can be compared to build a common stock of knowledge about economic benefits of standards.

As explained in more detail in chapter 2, which introduces the core elements of the ISO Methodology, 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.

Relevance of the results of studies about economic benefits of standards

Demonstrating these benefits is important for standards bodies as the developers of standards. It may assist them in attracting companies to use standards or to convince them of the benefits of getting involved in the development of standards. It needs to 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 stand-

ards organizations to which participation is open with the resulting standards being publicly available, are included in the assessment. Not included in the assessment are company-internal specifications, which are not publicly available and which are not developed through an open, consensus-based process that allows participation by interested stakeholders.

Introduction to the case studies in this book

This book brings together a first set of 11 case studies from 10 different countries about the economic benefits of standards. These case studies 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 collected were undertaken between October 2010 and June 2011 in South East Asia (Indonesia, Singapore, Thailand and Vietnam), Southern Africa (Botswana and South Africa), South America (Brazil, Colombia and Peru) and Europe (two studies from Germany). Unlike the other studies, the last two were carried out in the framework of formal course work by students at the Technical University Berlin.

Structure of the case studies

Each case study report follows a similar structure : after an introduction of the economic background and the selected company, a value chain analysis is developed for the industry and the company, followed by an identification of key value drivers and areas of company operations mostly impacted by standards. This leads to a decision about which of the business functions in the company should be covered by the assessment of the impacts of standards. With the help of operational indicators which capture the key impacts of the standards used by the company, the impacts of the standards and

their benefits as contributions to cost savings or revenue increases are quantified and expressed in financial terms as contributions to the company EBIT (Earnings Before Interest and Taxes).

Selection of the companies

The selection of the companies was carried out by the ISO member. The only requirement was that the company had been a user of standards at least for a number of years and that the member body had a good relationship with the company, to ensure that key staff members in the companies were available for interviews and discussions with the project teams. The table below shows the spread over different industries of the companies assessed in the 11 case studies contained in this book.

Industries	Countries
Agri-food business	Peru
Chemical industry	Thailand
Construction & construction materials	Botswana, Colombia, Indonesia, South Africa
Electrical appliances	Vietnam
Electrical power transmission	Germany
Food retail/food logistics	Singapore
Industrial automation equipment	Brazil
Information & Telecommunication	Germany

The size of the companies varies from small companies with 25 employees with annual sales revenue of around USD 4,5 million to companies with several thousand employees and annual revenue of over USD 1,5 billion.

Preliminary results

The results demonstrate consistently that companies achieve benefits from using standards. The overall benefits from the use of standards vary, for most cases, between around 0,5 % and 4 % of the annual sales revenues of the companies.

It should be noted, however, that the scope of the assessments in the different case studies was not the same : in some studies, the scope of the analysis was limited to only one business function (e.g. production) and the use of standards and their impacts in this business function. In other studies, several business functions (e.g. research & development, procurement, production, marketing & sales) have been assessed. It seems obvious that the impact of standards is higher when considering more business functions.

One factor that stands out is that standards can have an especially high impact, beyond the range mentioned above, if a company, by meeting key standards, is able to shape or to access new markets. A couple of case studies clearly indicate this result. Standards can indeed play a central role in creating confidence for potential customers in a new technology, or allowing companies that enter a new market, to deliver consistently products and services with the quality required by their customers.

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

Next steps

This is the first set of case studies and more studies are currently being carried out. It is therefore still too early to come up with final conclusions. However, it is possible to outline some of the questions that will be posed in the foreseeable future:

- Are there typical impacts that can be identified for certain industries ?
- Do the studies show that standards are mostly used to support certain activities in companies and have a stronger impact in these activities than in others ?

- Is it possible to advise companies on the use and the selection of standards based on the experiences gained in the pilot projects ?

These case studies provide a more solid foundation to address such questions. The studies will be an important source for standards organizations to demonstrate to current and potential stakeholders of standardization the gains that companies and other organizations can obtain from the use of standards with impacts that spread beyond the companies themselves to the wider societal environment in which they exist.

In chapter 14 of this book an article, from the June 2010 issue of *ISO Focus+* is reproduced, which gives some background information to the development process of the ISO Methodology. It also contains a summary of the first extension of the methodology from a focus on an individual company to an industry sector and gives the results of the assessment of the impacts of standards on the global automotive industry.

Those readers, interested in more details of the case studies, can find the reports published in this book, the full versions of the reports originally developed by the project teams and summary presentations about each project at the following location : www.iso.org/benefits_of_standards.

The ISO Methodology to assess the economic benefits of standards

2.1 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.

2.2 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, and
- 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.

2.3 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:

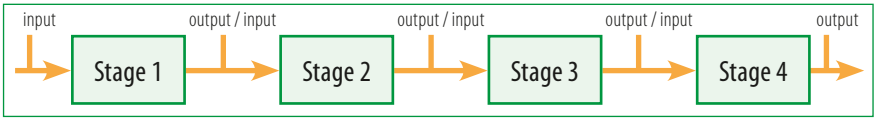
- **Context question:** How do industry and company specifics impact corporate value creation arising from standards?

- **Capability question :** How can companies maximize the value contributed by standards ?

2.4 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

2.4.1 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.

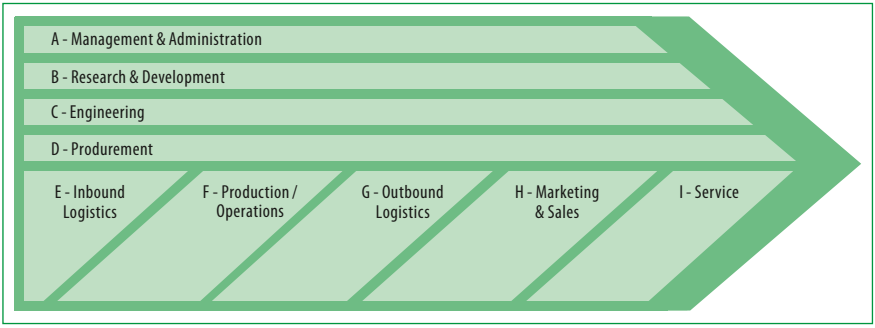


Figure 2 Company value chain (manufacturing company)

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.

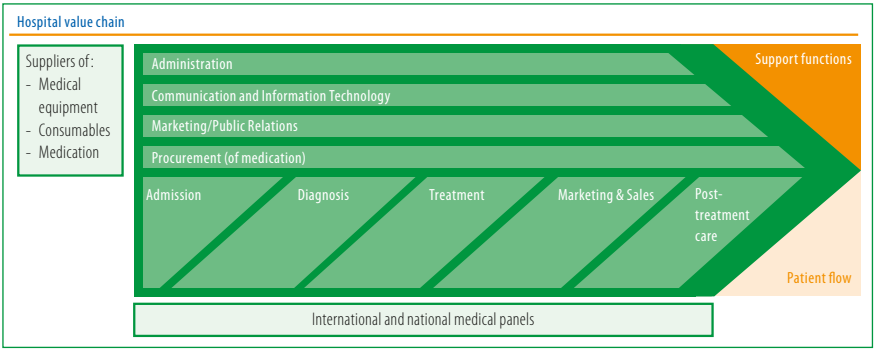


Figure 3 The value chain of a hospital

2.4.2 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*).

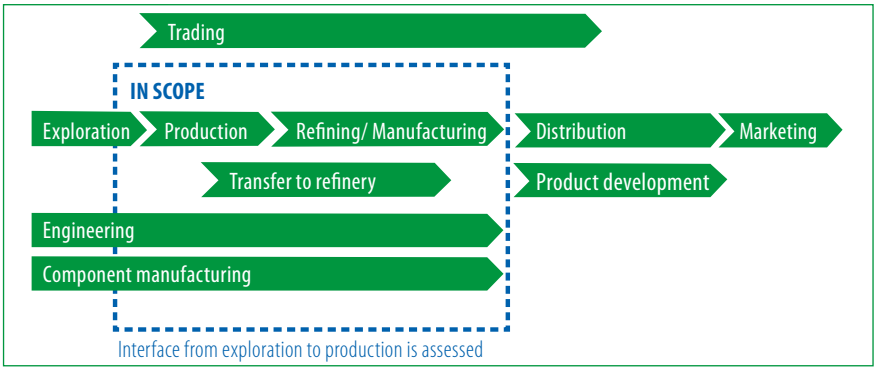


Figure 4 Oil and gas engineering industry value chain and scope (example)

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.

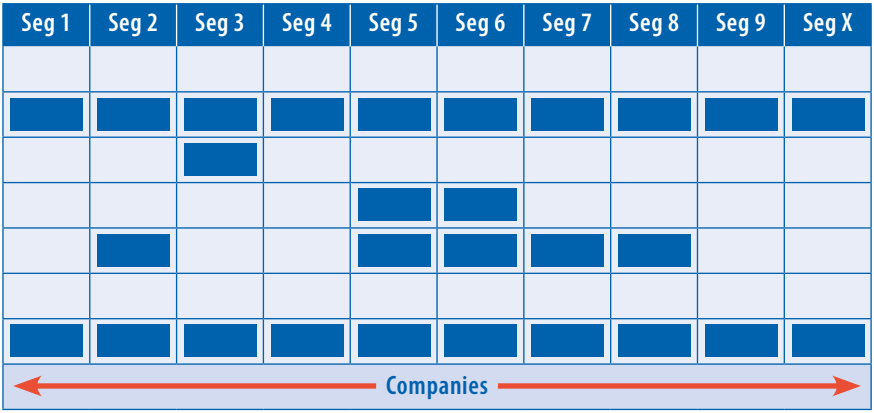


Figure 5 Placement of companies into their industry value chain segments

2.5 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).

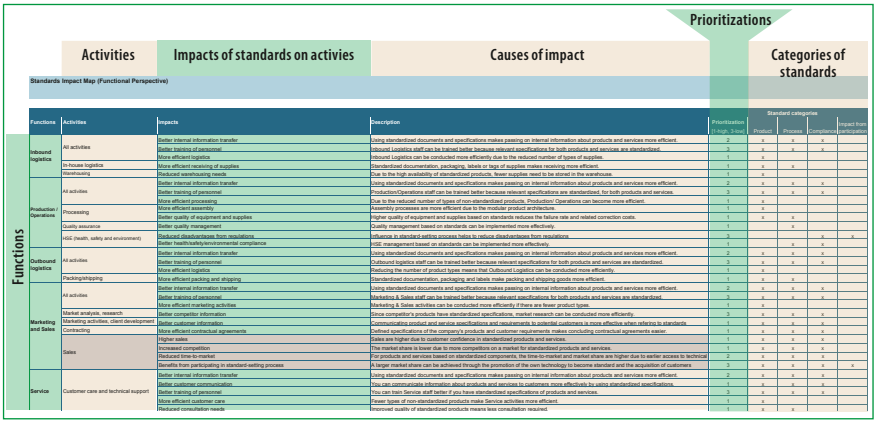


Figure 6 Standards Impact Map, business functions and associated activities

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.

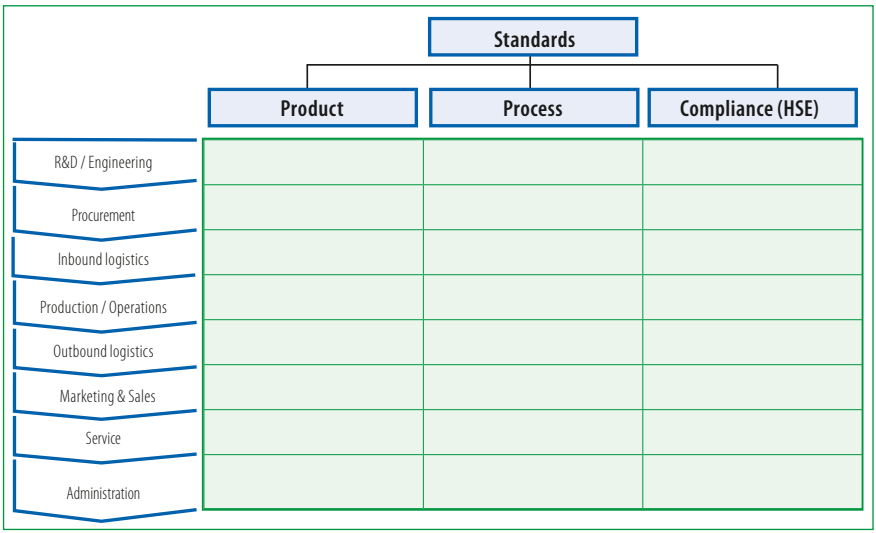


Figure 8 Relating business functions and impacts from standards

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.

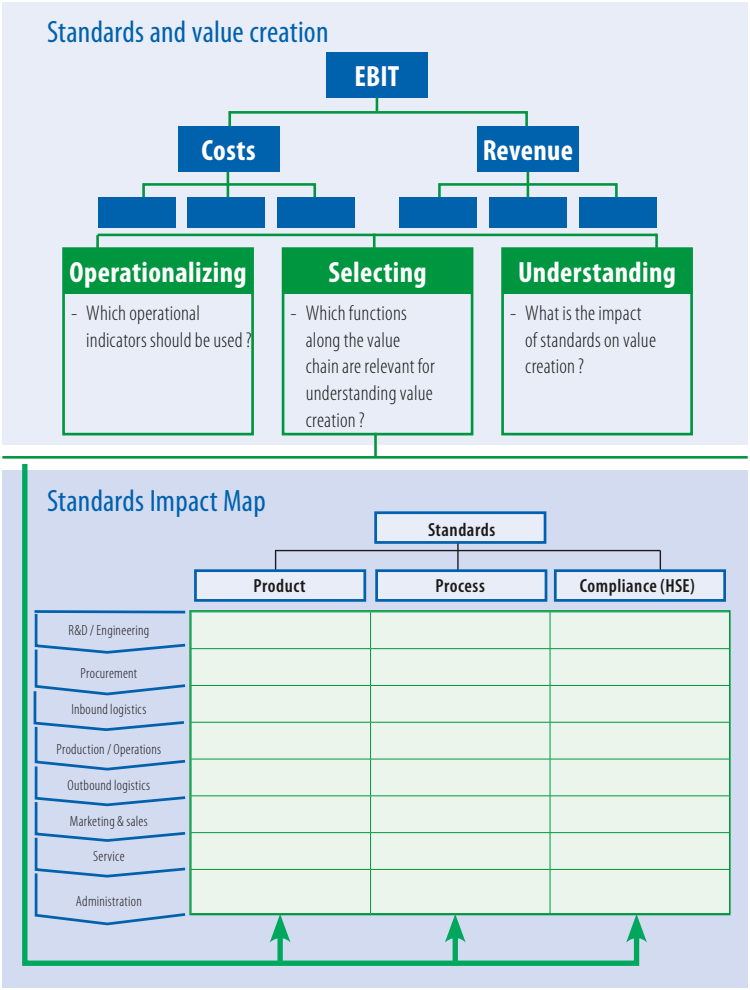


Figure 9 Relating standards to business functions and calculating their impact on company value creation

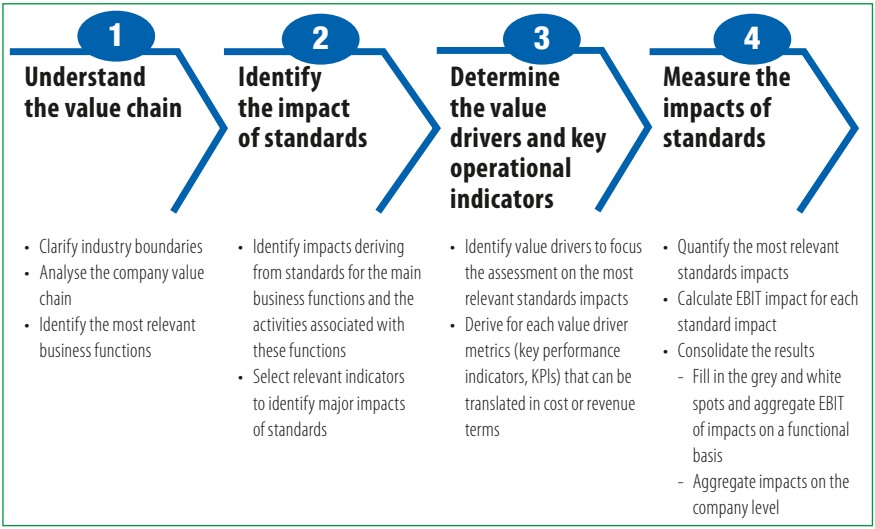


Figure 10 Key steps in the impact assessment

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.

2.6 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**).

2.7 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, as described in **Section 2.5**, 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.

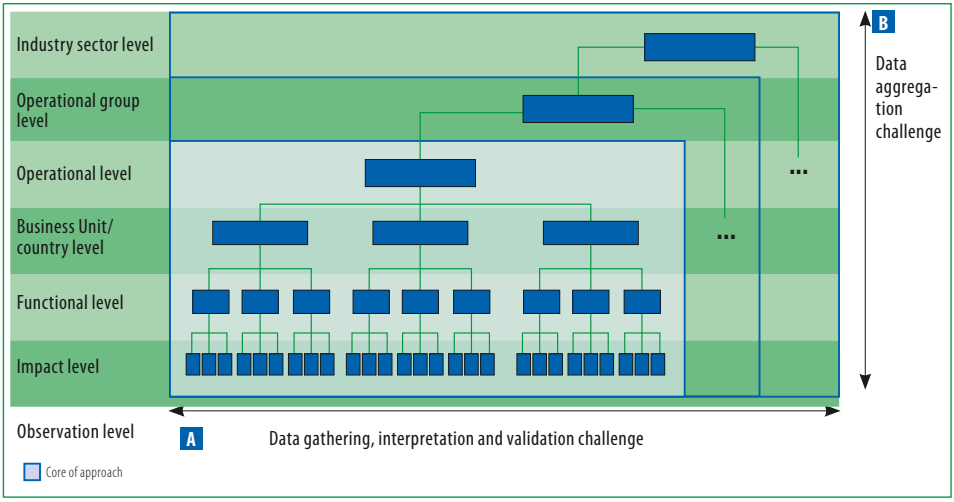


Figure 11 Different levels of the impact assessment approach

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.

2.8 Documents and tools of the ISO Methodology

The main documents/tools are:

- The **Methodology Guide**, which provides information on the theory behind the approach, how the methodolody can be applied to a private company or industry, and how it can be adapted to organizations from the public sector;
- The **Methodology Toolbox**, which provides methods and tools to manage the analysis;
- The **Implementation Guide**, which gives guidance on applying the methodology to assess the benefits of standardization, following a step-by-step approach;
- The report "**Economic Benefits of Standards in the Global Automotive Industry**", which provides an example of the implementation of the methodology for a specific industry sector.

All these materials are available to ISO member organizations.

3

PT. Wijaya Karya (WIKA) Beton, Indonesia

Country : Indonesia
ISO member body : Badan Standardisasi Nasional (National Standardization Agency, Indonesia) (BSN)

Project team :
Project leader : Mr. I Nyoman Supriyatna (Head of R&D Center, BSN)
Co-leader : Mrs. Untari Padjiastuti (Deputy head)
Project assistant : Mr. Teguh Pribadi
PhD student, Trisakti University (Jakarta) : Mrs. Ida Busneti
ISO Central Secretariat support : Reinhard Weissinger
Duration of the study : November 2010 – March 2011

3.1 Background, objectives, and organization of the pilot project

3.1.1 Background

The National Standardization Agency of Indonesia (BSN) is a Non-Ministerial Government Institution responsible for the development of standardization at the national level, representing Indonesia in the International Organization for Standardization, ISO.

There are several ways in which ISO and BSN 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.

Actual examples can be used to study the impact of standards and quantify these impacts in terms of their economic benefits. BSN has conducted studies and seminars on similar topics, such as an international seminar on *The Impact of Standarization on the Economy* held in 2009, with speakers from DIN, the German national standardization body.

3.1.2 Objectives

The main objective of this study is to determine the economic benefits that can be gained by a company implementing external standards in their business in a quantitative manner. The term "external standards" refers to all publicly available standards developed by consensus where participation in their development is open to interested parties, such as national, international or other standards development organizations or consortia, and where the criteria of public availability, consensus-based and open participation are met. Excluded from this study are company-internal specifications, and specifications developed and shared only between cooperating companies.

3.2 Introduction to the company : PT. Wijaya Karya (WIKA) Beton

3.2.1 Background on the selection of PT.WIKA Beton

The project team chose a company which has won the SNI Award given by BSN in recognition of the implementation of Indonesian National Standards (SNI), of the organization's commitment to standards development, and its good performance. Receiving the SNI Award is a proof of consistency in applying standards.

PT. Wijaya Karya (Persero) Tbk (WIKA) was the first winner of the SNI Award 2008 in the Large Service Business category. The subsidiary company PT. Wijaya Karya (WIKA) Concrete was chosen because it is a manufacturing company that uses a variety of product standards and test methods in its business operations, in addition to the quality management system widely used by large corporations. Based on the above criteria, PT. WIKA Beton, a subsidiary of PT. Wijaya Karya, Tbk was selected as a pilot project for the implementation of the ISO Methodology.

3.2.2 Overview of the company PT.WIKA Beton

Figure 1 Activities of PT.WIKA Beton

The head office of PT. WIKA Beton is based in Jakarta. It has 911 permanent employees in eight plants and ten sales offices. The plants

are located in Bogor (main factory), North Sumatra, Lampung, Majalengka, Boyolali, Pasuruan, South Sulawesi, and Algeria. The sales offices are located in Banda Aceh, Medan, Pekanbaru, Palembang, Lampung, Jakarta (head office), Semarang, Surabaya, Balikpapan and Makassar. Currently WIKA Beton contributes the largest profit of all WIKA subsidiaries.

Market structure

The precast concrete business in Indonesia, is dominated by a small number of companies that control their market share. As many as 40 large and small local companies, compete with PT. WIKA Beton, each producing one or more similar products. However, seven companies constitute the main competition.

PT. WIKA Beton has a market share of about 22.4 % for its major products, of which 22.6 % is piles, 23 % precast concrete retaining products, 21.8 % precast concrete products for bridges, 21.2 % railway concrete products, and 23 % power line products.

All suppliers of PT. WIKA Beton are domestic companies, while its customers are mostly domestic construction companies (with less than 1 % overseas). The company sells its products to customer order, that is, there is first an order and then follows the production in response.

3.2.2.1 Inputs : Raw materials used

Key raw materials used by PT. WIKA are aggregate (sand and gravel), cement, admixture, pre-stressed concrete wire and bar, spiral wire and rolled steel.

3.2.2.2 Products

As an industry with concrete as the main material, PT. WIKA Beton implements concrete standard SNI 03-2847-2002, *Indonesian Concrete*

Code extensively. As an example, in the following are the steps in the production of concrete piles :

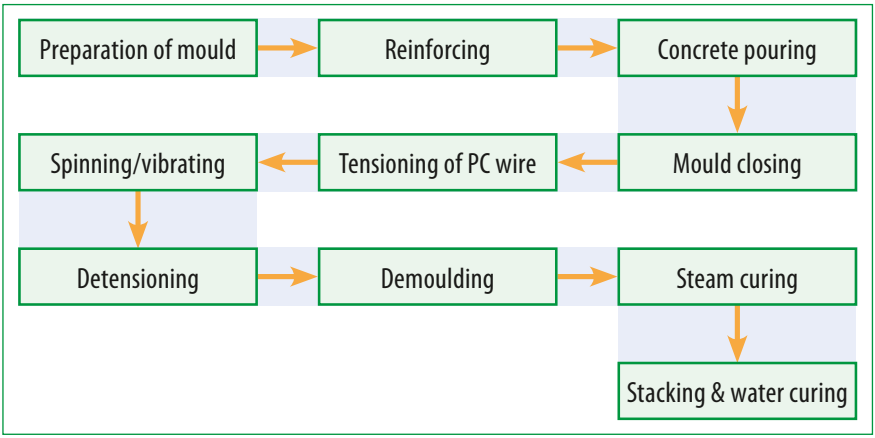


Figure 2 Example - Production of concrete piles

End products are :

1. Prestressed concrete poles
2. Prestressed concrete piles
3. Railway concrete products
4. Bridge concrete products
5. Retaining wall (sheet pile) concrete products
6. Hydro structure concrete products
7. Building and housing concrete products
8. Marine structure concrete products
9. Others concrete products

3.3 Company attitude towards standardization

As stated in Section 3.2, the main reason for selecting the company was that its parent, PT. Wijaya Karya, Tbk, was the first winner of the

SNI Award 2008 for the Large Business Services category. The SNI Award is a token of appreciation given by the national standardization agency BSN to an organization or company for implementing Indonesian National Standards (SNI) as well as for awareness of the development of standards, and good performance. The SNI Award is awarded as a proof of the consistency in implementing standards. Company experts participate actively in the national mirror committee to ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*.

3.4 Value chain analysis

3.4.1 Construction industry value chain

The construction industry value chain can be described as follows:

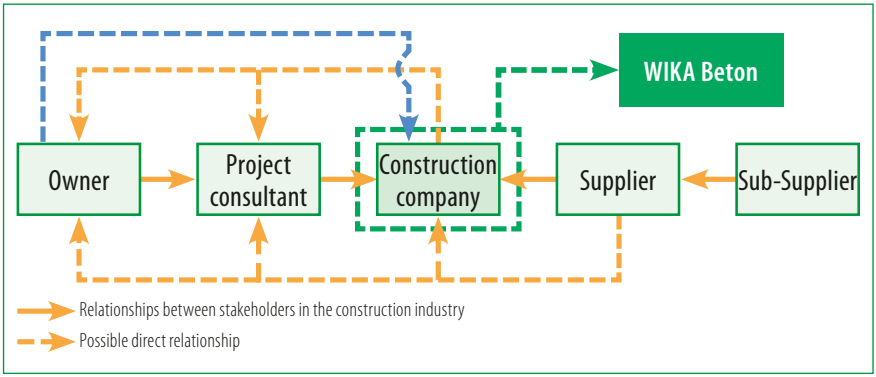


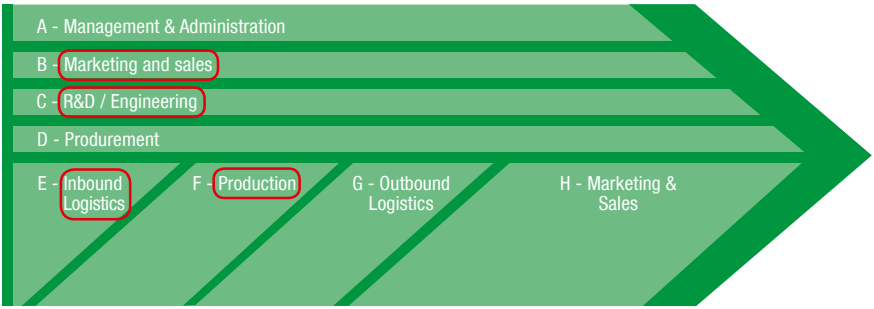
Figure 3 Construction industry value chain

In the construction industry value chain diagram, PT. WIKA Beton operates in the construction company supplier segment.

3.4.2 Company value chain of PT. WIKA Beton

The general value chain model for manufacturing companies, developed by Michael Porter, consisting of nine business functions, was modified to suit PT. WIKA Beton's system of basing production on orders and engineering processes conducted after the conclusion of sales contracts.

The company's value chain can be described as follows (the circles indicate the focus of the assessment in this study) :



Source : Michael Porter, Economic Benefits of Standards-ISO Methodology Guide, Version 1, 2010 (modified)

Figure 4 Value chain model modified for PT.WIKA Beton

3.4.3 Key value drivers of PT. Wika Beton

Based on interviews, PT. WIKA Beton has several value drivers that became the key for the success of the company in accordance to its core business processes :

No.	CORE PROCESSES	VALUE DRIVERS
1.	Sales and marketing	Customer intimacy
2.	R&D/Engineering	Product leadership
3.	Production	Operational excellence

Table 1 PT. WIKA Beton core processes and value drivers

3.5 Scope of the pilot project assessment

The scope of the case study conducted on PT. WIKA Beton was limited to the following key business functions : (1) Research and development/engineering, (2) Inbound logistics, (3) Production and (4) Sales and marketing. A further limitation was to focus the assessment only on the main factory located in Bogor.

The selection of business functions was based on the company's core processes — engineering, production, and sales.

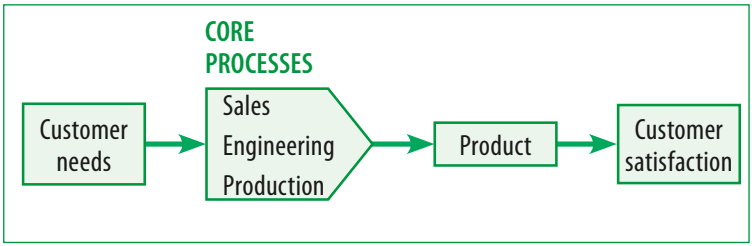


Figure 5 Core process diagram

Sales is part of the marketing and sales activity. Research and development and engineering cannot be separated and are considered as part of one business function. In this study the R&D function is chosen because it provides long-term results. The inbound logistics function was included in the study because the prior processes of production may affect/determine the quality of the final product.

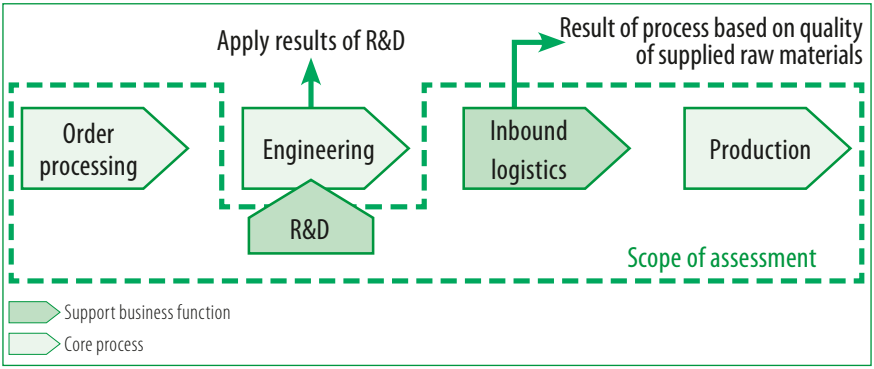


Figure 6 Selected business functions

3.6 Use of standards in the company value chain

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

1. Standards for raw materials
2. Standards for the final product
3. Standards for management processes.

Standards identified in the selected business functions and their relationship in supporting the company's value drivers are described in more detail below:

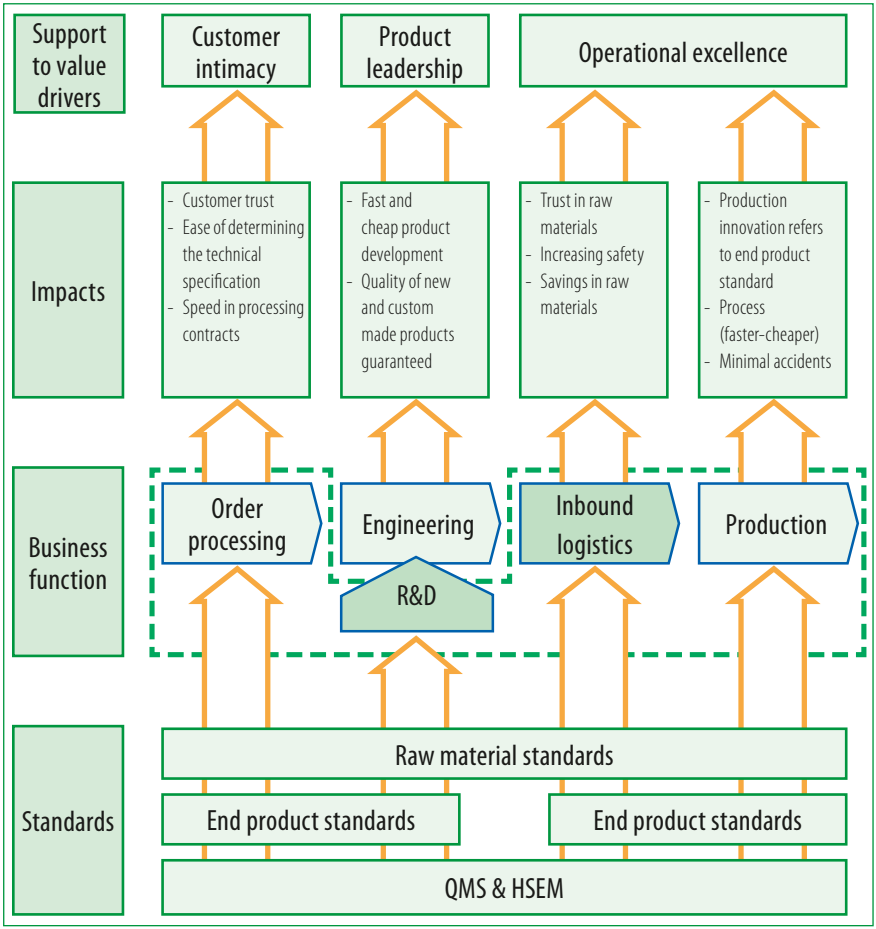


Figure 7 Relationship between types of standards, business functions, impacts and value drivers

A significant number of standards are used, the most important of which are listed in the Annex for each business function.

3.7 Operational indicators to calculate the impact of standards

To calculate the economic benefits of standards, we had to correlate business functions to the standards used. To do this we identified the impact of standards on the activities, then defined operational indicators so that the final economic benefits of the standards could be measured.

Where the operational indicators applied could not be calculated due to lack of data or limitation of project duration, any operational indicators and impacts were nevertheless still inventoried as described in Section 3.9.

Business functions being assessed	Related activities	Operational indicators
Research and development (= BF 1)	Collection of information about suppliers (in the product development process)	Savings in labour costs due to availability of qualified supplier information
	Product development research process	Savings in time due to the application of standards in research resulting in increased reliability
	Dissemination of research results and transfer of information (through the quality management system)	Saving of time through the dissemination of information due to the provision of standards indicators (e.g. for material specifications, process specification and standardization of the product, which are transformed into working instructions, operational procedures, brochures etc.)
Inbound logistic (= BF 2)	Raw material selection	Increased reliability in raw materials due to raw materials testing resulting in a reduction in their use
Production (= BF 3)	Removing steam curing in the production process	Savings due to increased efficiencies in production, in particular in the following processes : Steam curing Wire caging Simulant stressing
Marketing and sales (= BF 4)	Communication with purchasers	Time saving in negotiations : reference to standards in sales negotiations simplifies communication with purchasers
	Sales	Increase in customer reputation

Table 2 Impacts of standards on activities in business functions and selected operational indicators

3.8 Calculation of the economic benefits of standards

The method of identifying and calculating the impact of standards using operational indicators has been explained in Section 7. The results in the selected business functions are shown in **Table 3** below:

Business functions	Calculation of economic benefit per operational indicator (IDR/Year)	Percentage contribution to total revenue
Research & Development	201 010 271	0,08 %
Inbound logistics	341 716 540	0,14 %
Production	418 779 020	0,17 %
Marketing & Sales	90 202 415	0,04 %
Total Benefits	**1 051 708 246**	**0,43 %**

Table 3 Impacts of standards overall and by business function

3.9 Qualitative and semi-quantitative considerations

Other considerations resulting from the assessment study are as follows:

It is easier to implement external consensus-based standards than to develop internal standards (however, there are no data available on the costs of developing internal standards).

- By implementing widely used external standards, supplier's and company products will be more interoperable, cheaper, and faster to produce. Also, the variety of product types can be reduced more than would be possible by implementing internal standards. If producers and customers develop their own specifications for like products, then production overheads will increase.

- If the company's success in meeting customer quality requirements is based on external standards, the result is increased customer trust, improved corporate image and a basis for international competitiveness.
- There is better information transfer because communication between units is based on the same formats for data and documentation. This can reduce misunderstandings in communication that can cause errors or defects. It is also possible to reduce the frequency and cost of rework
- Unified management system : Integrating quality management and health and safety standards in one system covering key production stages can enhance quality control efficiency.
- Better competitor information : Competitive information is collected faster than before. Since competitor's product specifications are standardized, market research can be conducted more efficiently by reducing the costs for competitor screening activities.
- Quick response to complaints : Implementing standards can decrease repetitive complaints, and speed up response time.

3.10 Evaluation of results

Some important aspects that affect the calculation of the economic benefits of standards in this study (source of uncertainty, assumptions made) are as follows :

Data on the impact of standards on the four selected business functions are based on observations of benefits by key staff, and have been approved by the business development manager as top management representative. The method of expressing the impact of standards as economic benefits was discussed, and operational indicators associated with unit costs (monthly salary, materials prices, electricity costs per KWH, and others) were also identified.

- We identified as many as nine types of impacts on the four business functions, with a total economic benefit of IDR1 051 708 246, or 0,43 % of total revenue. This represents close to a 6 % contribution to the EBIT of PT. WIKA Beton, which is significant.
- Operational indicators in the study were based on a comparison between normal company operations using standards, and a hypothetical situation without the implementation of standards.
- This comparison was made because the company has implemented ISO 9001 and health and safety management standards, plus process and product standards, since its inception, so there was no period before the application of standards.
- We found that not all of the impacts (savings, for example) could be correlated with the use of standards. Therefore we made assumptions about the percentage of the contribution made by standards, which was based on a consensus within the project team and the company rather than a more quantitative method such as a weighting system.

3.11 Conclusions and recommendations

3.11.1 Conclusions

The conclusions summarize the overall findings of the analysis, and the key points learnt by the study/project team :

1. Implementation of the study through discussion with a standards user (company) creates awareness of the benefits of standards and demonstrates their contribution to company profits.
2. There were some difficulties due to the need for confidentiality of the company data. Even if a company has been willing to become the object of such a study, in some cases it might not be willing

to disclose all data to external parties, even if they are members of the project team.

3. The study team had some difficulty in understanding the benefits identified by the company's employees because the information was sometimes related to highly technical matters expressed in a very technical language.

3.11.2 Recommendations for next steps

1. Communicate the results of the study to stakeholders through seminars or workshops in order to raise awareness of, and interest in, the application of consensus-based external standards.
2. Disseminate methods to standards users so they can perform their own assessments of the impact of standards through training, since it is more difficult when such assessments are made by parties outside of the company.
3. There is a need for a similar study by BSN/ISO on companies in a different sector to disseminate knowledge about the methodology, increase awareness of the economic benefits of standards in other sectors, improve personnel skills of BSN, and refine the results of the study.
4. Similar studies carried out in future by BSN/ISO should take a personal approach to top management to explain the purpose and objectives of the study and the company data required.
5. Produce a pocket book/leaflet/brochure containing key steps about the methodology in a compact form.
6. Individuals should be included in study teams that have knowledge of the technological aspects of the participant company's industry sector and who understand the technical terms used.
7. Teleconferencing, as exemplified by ISO, could be used by BSN as an efficient and effective means of communicating standardization activities.

8. The ISO Central Secretariat should conduct regional or international workshops on the results of the ISO EBS methodology in order to share the outcomes with other ISO members.

ANNEX : Business functions and standards used

No.	Standards used			Business functions			
	Standard	Title	Type	Marketing and sales	R&D	Inbound logistics	Production
1.	ISO 9001:2008	Quality management systems – Requirements	CS	X	X	X	X
2.	–	Safety, health, and environmental management	CS	X	X	X	X
3.	ASTM C33 – 1999	Standard specification for concrete aggregates	PdS	X	X	X	–
4.	SNI 15-2049-2004	Portland cement	PdS	X	X	X	–
5.	ASTM C494-1985	Standard specification for chemical admixture for concrete	PdS	X	X	X	–
6.	JIS G 3536-1999	Uncoated stress-relieved steel wire and strand for prestressed concrete	PdS	X	X	X	–
7.	JIS G 3137-1994	Small size deformed steel bars for prestressed concrete	PdS	X	X	X	–
8.	JIS G 3532-2000	Low carbon steel wire	PdS	X	X	X	–
9.	JIS G 3101-2004	Rolled steel for general structures	PdS	X	X	X	–
10.	ANSI / AWS D1.1-1990	Structural welding code-steel	PdS	X	X	X	–
11.	SNI 03-2847-2002	Indonesian concrete code	PdS	X	X	X	X
12.	SNI 03-1752-1989	Recommendation for design loading of highway bridges	PcS	X	X	–	X
13.	JIS A 5309-1981	Prestressed spun concrete poles	PdS	X	X	–	X

No.	Standards used			Business functions			
	Standard	Title	Type	Marketing and sales	R&D	Inbound logistics	Production
14.	JIS A 5335-1987	Prestressed spun concrete piles	PdS	X	X	–	X
15.	JIS A 5326-1988	Prestressed concrete sheet piles	PdS	X	X	–	X
16.	JIS A 5325-1983	Reinforced concrete sheet piles	PdS	X	X	–	X
17.	JIS A 5332-1980	Core type prestressed concrete pipes	PdS	X	X	–	X
18.	EN 642-1994	Prestressed concrete pressure pipes	PdS	X	X	–	X
19.	ACI 318 – 2002	Building code requirements for structural concrete	PcS	X	X	–	X
20.	ACI 543R-00	Design, manufacture and installation of concrete piles	PcS	X	X	–	X
21.	SPLN 93:1991	Prestressed concrete poles for distribution line	PdS	X	X	–	X
22.	PD No.10 Perumka	Railway design	PcS	X	X	–	X
23.	American Railway Engineering Association (AREA) Chapter 10 – 1996	Manual for railway engineering	PcS	X	X	–	X
24.	GOST 10629 – 1988	Prestressed concrete sleepers for railway wide 1520 mm	PdS	X	X	–	X
25.	TB/T 3080 – 2003	-	–	X	X	–	X
26.	BMS 7 – 1992	Bridge design code	PcS	X	X	–	X
27.	AASHTO – 1992	Standard specification for highway bridges	PcS	X	X	–	X

X → used

- → not used

CS → Compliance standard

PdS → Product standard

PcS → Process standard

NTUC Fairprice, Singapore

Country : Singapore
ISO member body : Standards, Productivity and Innovation Board (SPRING SG)
Project team :
Leader : Ms. Susan Chong (Director, Special Projects), SPRING SG
Member : Mr. Phua Kim Chua (Head, Standards Division), SPRING SG
Member : Ms. Ho Buaey Qui (Executive Secretary, Information Technology Standards Committee, Singapore)
Member : Ms. Pauline Ping Ting Ting (MBA Student, Nanyang Technological University, Singapore)
Member : Mr. Preetesh Deora (MBA Student, Nanyang Technological University, Singapore)
ISO Central Secretariat advisor : Reinhard Weissinger
Duration of the study : October 2010 – March 2011

4.1 Introduction to the project and overview

The key objective of the ISO pilot project is to determine in a quantitative manner the benefits companies can derive from the use of standards in their business. Such knowledge is useful to demonstrate the advantages of participating in standards development initiatives and/or the use of standards. While many organizations realize the importance of the use of standards, few have analyzed their impact on the company bottom line and their key role in an organization's strategy.

The ISO pilot project in Singapore was conducted from October 2010 to January 2011 with the finalization of the report in March 2011. The project was led by SPRING Singapore [1] with the guidance of ISO and support of MBA Interns from the Nanyang Business School [2].

4.2 Introduction to the industry and selected company

This study is focused on the impact of standards in the supermarket sector of the food retail business. The supermarket is the defining retail element of the food industry. Restaurants, cafes, bakeries, food courts

1 SPRING Singapore is the enterprise development agency responsible for helping Singapore enterprises grow. We work with partners to help enterprises in financing, capability and management development, technology and innovation, and accessing new markets. As the national standards and accreditation body, SPRING develops and promotes an internationally-recognised standards and quality assurance infrastructure that builds trust in Singapore enterprises, products and services, thereby enabling their global competitiveness and facilitating global trade.

2 The NANYANG MBA is recognized internationally for its prestige and lifelong learning experience. Delivered by a top international faculty, The NANYANG MBA has consistently been recognized among the Top MBA programmes globally. Ranked amongst Asia's best, it is the first in Singapore and among a select few in the world to attain both highly prestigious accreditation from higher education bodies, EQUIS (EU) and AACSB (US). A select group of high calibre individuals from more than twenty nationalities from diverse backgrounds attend The NANYANG MBA to prepare them to lead and manage organizations in a global business environment, with a strong focus on Asian know-how.

and hawker centres are also ways consumers can purchase food. About 60 % of the food retail sales takes place in supermarkets, hyper marts and modern mini marts. The rest takes place in traditional provision stores, wet market stalls and convenience stores. Increasingly over the last 10 years or so, more households are going to supermarkets for their fresh produce, meats and fish requirements.

NTUC FairPrice Co-operative Ltd. was founded by the labour movement in Singapore in 1973, with a social mission to moderate the cost of living in the country. In 1983, NTUC Welcome merged with the Singapore Employees Co-operative to form NTUC FairPrice Co-operative Ltd., (FairPrice) selling groceries, household items, beverages, food items and other merchandise.

NTUC FairPrice has grown to become Singapore's largest supermarket retailer, with a network of more than 240 outlets and a market share of over 50 %, making it a household name and a highly trusted brand. The company achieved strong performance with revenues over SGD 2 billion in 2010 and has witnessed a CAGR of over 8 % over the past decade. Net profit of the company too has shown a steady increase to over SGD 120 million and it employs over 7 000 employees.

Today, with its multiple retail formats, the social mission of NTUC FairPrice has evolved to make the dream of living well accessible to everyone by moderating the cost of living in Singapore. Its service motto " Service from the Heart " is a part of Fair Price's corporate vision – " To Be Singapore's Leading World-Class Retailer with a Heart ".

The key value chain of NTUC FairPrice, which is impacted by the consensus standards identified, consists of three major business functions : procurement, warehousing/distribution and retail. The other business functions include finance, information systems and human resources.

The scope of the assessment in the pilot project focuses on the three major business functions – procurement, warehousing/distribution, and retail (only FairPrice Hypermarkets, supermarkets and FairPrice Finest).

4.3 Attitude of the company towards standardization

NTUC FairPrice is a believer and advocate of standards and hence is an ideal company for this project. Being the largest supermarket retailer, NTUC FairPrice not only uses standards to help increase its operation and cost efficiencies, it also helps to raise the standards of Singapore's retail industry by facilitating many local companies, namely its suppliers, to also use standards. It was among the first supermarkets to introduce many standards – both mandatory and voluntary in its business operations.

4.4 Analysis of the value chain

The supermarket industry is a complex, global collective of diverse businesses that together supply much of the food consumed by the world population. A value chain for any product or service extends from research and development to raw materials supply and food production, delivery to international buyers and disposal/recycling. A highly integrated supply chain helps to pull together the complex processes in this industry to ensure quality, safety and efficiency in its processes.

4.4.1 Industry value chain

Walmart, Carrefour, Metro Group, Tesco, Schwarz and Kroger are the top 5 giants in the global retail industry. Quality management and cost control are the key value drivers that increase their revenue and drive more benefits for their shareholders.

In Singapore, there is a rapid growth in the consumption of grocery products. Some 20 % of our annual household expenditure is on food and grocery. NTUC FairPrice [3], Cold Storage [4] under Dairy Farm International and Carrefour, are the three major supermarkets retailers in Singapore. NTUC FairPrice has been involved in the leadership of the Efficient Consumer Response (ECR) Singapore initiative since its launch in 1998 and focuses on the supply and demand management for the fast moving consumer goods industry,

Figure 1 shows the typical supermarket industry value chain.

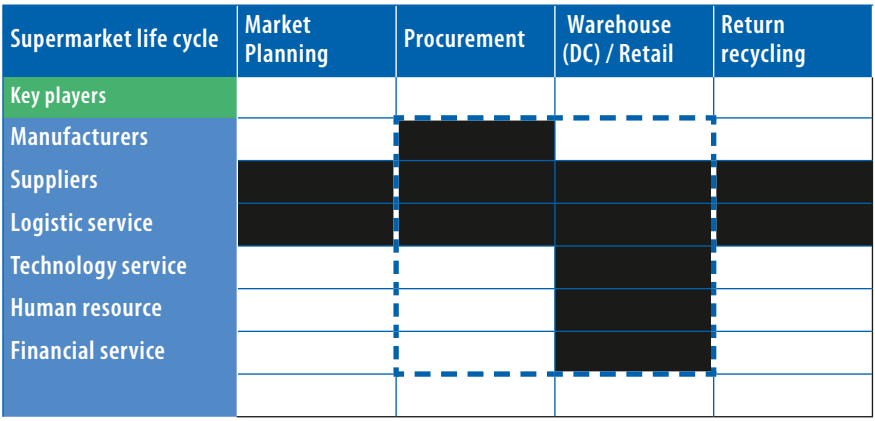


Figure 1 Supermarket industry value chain and scope of the ISO pilot study[5] (area in dotted lines)

3 Including FairPrice supermarket, FairPrice Finest

4 Cold storage supermarket only

5 http://www.slideshare.net/smehro/wal-mart-value-chain-analysis-by-sandro

The dotted line indicates the business functions that were identified as being key parts of the value chain assessed in this study.

4.4.2 Company value chain

The value chain of NTUC FairPrice was confirmed as being similar to that of other major supermarket companies, and the report provides an overview of the three major business functions – procurement, warehousing/distribution, and retail in NTUC FairPrice, which are directly involved in the processing and distribution of products and are impacted by the selected consensus standards.

Table 1 shows the business functions that constitute the company value chain.

Technology services – e.g. automatic sorting system, data synchronisation			
Financial services			
Human resource e.g. technical capability training			
Other supporting functions – e.g. governance, quality control, food safety and coordination, market research			
Procurement	**Inbound logistics to warehouse**	**Outbound logistics to retail**	**Retail**
Selection of suppliers * *(quality of process, quality & safety compliance)*	Receipt of goods *(efficiency of process)*	JIT-delivery to retail units *(efficiency of process)*	Receive goods *(efficiency of process)*
Relationship with suppliers *(partnership)*	Return goods *(efficiency of process)*	Return goods *(efficiency of process)*	Return goods *(Efficiency of process)*
Sourcing from suppliers *(quality of process)*	Warehouse mgt *(efficiency of process)*	Transaction mgt *(efficiency of process)*	Shrinkage mgt *(efficiency of process)*
Training of suppliers *(partnership)*	Transaction mgt *(efficiency of process)*	Asset utilisation *(efficiency of asset utilisation)*	Product category mgt *(quality of product)*
Communications *(quality of process)*	Asset utilisation *(efficiency of asset utilisation)*		Temperature/ environment mgt *(quality of product, quality & safety compliance)*
Product evaluation *(quality of product)*	Inventory management *(efficiency of process)*		Demand plan *(quality of process)*
			Order fulfilment *(quality of process, transparency)*
			Customer service *(sales effectiveness-retain customer)*

*Includes logistics capabilities
() Explanation of relative value driver

Table 1 NTUC FairPrice key value chain components

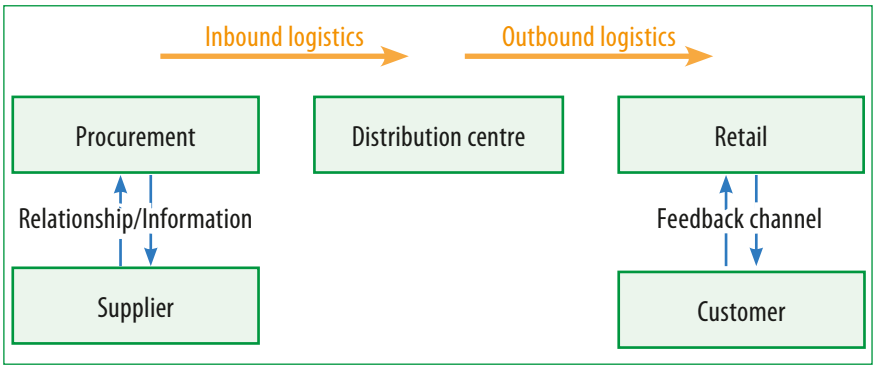


Figure 2 Process flow between the three business functions

The process flow between the three key business functions is as follows:

1. Procurement refers to the management of sourcing and supplier relationship;
2. Warehousing/distribution comprise inbound logistics and outbound logistics. Inbound logistics refer to the delivery of products to the distribution centre (DC), whereas outbound logistics pertain to the delivery of products from the point of production or the DC to retail;
3. Retail serves the daily demands of the consumers who also play a role in feeding back to NTUC FairPrice on its products and processes.

4.4.3 Key value drivers

The key value drivers are the crucial capabilities that provide the competitive advantages for the company. These capabilities are likely to reduce the risk associated with owning the business or enhancing the prospect that the business will grow significantly in the future. The key value drivers for NTUC FairPrice are its partnership with its suppliers, the quality and efficiency of its processes and its relationship with its customers:

Partnership with suppliers

The partnership between NTUC FairPrice and its suppliers is based on trust with standards being used to ensure quality and safety. The selected suppliers all comply with HACCP (Hazard and Critical Control Point) if they are food suppliers. The adoption of ISO 9001 is recommended to non-food suppliers who may also demonstrate that they have similar quality systems as an alternative to ISO 9001. For house brands, HACCP certification is a must or suppliers must be at least ready for a HACCP certified process. The Cold Chain Management Standard for Milk and Dairy as well as for Chilled Pork and the Standard Pallet are the other standards which NTUC FairPrice's suppliers are required to comply with. The efficiency of delivery is also essential as this helps to keep the costs down for both the supplier and NTUC FairPrice.

Quality of products and processes

NTUC FairPrice has increased the number of stores from 65 to 98 from 1999 to 2009, whilst the level of working capital per store has been reduced, and the number of staff who work in the procurement department and the DC (GLS) are maintained at the same level. Internally, systematic training programmes have enlarged the knowledge of the operating processes and enabled NTUC FairPrice to maintain or enhance the quality and variety of its products and enabled its suppliers to deliver the products in good condition.

Safety compliance

A temperature-controlled supply chain for critical perishable products like milk and dairy and chilled pork to ensure that health and safety is not compromised along the supply chain has also helped to expand the number of sources of milk and dairy products and chilled pork, and helped to extend their shelf life.

Efficiency of processes

NTUC FairPrice is constantly looking at ways to improve their processes. The implementation of a warehouse management system and the introduction of an innovative automatic sortation system in the main distribution centre smoothly integrates the information and product flow in the warehouse. Furthermore, consistent and reliable data exchange enhances the communications across different departments and reduces the time to fulfill the retail stores' orders. This results in an increase in its operational accuracy and throughput. The enhanced processes have helped to reduce operational costs in the warehouses and significantly increased the productivity of its existing resources. Efficient tracking of the goods within the DC using the centralized warehouse management system helps to reduce costs with an improved utilization of personnel time and the more efficient delivery and retrieval of goods.

Sales effectiveness retains customers

NTUC FairPrice, as a co-op organization, helps to stabilize the cost of living by providing reliable and efficient services that result in safe and cost efficient products for its customers. Customers who join its membership plan will receive rebates and dividends as part of the NTUC FairPrice's royalty programme.

4.5 Scope of the ISO pilot study

4.5.1 Key business functions of the value chain :

The ISO pilot study looks into the three major business functions that are critical to the value chain of NTUC FairPrice :

1. Procurement
2. Warehousing and distribution
3. Retail

1. Business Function : procurement

Procurement refers to the management of sourcing and supplier relationship. The core activities involved in this business function are shown in **Figure 3** below :

Figure 3 Procurement function activities

The prime responsibility of procurement is to ensure long lasting and smooth supplier relationship.

2. Business function : warehousing and distribution

The business function of warehousing and distribution is done through NTUC FairPrice's two major centralized warehousing and distribution centres which comprise inbound logistics and outbound logistics. The key activities are shown in **Figure 4** and include :

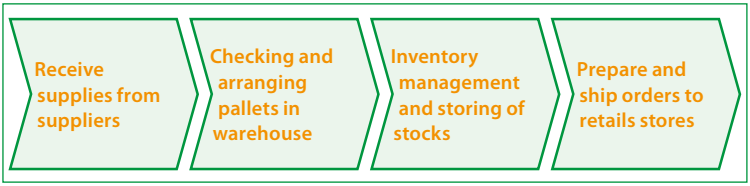


Figure 4 Warehousing/distribution function activities

Throughout the process, the warehousing and distribution centres are expected to operate in a cost-efficient manner as the overheads directly affect the bottom line of NTUC FairPrice.

3. Business function : retail

Retail, the key function in NTUC FairPrice's value chain is where the daily needs of its customers are met and is also where customer feedback on its products and processes is the most crucial for the company's viability. A well-managed supply and demand value chain results in the retail products and services meeting or exceeding the customers' expectation. **Figure 5** below shows the key activities of the retail function.

Figure 5 Retail function activities

4.5.2 Product types

Furthermore, due to the multitude of products handled by NTUC FairPrice, it was decided to restrict the assessment to the following two product types where consensus standards were applied and benefits are measurable :

1. Milk and dairy products
2. Chilled pork

4.5.3 Retail outlets

The focus of this pilot is on the following NTUC FairPrice food retail outlet types given that they contribute a high percentage of the supermarket revenue for NTUC FairPrice :

1. FairPrice Finest
2. FairPrice Supermarkets and
3. FairPrice Xtra (Hypermarkets)

4.5.4 Warehousing/distribution

The warehouse and distribution function is operated primarily through the central distribution centre, Grocery Logistics of Singapore (GLS) Distribution Centre and is supplemented by the Fresh Food Distribution Centre (FFDC).

4.6 Standards used in the company value chain

4.6.1 As mentioned in section 4.3, the company is actively using standards, and is certified to ISO 9001:2008 and HACCP. However, for the purpose of this study, we will focus on other consensus standards used by NTUC FairPrice in the three key business functions identified earlier.

4.6.2 The list of standards considered for this pilot study is as follows:

1. Cold Chain Management – Milk and Dairy Products (TR 2:2000 followed by SS CP 95:2002)
2. Cold Chain Management – Chilled Pork (TR 20:2005 followed by SS CP 552:2009)
3. Standards on Pallet: ISO 6780:2003 and SS 334:2010
4. Standards on Barcode:
    - Primary barcodes
        - EAN 13 [6]
        - ISO/IEC 16390 [7]:2007 (or ITF i2of5)
        - ITF-14 [8]

6 EAN 13 (European Article Number 13) is a barcode symbology defined by GS1 which encodes 13 characters

7 ISO/IEC 16390: 2007, *Information technology – Automated identification and data capture techniques – Interleaved 2 of 5 symbology specification*

8 ITF-14 is GS1's implementation of ITF i2of5 symbology but with 14 digits being used in the encoding

- Secondary barcodes
  - ISO/IEC 15417:2007 [9](or EAN 128 or SS 362 Part 2:2004)
  - EAN 8 [10]
  - ISO/IEC 16388:2007 [11] (or Code 39)
  - Code 93 [12]
  - Codabar [13]
  - UPC A (XMIT 12) [14] Carton Barcode

4.6.3 The more technical standards that are key to the company's primary purpose are the focus of this pilot.

The ISO 9001 quality management system standard, being a management standard, was not included in this study. ISO 9001 is used by NTUC FairPrice and is also recommended to its suppliers of non-food products. Direct economic benefits would be difficult to derive given that it would not have direct attributable economic benefits as it is used more to assure customers that the company has a proper quality management system in place.

The HACCP standard is required for all food suppliers to NTUC FairPrice and its possible economic benefits were discussed with the company. However, after detailed discussions, it was decided by all parties concerned that as the main outcome of HACCP for NTUC FairPrice was food safety and the economic benefits are indirect and not easily traceable, the HACCP standard would not be included in this study.

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9 ISO/IEC 15417:2007, (or EAN 128 or SS 362 Part 2 : 2004) *Information technology – Automatic identification and data capture techniques – Code 128 bar code symbology specification*

10 EAN 8 is the short form of EAN 13. This code is only used if the article is too small for an EAN 13 code

11 ISO/IEC 16388:2007, *Information technology – Automatic identification and data capture techniques – Code 39 bar code symbology specification*

12 Code 93 is a barcode symbology designed in 1982 by Intermec to provide a higher data security enhancement to Code 39.

13 Codabar is a linear barcode symbology developed in 1972 by Pitney Bowes Corp.

14 UPC A (XMIT 12) is Universal Product Code A barcode symbology

4.6.4 The application of the standards in the three business functions are given in **Figure 6**:

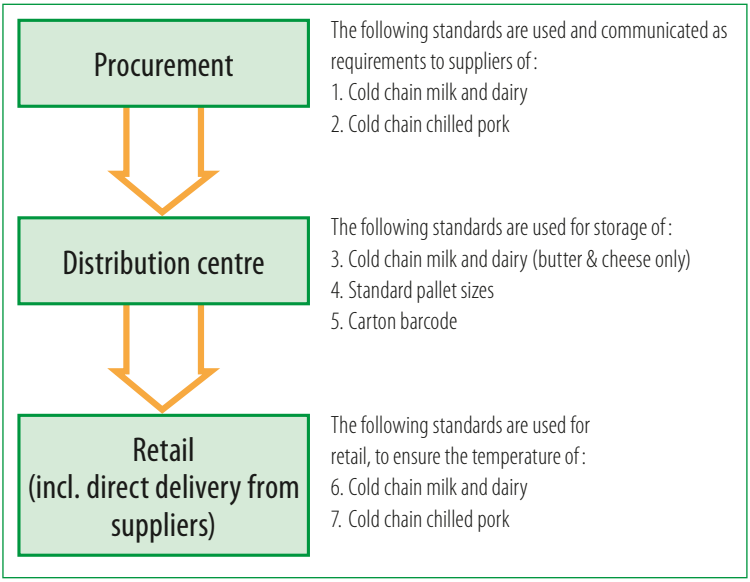

Figure 6 Business functions and their related standards

4.6.5 Key functions and objectives of the standards assessed

1. Cold chain standard for milk and dairy

The objectives of this standard are to establish and provide benchmarks for the management of temperature profiles along the supply chain for milk and dairy products manufactured under hygienic and sanitary conditions. It also aims to uphold the quality of products and reduce unnecessary wastage. It sets out the guidelines for the proper management of milk and dairy during the production, storage, transportation, manufacturing, distribution, handling and treatment at point of sale.

2. Cold chain standard for chilled pork :

The objectives of this standard are to establish and provide benchmarks for the management of temperature profiles along the supply chain for chilled pork to ensure the meat is processed, stored, transported and handled under proper hygienic and sanitary conditions. It aims to set out best practices in cold chain management for chilled pork so as to uphold the safety, quality and wholesomeness of chilled pork, safeguard public health, provide protection for consumers and reduce unnecessary wastage. This standard was implemented in 2005.

3. Pallet standard :

A significant portion of the benefits came from increased labour productivity and reduced cost of ownership of the pallets. Standardization has facilitated the movement and handling of goods, optimized the use of storage and warehouse space, reduced delivery costs and facilitated the automation of warehouse operations. More than 300 000 standard pallets are in use currently by the industry, resulting in savings of SGD 7.8 million for the fast moving consumer goods industry as a whole.

4. Carton barcode standards :

Before the use of carton barcodes, NTUC FairPrice manually recorded the information of products received by the distribution centres and delivered to their retail stores. This method was prone to errors. Carton barcodes were introduced in NTUC FairPrice in 2000 to improve the operational efficiency, accuracy of information and delivery of products from their distribution centres.

NTUC FairPrice does not use one but several barcode standards to accommodate the variety of barcode standards adopted by its different suppliers.

The use of carton barcodes has enabled the distribution centres to:

- Increase accuracy in the receipt and tracking of its products.
- Move the products from receipt to storage to assembly as well as delivery to retail stores in the shortest possible time. It generally takes a few seconds to scan the carton barcodes compared to a few minutes to write down the product codes by hand. This has helped to increase its productivity and throughput significantly.

5. Selection of operational indicators to measure the impact of standards

The objective of the study is to quantify the economic impact of standards. In order to do so, we apply a set of operational indicators to measure the impact before and after the introduction of the standards. These operational indicators have been carefully chosen on the basis of a series of interviews with FairPrice. Some of these indicators have originally not been designed to measure the economic impact of standards, but most have been used to measure the company's business performance in terms of non-economic indicators such as customer satisfaction, growth, operational excellence, etc. In the discussions with the company, a number of the operational indicators were developed that were specific to measuring the impact of standards. The operational indicators derived and confirmed by the company leaders are also aligned to the company KPIs.

ID of indicator	Operational indicators	Business function	Standards	Definition of the indicators
1	Time spent on communication with supplier	Procurement	CC Milk & Dairy, CC Pork	Time spent on communicating product requirements – AVA requirements, standard compliance, package size, quality, etc., while placing orders and general matters
2	Contracting activities with suppliers	Procurement	CC Pork	Long term contracts are concluded with selected suppliers on basis of their quality and standards in factory / abattoir
3	Number of customer return cases	Procurement, distribution centre (FFDC), retail	CC Milk & Dairy, CC Pork	Customer returns cases from retail store occur due to spoilt product after purchase
4	Number of non-conformance cases	Procurement, distribution centre (FFDC), retail	CC Milk & Dairy, CC Pork	Cases of product supplied by suppliers not meeting quality / standard requirement (at receiving point at distribution centre (DC) and retail stores)
5	Space savings	Distribution centre (GLS)	Barcode	Warehouse space savings with implementation of automated sortation system
6	Order fulfillment	Distribution centre (GLS)	Barcode	Speed of fulfilling orders of retail stores, thereby freeing up space at DC
7	Reduction in amount of handling damage cases	Distribution centre (GLS)	Barcode	Costs associated with handling damages during goods movement in the DC
8	Reduction in amount of stock-take	Distribution centre (GLS)	Barcode	Time spent on checking and tallying physical inventory in DC with book inventory
9	Reduction in amount of assets	Distribution centre (GLS)	Barcode	Machinery and equipment used in managing logistic operations at DC
10	Throughput rate	Distribution centre (GLS)	Barcode	Throughput rate (speed) in receiving, picking and packing of goods/ supplies

ID of indicator	Operational indicators	Business function	Standards	Definition of the indicators
11	Better information transfer about pallets	Distribution centre (GLS)	Standard pallet	Internal communication between employees on configuration and quantity of pallets and cartons
12	Expenditure on pallets	Distribution centre (GLS)	Standard pallet	Annual cost on pallets paid to external suppliers / leasors of pallets
13	Space requirement for receiving supplies	Distribution centre (GLS)	Standard pallet	Area (in sq m) in DC dedicated for receiving supplies which come in trucks (" receiving bays ")
14	Space requirement for storing pallets	Distribution centre (GLS)	Standard pallet	Area within the DC to store pallets when not used to stack goods/ supplies
15	Time spent on checking, receiving and arranging supplies	Distribution centre (GLS)	Standard pallet	Time spent by personnel on checking quantity of supplies received (whether the quantity matches the invoice)
16	Time spent on sorting pallets	Distribution centre (GLS)	Standard pallet	Time spent by personnel on sorting different types of pallets in the DC for storage and use
17	Value of write-off / disposal of spoilt or expired stock	Distribution centre (FFDC), retail	CC Milk & Dairy (Butter & Cheese), CC Pork	Product cost of goods/ supplies disposed off due to spoilage / expiry during storage or display at DC or retail
18	Customer returns	Retail	CC Milk & Dairy (All)	Product cost of goods/ supplies returned by customer due to spoilage or poor quality
19	Time required for quality checking	Retail	CC Milk & Dairy, CC Pork	Time spent on quality checking of goods while being displayed at retail
20	Time spent on daily disposal of pork	Retail	CC Pork	Time spent by personnel on disposal of spoilt / expired goods/ supplies at retail
21	Time spent on receiving supplies	Retail	CC Pork CC Milk	Time spent by personnel on receiving and checking quality conformance of supplies at retail

Table 2 Operational indicators applied in the assessment

CC = Cold Chain / FFDC = Fresh Food Distribution Centre / GLS = Grocery Logistics of Singapore
AVA = Agri-Food and Veterinary Authority of Singapore

4.7 Financial impacts of the standards

The total financial impact of the implementation of the standards is **SGD 4 516 467** calculated on an annual basis. In the following this impact is presented for the three selected business functions (see 4.7.1) and by standards (see 4.7.2) on an annual basis. An overview of the cumulative impacts in the period from 1999, when the implementation of standards started, until 2009, is given in 4.7.3.

4.7.1 Financial impacts by selected business functions

The following table provides the total annual impacts of the implementation of the standards by business function:

Business functions (BF)	Implemented standards	Total financial impacts on the BF (in SGD)
Procurement	Cold Chain Management Standards for Milk & Dairy and Chilled pork	26 548
Warehousing/distribution	Carton barcodes, standard pallet, Cold chain Management Standard for Milk and Dairy	3 809 763
Retail	Cold Chain Management Standards for Milk & Dairy and Chilled pork	725 156
Total		4 561 467

Table 3 Impact of standards by business function

4.7.2 Financial impacts by implemented standards

The following table provides the total annual impacts for the implemented standards:

Standards	Affected business functions	Total financial impacts on the BF (in SGD)
Cold Chain Management Standards for Milk & Dairy	Procurement, warehousing and distribution, retail	141 677
Cold Chain Management Standards for Chilled Pork	Procurement, retail	641 639
Carton barcodes, standard pallet	Warehousing and distribution	3 733 151
Total		4 561 467

Table 4 Impact of standards by assessed standards

4.7.3 Cumulative impacts between 1999 and 2009

The implementation of the standards in the three selected business functions started in 1999. However, the standards were not implemented at the same time. If we assume that the average period of impacts of standards is approximately five years, before they become "regular" business practice, then it is possible to summarize the financial impacts over this ten-year period as follows:

Year of implementation in FairPrice	Savings from standards over time (annual averages calculated over a 5-year period)			TOTAL (per year) in SGD
	Procurement	Warehousing/ Distribution	Retail	
1999		713 600		**713 600**
2000	7 613	713 600+31 613	102 451	**855 277**
2001	7 613	713 600+31 613	102 451	**855 277**
2002	7 613	713 600+31 613	102 451	**855 277**
2003	7 613	713 600+31 613	102 451	**855 277**
2004	7 613	31 613	102 451	**141 677**
2005	18 935		622 704	**641 639**
2006	18 935		622 704	**641 639**
2007	18 935		622 704	**641 639**
2008	18 935	3 064 551	622 704	**3 706 190**
2009	18 935	3 064 551	622 704	**3 706 190**
Total	**132 740**	**9 855 167**	**3 625 775**	**13 613 682**

Table 5 Cumulative impact of standards (1999 – 2009)

The largest impact has come from the warehousing/distribution function where the estimated savings from the implementation of the automated sortation system has brought with it manpower savings that has allowed for the same number of staff to handle the significantly higher number of stores without an increase in staff.

The implementation of these four standards has brought FairPrice benefits totaling SGD 13.6 million over 10 years from 1999 until 2009.

4.8 Qualitative and semi-quantitative considerations

4.8.1 Increase in revenue

The impact of all the standards have been to increase consumer confidence and therefore market share of NTUC FairPrice by providing higher quality of goods as well as increased operational efficiency.

The use of technology has helped to reduce the need for additional manpower to serve a more than double growth in the number of stores over the last 10 years and in handling the increasing demand for fresh foods which has more than doubled in the past 7 years. This has helped NTUC FairPrice to reach the high income market which has higher margins without sacrificing the needs of the middle and lower income markets.

While the impact of the cold chain standards in dollar terms would seem small, it is important to understand the qualitative aspects behind each of these benefits. The operational efficiency improvement has been crucial in streamlining the operations of NTUC FairPrice to meet the pace of sales growth as the number of stores has more than doubled over the last 10 years or so. For example, in the case of cold chain standards, the savings in the process of handling customer returns might not show a significant dollar benefit. However, the whole process has been streamlined and it has significantly improved inter-departmental communication and coordination.

The greater availability of chilled pork and milk and dairy products on the shelves with the extended shelf life, has helped to increase the revenue generated from these products.

In 2009, chilled pork sales increased by 22% from 2005 when the cold chain standard for chilled pork was implemented. Improved

throughput of good quality chilled pork has been made possible by the standard which has also brought with it significant operational cost efficiencies. If we assume that the contribution of the standard to establishing a more efficient supply chain resulting in increased sales of chilled pork over the 5 years, is 10 % i.e. SGD 800 000, this contribution would be significant to company revenues.

The cold chain standard for milk and dairy was implemented in 2000. Sales revenue doubled between 2003 and 2009 with the number of stores increasing from 65 in 1999 to 98 stores in 2009. Assuming that the contribution of the standard to establishing a more efficient supply chain resulting in increased sales of milk and dairy over the 6 years is 10 % i.e. SGD 5.5 million, then this contribution is of high significance to company revenues.

4.8.2 High quality products

The cold chain management standards have helped NTUC FairPrice in meeting its brand mission of providing high quality products and ensuring consumer confidence. The introduction of the standards in the supply chain has significantly reduced non-conformance incidents by suppliers, wastage during storage and the incidence of customer returns. More specialty fresh foods are also possible with the better temperature control systems in place. With better temperature control, a wider choice of suppliers overseas became also available, bringing with it both more competitive pricing and access to more specialty foods.

4.8.3 Increased operational efficiencies

Significant efficiency improvements have been seen with the reduction in product specifications for milk and dairy and chilled pork, and the greater availability of training both in house and outside the company. All operational indicators for the retail function have shown an

improvement of about 50 % except for the quality checking indicator which improved by 33 % for both milk and dairy and chilled pork. For the distribution function, all operational indicators show an increase of more or equal to 50 % annual efficiency improvement. The focus on reducing distribution costs has also helped towards FairPrice's mission of lower cost and higher quality products.

4.9 Evaluation of results

4.9.1 Cost savings

Taking into consideration the impact of standards over 5 years, the reduction of about SGD 13.6 million in operational costs over the last 10 years demonstrates the importance of standards, a point that FairPrice leaders are prompt to acknowledge.

Lower prices for good quality products are a key component of FairPrice's service philosophy. By implementing the cold chain standards, FairPrice increased the number of overseas suppliers in the sourcing of chilled pork to help to keep its prices lower.

4.9.2 Operational efficiencies

Operational efficiency gains for almost all operational indicators are above 50 %, with several indicators above 75 %.

The distribution centre throughput increased by 200 % with the automated sortation system based on the carton barcode in place, enabling the servicing of fast growing retail stores without the need for additional investment in additional shifts and warehouse space. Distribution centre savings over the last 10 years from implementing two standards is about 50 % of the total savings from the estimated SGD 13.6 million gained through the use of four standards.

4.9.3 Streamlining of procedures and processes and partnership with suppliers

While the financial impact for the other two business functions – procurement and retail, are not as significant, there are numerous qualitative and semi-quantitive benefits described in Section 4.8 above. For these functions, standards have helped reduce non-conformance and customer returns, and lowered the resulting costs for non-compliance issues. The standards have also helped to reduce wastage, increase the number of suppliers and improve the relationships with, and the benefits for, their suppliers.

The implementation of the cold chain standards by the milk and dairy and chilled pork suppliers, and the standard pallet standard, have also brought benefits in less wastage and less time spent in contract negotiations and delivery.

4.10 Conclusions

The ISO pilot study has helped the company obtain a holistic view of the quantitative and qualitative benefits of the four implemented standards as well as their contribution to the corporate mission of lower costs and higher quality. An estimated SGD13.6 million in benefits has been derived over the last 10 years with the use of just four standards. It is therefore likely the company will continue to implement standards and be involved in their development.

The company's effort to lead in standards development and implementation initiatives is highlighted by this pilot study which demonstrates the interconnectivity of the standards through the value chain, and the contribution they make to FairPrice's value drivers.

The ISO pilot has also shown that FairPrice's partnership with its suppliers, who have committed to the use of the standard pallet and the

cold chain management standards for chilled pork and milk and dairy products, have also benefitted through less wastage and improved operational efficiencies.

PTT Chemical Public Company Limited (PTTCH), Thailand

Country : Thailand
ISO member body : Thai Industrial Standards Institute (TISI)
Project team :
Leader : Ms. Chaowalee Ratanamungmeka (Director of Standardization Promotion and Development Bureau, TISI)
Consultant : Mr. Prakob Petcharutana (Senior Vice President, NPC Safety and Environmental Service Co., Ltd.)
Member : Ms. Nopporn Klum-em (Foreign Relations Officer, International Affairs Bureau, TISI)
Member : Ms. Boonsri Hanesopa (Promotion Officer, Standardization Promotion and Development Bureau, TISI)
ISO Central Secretariat advisor : Reinhard Weissinger
Duration of the study : October 2010 – February 2011

5.1 Objectives and structure of the pilot project

The Thai Industrial Standards Institute (TISI), a member body of ISO, was selected to participate in the ISO pilot project and has chosen a company from the chemical industry sector, PTT Chemical Public Limited, as the object of the assessment. The project team has been set up and is composed of the members of TISI and one external consultant.

5.2 Introduction of the selected company

The petrochemical business is important for Thailand's economic development since it is a downstream industry which supports sustainable development and produces products used in the four key sectors of housing, food, clothing and medicine. Moreover, petrochemical products provide the raw materials essential for manufacturing consumer products, and the means and facilities to enable convenient living.

PTT Chemical Public Company Limited (PTTCH), which is a leading petrochemical company in Thailand, operates broadly across the chemical sector with its main products being olefins and shared facilities, polymers and ethylene oxide-based performance products. In addition, the company also produces oleochemical products as well as jetty and petrochemical buffer tank farm facilities in order to support the activities of the PTT Group. Most of the company's products have been certified in conformity with product and management system standards.

In this respect, PTTCH is determined to improve the living standards of the Thai people. It is the company's commitment to contributing to the country by developing and adding value to the national resources, reducing imports, generating jobs and income, and ex-

tending technology and innovation competence to help upgrade the country's human resources to meet international standards. Consequently, the company has been selected by TISI for assessment within the ISO project.

Business assessment

TISI and PTTCH have discussed the pilot project aimed at assessing the economic benefits of standards, and have selected the company's polymer products to be the object of the assessment.

Polymers, as finished petrochemical products, are used as synthetic plastics to serve the other process industries, and the packaging, electric appliances and construction industries, etc. PTTCH polymer products include the following :

1. High density polyethylene (HDPE)
2. Low density polyethylene (LDPE)
3. Linear low density polyethylene (LLDPE)
4. Polystyrene (PS)

The assessment in this report is focused on the HDPE plant which has a capacity of 300 000 tons per year. Another plant operated by its subsidiary Bangkok Polyethylene Plc. (BPE) has an annual capacity of 500 000 tons. The products from the two plants are distributed under the brand " InnoPlus ". In this case study, the HDPE Plant that was assessed is referred to as " HDPE I-1 ".

The HDPE I-1 plant uses process technology purchased from Mitsui Chemical Inc., Japan. It is capable of producing HDPE, making the conversion to end-products via the processes of blown film, cast film, pipeline, injection and thread. Quality requirements can be adjusted to fit specifications for the production of plastic bags, drinking water bottles, milk bottles, oil containers, home appliances, toys, construction materials, as well as industrial and agricultural implements

like ropes, fishing nets, nets, plastic boxes, showcases, water pipes, electrical wire pipes, etc.

HDPE is distributed to local and international industrial plants via PTT Polymer Marketing Co., Ltd. (PTTPM) which handles marketing and distribution activities for the group, to strengthen marketing competitiveness in domestic and overseas markets.

Company Information

PTT Chemicals was established in December 2005 and has over 1 360 employees. It has the following production divisions:

- Olefins and shared facilities
- Polymer products value centre
- EO-based performance products value centre
- Oleochemical products value centre
- Services and others

Its annual production capacities are:

- Ethylene 1 276 000 tons
- Propylene 437 000 tons
- Total potential olefins output per year 1 713 000 tons

The company also produces:

- Mixed-C4s
- Pyrolysis gasoline
- Cracker bottom tailgas
- Hydrogen

Company operations are organized at its Bangkok headquarters and in branches situated in the industrial district of Rayong, located about 180 km southeast of Bangkok.

Polyethylene is a product which PTTCH manufactures for the process industry. It is used to produce equipment and plastic resins used in

daily life, thus supporting the development of the national economy. This has resulted in the reduction of imports of plastic resins from abroad. On the other hand, through its exports, PTTCH is able to contribute to the national income and to increase the efficiency of the Thai economy.

Most PTTCH customers are factories participating in the petrochemical process industries such as packaging, electrical appliances, motor parts, and textiles. PTT PM manages marketing and distribution through over 30 appointed domestic distributors and more than 120 appointed distributors covering all regions of the world. Moreover, distributors, in particular in China and Viet Nam, strongly support the management in their target markets and contribute to increased efficiency in distribution and in leveraging opportunities for greater PTTCH productivity throughout these markets.

Organizational structure of PTT Chemical

PTT Chemical is organized in five value centres covering the different products, and two centralized services for governance and shared services, as shown in **Figure 1.** Governance and shared services are at the corporate centre and serve the five value centres.

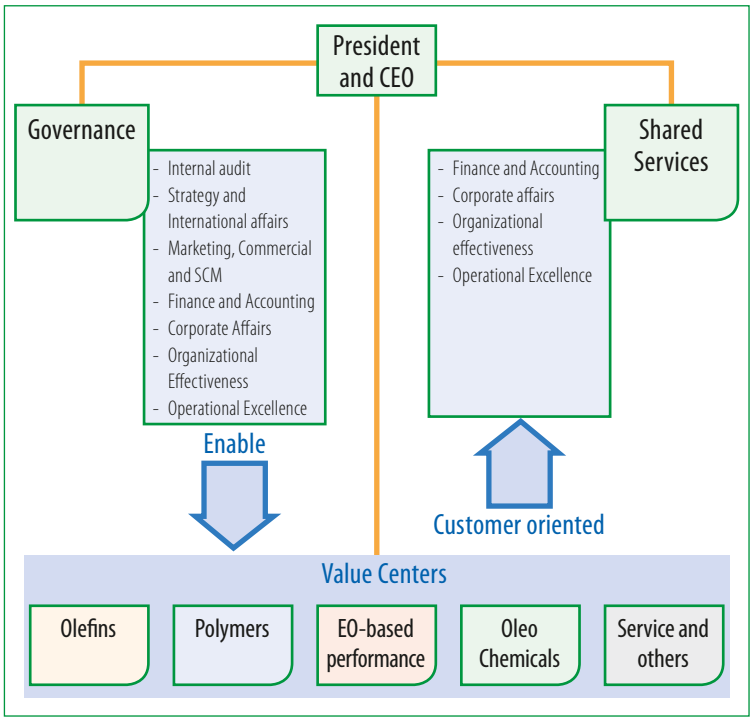

Figure 1 Organizational structure

5.3 Attitude of the company towards standardization

The petrochemical industry is categorized into three main segments, i.e. **upstream industry**, **intermediate industry** and **downstream industry**. Each industry category is large and has high costs since production and factory construction use costly advanced technology.

In general, the management of the petrochemical industry has been involved in production processes that involve certain risks with chemical reactions, and associated activities that can be dangerous to health and the environment. If an accident occurs that disrupts

production processes and results in environmental damage, there can be major losses that may also have a long-lasting impact on the company image. Therefore, PTTCH has made it a core part of its policy to apply management system standards such as ISO 9001, ISO 14001 and OHSAS/TIS 18001 rigorously in order to institute a systematic management approach as well as to reduce occupational health, safety and environmental hazards. In addition, PTTCH emphasizes the importance of product quality and applies product standards that are intended to create and maintain customer confidence. The HDPE I-1 plant applies product and management system standards.

5.4 Analysis of the value chain

5.4.1 Industry value chain

The **upstream petrochemical industry** transforms natural gas such as ethane, propane, liquid petroleum and fuel products into raw material to supply feedstock for the intermediate petrochemical industry. The **intermediate petrochemical industry** transforms the upstream products into raw material for manufacturing intermediates and transfers them to the downstream industry. The **downstream industry** transforms upstream and intermediate products into plastic resins and synthetic fibres which are the fundamental raw materials for process industries such as packaging, electrical appliances, motor parts and textile etc.

The petrochemical industry value chain is shown in **Figure 2** below :

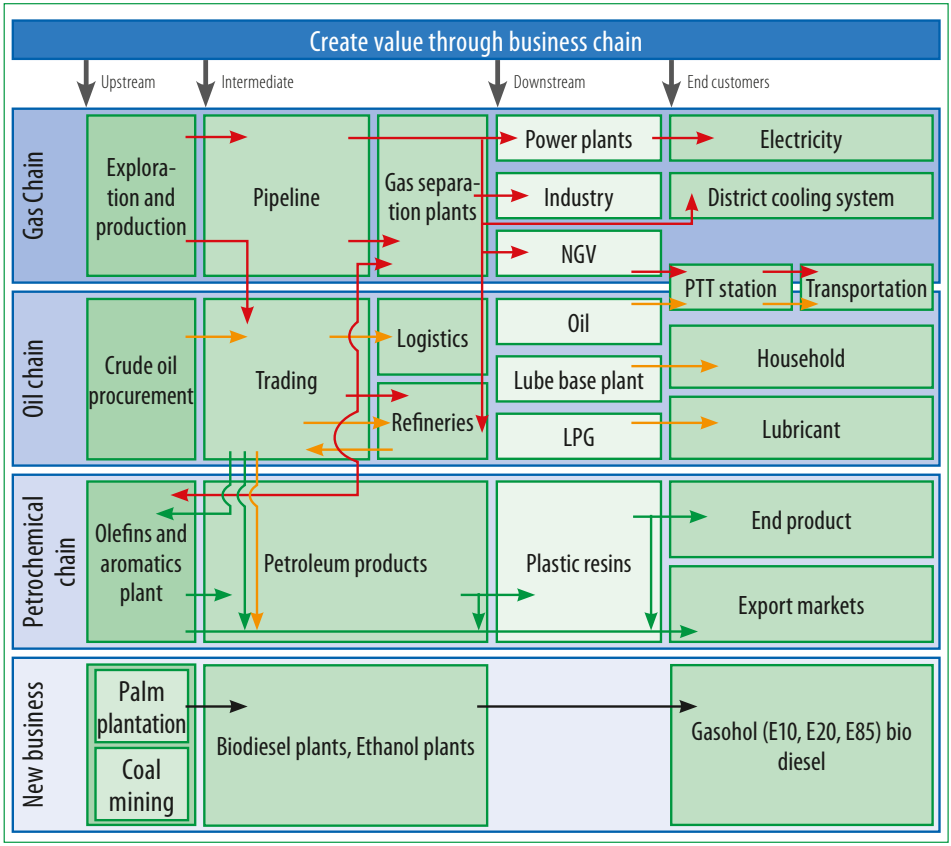

Figure 2 Petrochemical industry value chain

PTTCH is a fully-integrated petrochemical manufacturer covering the whole value chain from the upstream to the downstream segment. Production starts from the olefins-shared facilities business, with upstream petrochemical and related supply feedstock such as ethylene and propylene. It continues with the intermediate ethylene oxide-based performance products value centre business with specialty chemicals such as ethylene oxide (EO) and ethylene glycol (EG), choline chloride, ethanolamine and Intoxicate, etc. The final business is

the downstream polymer products value centre, producing polymers, the fundamental raw materials of many industries. Moreover, PTTCH's oleochemical products value centre bio-based chemicals fully support energy conservation and offers environmentally-friendly products.

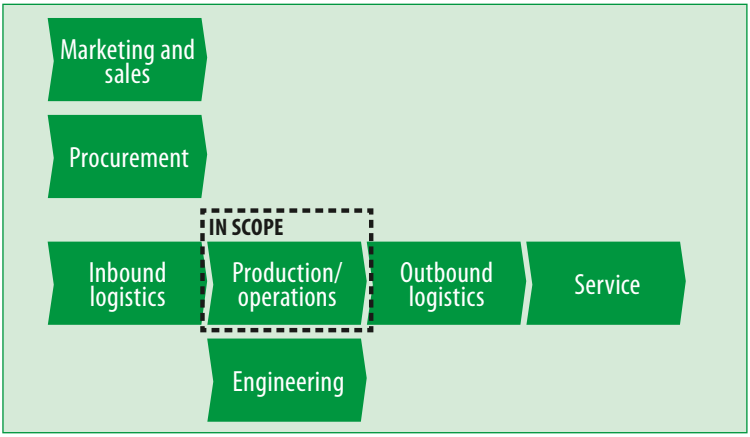

Figure 3 HDPE I-1 plant – Company value chain (with scope of assessment)

5.4.2 HDPE I-1 plant value chain

As stated in Section 5.2, the scope of this case study is limited to the downstream petrochemical industry, and focuses on the production of high density polyethylene (HDPE), the core activity of the HDPE I-1 plant. The reason for this selection is that, from the beginning, the company introduced production and operational indicators that can be used to assess the economic benefits of standards.

The details of the HDPE I-1 plant's value chain are as follows :

The value chain is driven by orders from customers to PTT Polymer Marketing Co., Ltd (PTTPM), a marketing agent and distributor of polymer products for the PTT Group. PTTPM collects customer orders and customer specifications and communicates these to the planning department. It transfers then the raw materials to the quality instru-

ment unit and to the HDPE I-1 production unit. The plant covers the complete process through to packaging and storage. The effective placement of polymer products is inspected by the technical unit during the process. Before packaging and storage, the products will be tested and checked before they are transferred to PTTPM for distribution.

5.4.3 Key value drivers

PTT Chem (HDPE I-1)		
Value drivers	**Description**	**Source**
Focused value chain coverage	Focus on operator skills in the production process	PTT Chem (HDPE I-1)
Quality of the production process	Ability to minimize failure rates in production	PTT Chem (HDPE I-1)
Product quality	Ability to create high quality products	PTT Chem (HDPE I-1)
Efficiency of production	Ability to optimize production processes in terms of process time and costs	(PTT Chem (HDPE I-1)

Table 1 Key value drivers of the HDPE I-1 plant

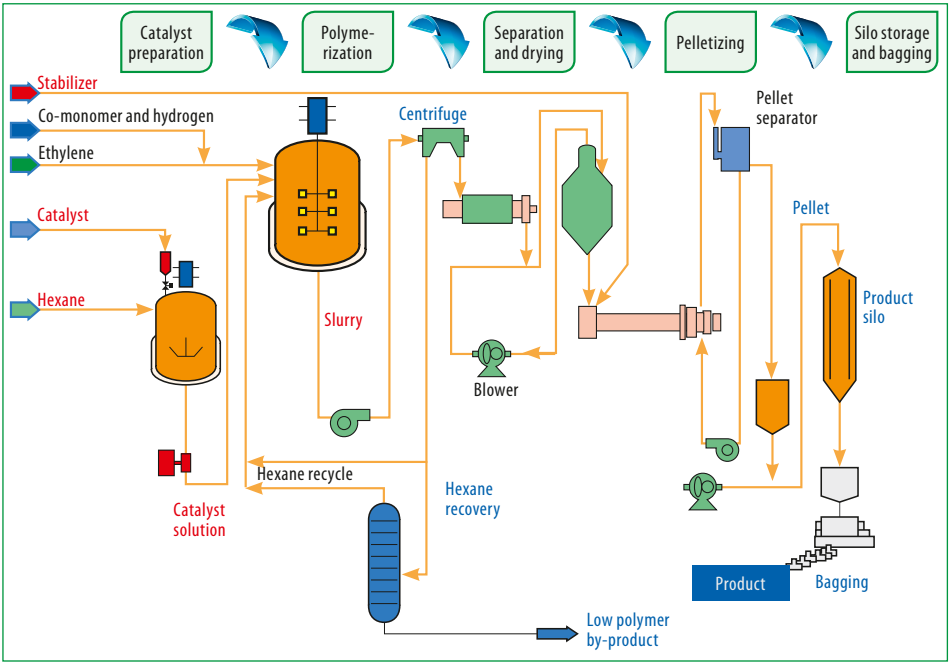

Figure 4 HDPE I-1 process flow

5.5 Scope of the pilot project assessment

In this case study, the HDPE production was selected for assessing the economic benefits of standards. The project covers the production and operation from planning, production and quality control to laboratory testing. Standards related to product, technology and management systems are applied at each process stage, enabling us to assess their benefits to the company. As mentioned in Section 5.4.2, we selected HDPE because manufacturing is the core operation of the company. Since the beginning of its operations in 2005 certain production process indicators have been applied. These will also be used to assess the economic benefits of standards (see Sections 5.7 and 5.8 of this report).

It should be noted that the report does not cover the assessment of suppliers nor the quality of their inputs. The reason is that raw materials testing is completed by the suppliers before the materials are delivered, so the plant relies on the correctness of such tests. The olefin plant adheres to ISO standards and is part of PTTCH, and minor raw materials are already subjected to random testing by the internal PTTCH laboratory.

5.6 Use of standards by the company

The HDPE I-1 plant applies the following standards throughout its operations.

5.6.1 Product standards and similar requirements

The HDPE I-1 plant implements product standards recognised in domestic and international markets. The company has certified its products against the standards listed below:

No.	Product standards	Year of certification
1	TIS 816:1995, Polyethylene resin	2007
2	US FDA 21 Code of Federal Regulations part 177.1520, test for PE, PP or olefin copolymers) (Revised 1 April, 2010)	2006
3	RoHS Directive 2002/95/EC (Directive of the European Commission on the Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment)	2006
4	European Standard EN 71:1994 + A1:2000 + AC:2002, Safety of toys – Part 3 : *Migration of certain elements*	2008
5	DIN 10955:1983, (revised 2003) *Sensory Analysis - Testing of Packaging Materials and Packages for Foodstuffs*	2009

Table 2 Main product standards

5.6.2 Process Standards

In recent years product competition has been on the increase at the international level. This relates in particular to efficiency of production, which cannot be expressed simply through the quality of the product. To increase efficiency, the company follows the approach of continual improvement in efficient management by applying the following International Standards in the HDPE I-1 plant:

No.	Process standards	Year of certification
1	ISO 9001:2000, *Quality management systems – Requirements*	2006
2	ISO 14001:2004, *Environmental management systems - Requirements with guidance for use*	2009
3	TIS 18001:1999, *Occupational health and safety management systems*	2009
4	OHSAS 18001:1999, *Occupational health and safety management systems -- Specification*	2009
5	ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*	2006

Table 3 Main process standards

5.6.3 Engineering Standards

As explained in Section 5.2, the process technology for the manufacturing of HDPE has been purchased from Mitsui Chemical Inc., Japan. The complete design of the plant, including the construction and the process technology, has been developed by Mitsui and is used unchanged. The "Mitsui technology" and PTT Chem engineering knowhow applies engineering standards extensively (mainly standards of ASTM, ASME, AWS and some other standards organizations).

Engineering standards are particularly relevant to the organization of production and company processes in accordance with scientific criteria for the monitoring and measuring of company operations.

5.7 Selection of operational indicators to measure the economic impacts of standards

Several indicators have been defined in order to assess the success of the plastic resin production process at HDPE I-1. Four key indicators are used in our assessment which relate to standards, and are applied to the production process. These four indicators are defined below:

Plant reliability: This indicator measures the stability and reliability of the operation of the plant by comparing actual production with the nameplate production capacity (the production capacity as stated by the equipment manufacturer).

Off specification: The amount of product that does not comply with specification. This is calculated as the prime production as a percentage of total polyethlyene (PE) production:

$$\text{Off spec. ratio (\%)} = \frac{100 \text{ Prime production (Ton)}}{\text{Total PE production (Ton)}}$$

Ethylene consumption: Ethylene consumption is calculated using the equation below:

$$\text{Ethylene consumption} = \frac{\text{Ethylene (Ton)}}{\text{PE actual (Ton)}}$$

Energy index: This indicator measures the usage of energy in polyethylene (PE) production. If this indicator is low, the energy consumption during the polyethylene production process is low. The equation is:

$$\text{Energy index (Mwh/Ton)} = \frac{\text{Net energy (Mwh)}}{\text{PE actual (Ton)}}$$

A production quality management manual has been prepared for the plastic resin production process in accordance with ISO 9001 specifying the quality management system as the fundamental guideline for good manufacturing practice.

Data on core processes, related processes and any relevant criteria have been established to enable higher efficiency. In addition, the HDPE I-1 production plan and criteria such as production quantity versus machinery capacity, the amount of off spec, in and out of planning, shut-down periods, the quantity of each raw material used, energy consumption, etc., have been clearly established.

The plant reviews these indicators every year to further improve efficiency and effectiveness. In this respect, the indicators explained above, i.e. plant reliability, off spec., ethylene consumption and the energy index, have been selected by the TISI project team as the means of assessing the economic benefits of standards. If these indicators have not been specified in accordance with ISO 9001 in the quality manual, the production process does therefore not comply with the specified planning.

5.8 Aggregated impacts and economic benefits of standards

The calculation of the economic benefits of standards for the four indicators is based on a comparison of 2005 data — the year the plant first implemented the standards — and 2009 data to demonstrate the increase in benefits obtained.

Selected business function	Operational indicators	Financial impact of standards on the whole business function (in 2010 prices - million USD)
Production/operation	Plant reliability	4.6
	Off specification	0.3
	Ethylene consumption	1.7
	Energy saving	2.8
	Total:	**9.4**

Table 4 Financial impact of standards

The contribution of standards as a percentage of total HDPE I-1 sales revenues or turnover is approximately **3 %**.

5.9 Qualitative and semi-quantitative considerations

An important additional indicator in this case study is the saving resulting from reduced need for laboratory testing. However, it has been impossible to calculate the impacts for this indicator since no data have been recorded. The PTTCH testing service centre, which achieved ISO/IEC 17025 certification, conducts laboratory tests and is responsible for the inspection of raw materials used in manufacturing, including the quality of several HDPE I-1 products. Plastic resin produced by the plant is also tested and monitored. The benefits from meeting the requirements of the ISO/IEC laboratory testing and calibration standard can be seen in high and consistent product quality and customer confidence. This results in cost and time savings due to a reduced need for repeated tests for manufacturers and customers. It demonstrates how the standards generate economic benefits and provide guidance for further plant improvements.

5.10 Evaluation of results

In this study we were unable to compare the situation before and after the introduction of standards. The reason is that the standards have been used since the beginning of the operation of the plant in 2005.

Moreover, the HDPE I-1 plant has proactively introduced management system standards such as ISO 9001, ISO 14001, TIS 18001, OHSAS 18001 and ISO/IEC 17025 as a framework for its manufacturing operations. The combined effect of management system standards and engineering standards "built-in" to the company and Mitsui technology, has been to raise the plant to a level of performance indicated by improvements in the four key indicators. Without consistent use and a management approach based on these standards, such an improvement would not have been possible. An impact from standards of 3 % of the sales revenue can be considered significant. In addition, the standards provide a framework for management and plant operation and can therefore be regarded as the "glue" that keeps the different operations and systems of the plant together.

This case study also demonstrates how the ISO methodology can be applied in a specific and flexible way. A flexible approach is required when a company has used standards from the outset, making it impossible to compare empirical data collected "before and after" the introduction of standards.

As the authors of this study, TISI suggests that reports resulting from case studies in other countries be provided to enable a comparison between the findings and the specific conditions of the companies under assessment.

5.11 Conclusions

To assess the economic benefits of standards for PTTCH, TISI selected the production and operations of the HDPE I-1 plant as the subject of its study. The four indicators : plant reliability, off specification, ethylene consumption and energy index, were chosen to assess the impacts of standards. The reason for this selection is that the plant collects regular data for these indicators, and it was possible to relate that information to the systematic use of standards at the management, technical and engineering levels.

After 2006, the plant systematically conformed to ISO 9000 as an administrative and management guideline resulting in increased manufacturing output and reduced use of ethylene and energy. In addition, the plant has published a quality production manual used as a basis for planning, raw material provision, and monitoring and testing of the material before manufacture, which is also followed by its suppliers. It controls production via a high-performance control system and can identify product that does not meet specification through measurements and product tests. The manual also provides guidance on the function of every unit, and helps to improve the ability of employees to control the production processes and achieve cost and time reductions, while reaching higher levels of efficiency.

TISI is currently discussing the possibility of cooperation in similar projects with other companies in Thailand with a view to extending the pilot project undertaken with PTT Chemical.

Electrical Devices Joint Stock Company No. 1 (VINAKIP), Vietnam

Country : Vietnam
ISO member body : Directorate for Standards, Metrology and Quality (STAMEQ). The study has been undertaken by the Vietnam Standards and Quality Institute (VSQI) which operates under the authority of STAMEQ.

Project team :
Project leader : Mr. Pho Duc Son (Director, VSQI)
Consultant : Ms. Man Thuy Giang (VSQI)
Member : Ms. Bui Ngoc Bich (VSQI)
ISO Central Secretariat advisor : Reinhard Weissinger
Duration of the study : October 2010 – March 2011

6.1 Objectives and organization of the pilot project

This pilot study is based on the selection of one company in Vietnam in order to assess the economic benefits the company obtained from using standards. Before introducing the company, we give a short overview of standardization activities in Vietnam to demonstrate the relevance of the study.

6.1.1 Standardization activities in Vietnam

Standardization activities in Vietnam have taken place for nearly 50 years. They have contributed to trade and industry development and to solving some of the socio-economic development needs of the country.

With the globalization of trade comes increasing awareness of the important role of standards and the benefits they bring. Standards are seen as technical tools to improve product quality, enhance competitiveness, facilitate domestic, regional, and international trade, speed up innovation and enhance technology transfer. They also help in providing solutions to global issues such as social responsibility, societal security, and environment and climate change.

However, in Vietnam, there has been no systematic study of the impacts and benefits of standards. While the benefits are mentioned in some scientific documents there are no quantitative figures available.

It was recognized that participation in this pilot project would help the NSB to address the issue of the economic benefits of standards to :

- Enable private and public sector stakeholders to appreciate the economic and social impact of voluntary consensus standards better

- Raise the awareness of policy makers and business leaders of the importance of standardization.

Applying the ISO project methodology was an excellent means of describing and quantifying the benefits of standards. This is extremely important for monitoring and prioritizing standardization activities, and for raising awareness, improving communication, promoting the use of standards and encouraging stakeholder participation.

The project was focused on the electrical equipment industry and includes a case study of an electrical equipment manufacturer. The main objectives were to :

- Apply the ISO methodology to assess the impact of standards in one sub-sector of the electrical equipment industry
- Evaluate the results to obtain the EBIT impact of standards on one company in the sector
- Expand the results from company to industry level, and then cover the entire economy in a later project.

The Vietnam Standards and Quality Institute (VSQI) conducted the project, from September 2010 to March 2011, under the authorization of STAMEQ, the national standards body of Vietnam.

6.1.2 Economic policy context

One of the ASEAN common market's activities is to provide common technical specifications for products and services based on regionally harmonized standards as well as international standards.

Electric and electronic products are among the first in this harmonization process. As a result, standardization activities in the sector are a main focus in Vietnam. In parallel with economic growth, industrialization and modernization in Vietnam, the electrical equipment manufacturing industry is also growing quickly and has a very high potential of development.

According to experts [1], the industry has a roadmap and significant development opportunities due to the huge potential for consumption in the country and abroad.

Growth perspectives

- **for the domestic market**: According to development plans approved by the government for the period 2015-2025, the industry will grow to meet increases in demand of 70 % for line equipment and transformer stations, and 55 % for electric motors and some types of commonly used generators. Manufacturers are expected to produce and supply complete electrical systems for power lines, transformer stations, and meet 50-60 % of the demand for 110-220 KV transformers.
- **for export markets**: By 2015 exports are forecast to reach 30-35 % of production to fulfill the demand for electrical meters, instruments, systems to monitor the safety of the power grid, plus a complete range of power station equipment. Exports in manufacture of high quality electric wire and cable will reach around 20 % of production and attain an annual increase of around 35 %. In addition to the traditional markets, the electrical equipment manufacturing industry sees huge potential markets in neighboring Laos and Cambodia. Vietnam has made commitments to these two markets in the form of a memorandum of understanding and a cooperation and investment agreement to develop the electrical sector.

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1 http://www.bsc.com.vn/NewsDetail.aspx?NewsID=109904
Electrical equipment manufacturing industry : Many big market waiting for (in the seminar "The potential and opportunities for Vietnam's power sector equipment" was held recently in Ho Chi Minh City) (ven.vn – 02/09/2010 7:45:00) (last accessed on 10th January, 2011)
http://www.baohoabinh.com.vn/12/46866/Thiet_bi_dien_Nganh_hap_dan_.htm
http://www.business.gov.vn/newsevents.aspx?id=8678
http://ven.vn/news/detail/tabid/77/newsid/15024/seo/Nganh-thiet-bi-dien-Viet-Nam-la-mot-trong-nhung-nganh-hap-dan-dau-tu-nhat-trong-khu-vuc/language/vi-VN/Default.aspx

6.2 Introduction to the selected company

The electric equipment manufacturer **Electrical Devices Joint Stock Company No. 1 (VINAKIP)** [2] has been selected as the subject of this study. Established in 1967, the company is a subsidiary of the Vietnam Electrical Equipment Corporation, a joint stock company of which 36,03 % are owned by the Ministry of Industry and Trade, and 63,97 % by private stakeholders.

VINAKIP is located in Xuan Khanh Dist., Son Tay Town, 70 km from Ha Noi City. The company has about 540 employees and seven branch offices in Ha Noi, Quang Ninh, Nghe An, Quang Binh, Da Nang, Ho Chi Minh, Buon Ma Thuot, and 19 distributors.

Key products are sockets, wire and cable, electromagnetic ballasts, plugs, switches, lamp holders, electrical boards, circuit breakers, magnetic contactors, and fuses.

Currently, the market for electrical products in Vietnam is expanding at around 16 % per annum, so there is high demand and good prospects for company sales. At present, VINAKIP produces only for the domestic market, but intends to export in the future. An " indirect " form of export of some VINAKIP products has occurred through construction projects in other countries in the South East Asian region. Apart from household appliances, the company provides a significant amount of product for the construction and electricity generation industries. In view of the very high rate of development of the industry, VINAKIP enjoys a high potential for growth.

The company's total revenue in 2010 was 196 billion Vietnamese Dong (VND) (approx. USD10,1 million).

2 http://www.vinakip.vn

There are several other large manufacturers in the domestic market that produce the same type of products as VINAKIP. These include Power Engineering JSC (PEC), part of Electricity of Vietnam ; Hanoi Transformer Manufacturing and Electric Material JSC ; Electric Equipment Corporation (THIBIDI) ; Vietnam Electric Wire and Cable JSC (CADIVI) ; Vina LS Cable Co. ; DongAnh Electrical Equipment Manufacturing JSC, and the HANAKA Group JSC.

In recognition of the severity of such competition, VINAKIP has decided to focus on customers with average to low income. Compared with other companies producing the same type of electrical equipment, VINAKIP dominates in terms of quality, with products manufactured and tightly controlled in conformity with the ISO 9001:2000 quality management system standard. As such, the company provides assurance of quality to meet customer expectations.

To maintain quality, VINAKIP is careful to invest in equipment and technology, and to focus on research, development, and product improvement, to support its motto " always listen and constantly improve ". The company undertakes market studies, researches competitive products and services, and designs new products to increase its competitiveness in the market.

All strategic decisions and production processes are implemented in connection with standards.

6.3 Attitude of the company towards standardization

In the past VINAKIP was a state-owned company forced to use standards, which, at that time, had the status of technical regulations. After the Law on Standards and Technical Regulations came into effect in January 2007, standards implementation became voluntary, except

in cases where mandatory use was required in technical regulations. The company continues to use standards as a foundation of its work. Therefore, using standards is a tradition in VINAKIP. Management and staff are well aware of the importance of standardization to its business. The company employs standards from the very beginning of production, at the product design phase. It uses standards to manage its business internally, and externally with suppliers and customers.

At present, the company applies mainly national standards (TCVNs) and IEC standards. It has been certified to ISO 9001:2000 since 2003.

According to VINAKIP top management, the main reasons for implementing standards are :

- To achieve higher reliability of the technology covered by the standards
- To achieve a higher degree of interchangeability and compatibility of products
- To support the organization of processes
- To meet requests from customers for conformity with standards
- To comply with legal requirements stipulating that product documentation, including labels, must contain information about applied standards, and that products subject to technical regulations must conform with the requirements of standards referenced in technical regulations
- To meet regulatory requirements for the use of health and safety standards.

As a result, VINAKIP has registered as a member of the standard information networks SICNET and TCVN-NET in order to receive updated information about national, foreign, regional and international standards. In addition, the company has also develop its own internal standards based on existing standards.

VINAKIP is not an official member (participating member) of any national technical committee (TC) but it regularly gives comments on drafts of TCVNs and sends representatives to participate in meetings during the development of national standards in the relevant fields.

6.4 Analysis of the value chain

6.4.1 Industry value chain

The electrical equipment industry is divided into three sub-sectors:

- Stable electrical equipment
- Rotational electrical machines
- Electrical devices.

VINAKIP is active in the electrical devices sub-sector which mainly uses the following production materials:

- Metal including cooper, aluminum, alloy, steel
- Plastic
- Insulated porcelain.

The company uses the following services for its business activities:

- Transportation
- Testing
- Installation
- Subcontractors for spare parts manufacture or special technologies such as plating or painting.

Users of products of this sector include the electricity and construction industries and consumers (end users).

The industry value chain can be illustrated as in **Figure 1**:

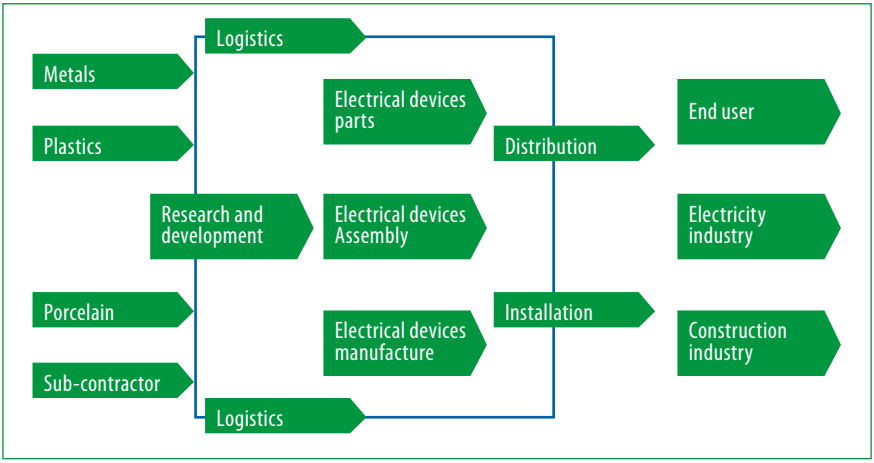

Figure 1 Electrical devices industry value chain

6.4.2 Company value chain

In line with the ISO methodology, we applied the approach of Michael Porter to describe company activities as a value chain, and to categorize the company activities into different business functions.

	Business functions	Activities
A	Management and administration	• Management review • Quality planning • Equipment management • Measurement equipment control • Training • Documents and records control • Correction, prevention and innovation
B	Research & Development	• Customer requirement review • Design • Prototype production
C	Engineering	• Material, semi-product and final products testing • Checking and calibrating equipment

D	Procurement	• Selection of suppliers • Negotiation and contracting • Raw materials procurement • Parts procurement • Services hiring • Monitoring
E	Inbound logistics	• Suppliers assessment • Material norms control • Storage management • In-house logistics
F	Production/operations	• Production planning • Material checking • Producing • Fitting • Testing • Control of non-conformity products • Traceability • Non-conformity correction and prevention • Production innovation
G	Outbound logistics	• Packaging and labeling • Warehousing • Distribution • Delivery • Transportation
H	Marketing and sales	• Market survey • Orders receiving and considering • Customer satisfaction measurement
I	Services	• After-sales services • Feedback from customers

Table 1 Company value chain of VINAKIP

6.4.3 Key value drivers

Value drivers are the capabilities of companies that give them an advantage over their competitors and are key to success in their business.

Below are the value drivers that company managers in VINAKIP identified as the keys to success.

Value drivers	Description
Safety and quality of products	Safety is the most important characteristic of electrical products, and of concern to all producers. Product safety will decide the reputation and position of the company in the market.
Continuous improvement	Product improvements will bring two competitive advantages to the company : Firstly, product improvement will help satisfy the highest demands of customers that switch brands regularly ; Secondly, in such a competitive market, improvement will help the company optimize its production activities leading to enhanced production efficiency, reduced cost and competitive advantage.
Price	Products that combine reasonable price with high quality gain a competitive advantage by appealing to medium income buyers.
Customer orientation	This is the decisive factor in the R&D function before new products are designed and produced.

Table 2 Value drivers of VINAKIP

6.5 Scope of the pilot project assessment

For reasons of limited time and the need to base the study on the most important company activities, the project team and VINAKIP experts agreed to focus on assessing the economic benefits of standards for the following business functions :

- Inbound logistics
- Production.

However, we also addressed the following related business functions :

- Procurement

- Research and development
- Marketing and sales.

Although it had been our objective to include outbound logistics in the assessment, it was not possible to find quantifiable data for this business function, so further analysis was not pursued.

Furthermore, we decided that the assessment should focus on two types of products, electrical sockets, a product that has been produced by VINAKIP for many years and cables/wires, which is a new product in the portfolio of the company.

6.6 Use of standards in the company value chain

Standards applied to company activities are mainly national standards (TCVN), although they are almost identical to ISO and IEC International Standards. The standards used in the company value chain of the two products investigated – sockets, and wire and cable - in the selected business functions are listed in the table in the annex of this report.

6.7 Selection of operational indicators to measure the impacts of standards

Following is a list of operational indicators used to quantify the impacts of the standards. Most are related to the inbound logistics and production business functions.

No	Related business function / type of data measured	Operational indicators	Definitions
1	**Procurement** Type : Average savings per year	Reduction in supplier management costs	By applying standards for materials, the company can cooperate with more reliable suppliers and reduce the cost of supplier management in terms of time and human resources
2	**Inbound logistics** Type : average savings per year	Reduction in materials testing costs	By applying standards for materials, the company can save the cost of materials testing before production through a reduction in test frequency
3	**Production** Type : average savings per year	Reduction of waste (i.e. products that have to be disposed of and cannot be re-used or repaired)	By applying standards for materials, the rate of waste can be reduced
4	**Production** Type : average savings per year	Replacement costs for non-functional products (warranty)	By applying standards for products, the rate of product replacement can be reduced
5	**Production** Type : Average savings per year	Reduction in costs for testing finished products	By applying standards, the company can save the cost of testing finished products through a reduction in test frequency
6	**Production** Type : average savings per year	Saving in production costs through continuous improvements	By implementing a QMS according to ISO 9001 and applying continuous improvement processes to promote initiatives, the company can make significant savings in production costs in terms of time, human resources and materials, and can achieve product improvements
7	**Production** Type : average savings per year	Savings in production materials	By using materials conforming to standards the company has less production waste
8	**Research and development** Type : this is a one time saving (not an average saving per year)	Savings due to not needing to write specifications internally	Using existing standards for materials, products, processes etc., the company can make savings in money, time and human resources, which would accrue if internal specifications would have to be prepared

No	Related business function / type of data measured	Operational indicators	Definitions
9	**Sales and marketing** Type : average sales revenue increase per year	Increased revenue due to improved customer confidence as a result of using standards	Demonstrating that company products conform to external standards (national or international) increases customer confidence, which leads to increased sales

NOTE : **Indicator 8** expresses a one-time impact and does not represent annual averages.

Table 3 Operational indicators used in the assessment

6.8 Calculation of the economic benefits of standards

Below is a calculation of the impact of standards expressed as annual impacts in 2010 (in Vietnam Dong (VND) and prices of 2010) :

Revenue from the sales of sockets in 2010 was approximately VND 35 billion, and wire and cable around VND 37 billion, so total revenue from these two products was VND 72 billion.

Production costs for sockets were about VND15,3 billion, and about VND 21,5 billion for wire and cable - resulting in a total of approximately VND 36,8 billion.

Earning from these products before tax and interest payments was VND 35,2 billion.

The percentage of the total financial impacts on the **company EBIT** due to the use of standards **for the two products is 21,3 %**, calculated as :

(VND 7 490 479 019 / VND 35 200 000 000) x 100 = **21,3 %**

The percentage of the total financial impacts due to the use of standards on the company revenue which is generated by **sales of the two products** is **10,4 %** and is calculated as

(7.490.479.019 VND / 72.000.000.000 VND) x 100 = **10,4 %**

This is the percentage contribution of standards to company earning from two of its products derived from inbound logistics, production, marketing and sales, and R&D.

If we calculate the impacts as a **percentage of the total sales revenue** in 2010, then this equates to (VND 7.49 billion / VND 196 billion) x 100 = **3,8 %**.

6.9 Qualitative and semi-quantitative considerations

Within the scope of this study, several impacts of standards have been identified for which quantification was not possible. In particular, some of the benefits deriving from the use of standards cannot be directly quantified as indicated under Section 6.5, mainly because of lack of data. Below are some examples.

a) Production

- With standardized specifications for specific components, the number of standardized products increases. Production becomes more efficient because of the reduced number of types of non-standardized products,. However, this cannot be quantified
- After introducing ISO 9001, internal information can be transferred faster, more efficiently and more precisely. Using standardized documentation and specifications means that internal information about products and services is passed on more efficiently within production. But there is no related data available

- Production staff can be trained better because relevant specifications are standardized, for both products and services. But there is no calculation of the effectiveness of training due to the presence of standards.

b) Logistics

There are many impacts of management standards on logistics activities although there are no figures available. They can be listed as follow :

- Standardized documentation, packaging, labels or supply tags make goods receiving more efficient. Savings of time and labour costs are evident, although it was not possible to quantify these.
- Acceptance and handling of supplies in inbound logistics can be conducted more efficiently due to the reduction in the number and type of supplies. In addition, with the greater availability of standardized products, fewer supplies need to be stored in the warehouse. They are put into production faster, and inventory time decreases
- After implementing ISO 9001, the transmission of logistics information must be strictly controlled as required under the QMS procedures
- Since training staff in the logistics function is mainly achieved on the job, the standardization of product and service specifications helps in raising training effectiveness
- Additional positive impacts are improved customer satisfaction and confidence.

6.10 Evaluation of the results

The study results take the following limitations into consideration :

- Standards are seen as enabling and contributing to overall value creation, thus individual causes are difficult to identify separately

- Company assessments are based on estimates of perceived effects and not always on technical or managerial data
- The collected examples only cover the most relevant functions.

The basic limitation of the study approach is that most impact assessments have been based on the best estimates by the field study participants. Only in some cases could actual data be obtained and applied, while the estimates of participants are naturally influenced to a large extent by subjective perceptions.

Moreover, not all of the impacts could be quantified in all cases. Therefore, assumptions were required based on qualitative estimations.

In order to validate and refine the findings of this study, the sample should be extended and the data (most captured from interviews) refined through an iterative process.

However, the results of this case study using VINAKIP as an example clearly indicate that the economic impact of standards on the industry is substantial. By contributing to more than 20 % of the company EBIT and to nearly 4 % of the overall sales revenue, it is evident that standards have an important and integrative role to play in the growth and success of the company. Despite the limitations of the study, the outcome can be considered as meeting the objectives.

To further improve the impact of standards VINAKIP should take part in standards development more actively, even though the company has a history of using standards and is well aware of their role in its business. Indeed, VINAKIP seems - to a certain degree - to have underinvested in standardization activities if one considers the contribution and economic benefits they bring to the company.

6.11 Conclusions

The findings of the assessment reveal that standards play a very important role in the success of the company, however, their impact is not always measured quantitatively.

During the interviews all members of the company agreed that they could not conduct their business as well without standards. However, due to a lack of statistics, many activities could be found that were impacted by standards, but it was not easy to quantify them. Data included in the calculations was based mainly on estimates and on the interviewees experience.

Another difficulty was that data on total revenues, or related to activities such as manufacturing, purchasing raw materials, technical innovations, etc., were sometimes available but not for each category of company products.

Despite the limitations and difficulties, the basic project objective was achieved satisfactorily.

The project has brought valuable experience for the company and the project team which can be used in further expanding the study. Above all, the project provided strong evidence of the possibility to quantify those impacts despite the difficulties in doing so. It also helps National Standards Bodies and policy makers to gain convincing evidence of the effectiveness of government investments in standardization activities in Vietnam, and to demonstrate that these activities can bring even more positive impacts to help businesses, industries and the entire economy achieve stable and sustainable growth.

ANNEX : List of standards implemented by VINAKIP relevant for the two selected products sockets and cables/wires

No.	TCVN number	Title	Identical with International Standards
	Product 1 : Sockets		
1	TCVN ISO 9001:2008	Quality management system — Requirements	ISO 9001:2008
2	TCVN 1917:1993	Metric threads. Fit with gap. Tolerances	
3	TCVN 2244:1999	ISO system of limits and fits. Bases of tolerances, deviations and fits	ISO 286-1:1988
4	TCVN 2245:1999	ISO system of limits and fits. Tables of standard tolerance grades and limit deviations for holes and shafts	
5	TCVN 2246-1:2008	ISO general purpose screw threads. Basic profile. Part 1 : Metric screw threads	ISO 68-1:1998
6	TCVN 2246-2:2008	ISO general purpose screw threads. Basic profile. Part 2 : Inch screw threads	ISO 68-2:1998
7	TCVN 2250:1993	Metric screw threads. Interference fits	
8	TCVN 2253:1977	Metric taper threads. Basic dimension and tolerances	
9	TCVN 4683-1:2008	ISO general purpose metric screw threads. Tolerances. Part 1 : Principles and basic data	ISO 965-1:1998
10	TCVN 4683-2:2008	ISO general purpose metric screw threads. Tolerances. Part 2 : Limits of sizes for general purpose external and internal screw threads. Medium quality	ISO 965-2:1998
11	TCVN 4683-3:2008	ISO general purpose metric screw threads. Tolerances. Part 3 : Deviations for constructional screw threads	ISO 965-3:1998
12	TCVN 7582-1:2006	Technical drawings. Projection methods. Part 1 : Synopsis	ISO 5456-1:1996
13	TCVN 7582-2:2006	Technical drawings. Projection methods. Part 2 : Orthographic representations	ISO 5456-2:1996
14	TCVN 7582-3:2006	Technical drawings. Projection methods. Part 3 : Axonometric representations	ISO 5456-3:1996
15	TCVN 7582-4:2006	Technical drawings. Projection methods. Part 4 : Central Projection	ISO 5456-4:1996
16	TCVN 7583-1:2006	Technical drawings. Indication of dimensions and tolerances. Part 1 : General principles	ISO 129-1:2004

No.	TCVN number	Title	Identical with International Standards
17	TCVN 6099-2:1996	High-voltage test techniques. Part 2 : Test procedures	IEC 60-2:1973
18	TCVN 6188-1:2007	Plugs and socket-outlets for household and similar purposes. Part 1 : General requirements	IEC 60884-1:2002
19	TCVN 6190:1999	Plugs and socket-outlets for household and similar purposes. Types and main dimensions	
	Product 2 : Cables and wires		
1	TCVN ISO 9001:2008	Quality management system – Requirements	ISO 9001:2008
2	TCVN 5933:1995	Electro-technical round copper wire. General requirements	
3	TCVN 6610-1:2007	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V. Part 1 : General requirements	IEC 60227-1:1998
4	TCVN 6610-2:2007	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V. Part 2 : Test methods	IEC 60227-2:2003
5	TCVN 6610-3:2000	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V. Part 3. Non-sheathed cables for fixed wiring	IEC 227-3:1997
6	TCVN 6610-4:2000	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V. Part 4. Sheathed cables for fixed wiring	IEC 227-4:1992, Amd. 1:1997
7	TCVN 6610-5:2007	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V. Part 5 : Non-sheathed cables for fixed wiring	IEC 60227-5:2003
8	TCVN 6612:2007	Conductor of insulated cables	IEC 60228:2004
9	TCVN 6613-1:2000	Tests on electric cables under fire conditions. Part 1 : Test on a single vertical insulated wire or cable	IEC 332-1:1993
10	TCVN 6483:1999	Round wire concentric lay overhead electrical stranded conductors	IEC 1089:1991
11	TCVN 6614-1-1 : 2000	Common test methods for insulating and sheathing materials of electric cables. Part 1 : Methods for general application. Section 1 : Measurement of thickness and overall dimensions. Tests for determining the mechanical properties	IEC 811-1-1:1993
12	TCVN 6614-1-2:2000	Common test methods for insulating and sheathing materials of electric cables. Part 1 : Methods for general application. Section 2 : Thermal ageing methods	IEC 811-1-2:1985

No.	TCVN number	Title	Identical with International Standards
13	TCVN 6614-1-4 : 2000	Common test methods for insulating and sheathing materials of electric cables. Part 1 : Methods for general application. Section 4 : Tests at low temperature	IEC 811-1-4:1985, Amd. 1:1993
14	TCVN 6614-3-1 : 2000	Common test methods for insulating and sheathing materials of electric cables. Part 3 : Methods specific to PVC compounds. Section 1 : Pressure test at high temperature. Tests for resistance to cracking	IEC 811-3-1:1985, Amd. 1:1994
15	TCVN 6614-3-2 : 2000	Common test methods for insulating and sheathing materials of electric cables. Part 3 : Methods specific to PVC compounds. Section 2 : Loss of mass test. Thermal stability test	IEC 811-3-2:1985, Amd.1:1993

7

Festo Brasil, Brazil

Country : Brazil
ISO member body : Associação Brasileira de Normas Técnicas (Brazilian Association of Technical Standards) (ABNT)
Project team :
Project leader : Eduardo Campos de São Thiago (ABNT)
Consultant : Dr. Maria Fatima Ludovico de Almeida, Professor at Pontifical Catholic University of Rio de Janeiro (PUC- Rio)
Member : Ms. Audrya Almeida, M.Sc student at the Metrology, Quality and Innovation Programme, PUC-Rio
Member : Mrs. Thalita Romano (ABNT)
Member : Ms. Lilian Secron (ABNT)
ISO Central Secretariat advisor : Daniele Gerundino
Duration of the study : September 2010 – March 2011

7.1 Objectives and organization of the pilot project

The objective of this pilot project is to develop a company case study applying the ISO methodology to assess the economic benefits of standards, by:

- Enabling stakeholders in both private and public sectors to better appreciate the economic and social impact of voluntary consensus standards
- Raising the awareness of policy makers and business leaders of the importance of standardization.

It can also be an excellent means of:

- Strengthening interaction with national stakeholders by focusing on their business needs and on the understanding of how standards can contribute to the performance of organizations
- Developing cooperation with academic institutions
- Integrating a collection of case studies, to be maintained by ISO/CS, which can be used to promote the value of standards widely to stakeholders.

The Brazilian company selected for study is Festo Brasil, a subsidiary of Festo AG, a German company and a leading worldwide supplier of automation technology and solutions.

The timeframe for the execution of this project is shown in **Table 1.**

Activity	Started	Concluded
Establish the project team	15 Sept 2010	27 Sept 2010
Prepare and assimilate the pilot project materials	28 Sept 2010	20 Oct 2010
Select the company	01 Sept 2010	22 Nov 2010
Conduct an industry / company analysis	10 Nov 2010	22 Nov 2010
Undertake field research	24 Nov 2010	26 Nov 2010
Analyze the information gained through the interviews	01 Dec 2010	18 Feb 2011

Activity	Started	Concluded
Refine/complete company data	21 Feb 2011	17 Mar 2011
Consolidate results and develop draft report	17 Mar 2011	18 Mar 2011
Exchange and discuss draft results in the project team	21 Mar 2011	25 Mar 2011
Develop the final version of the case study	25 Mar 2011	31 Mar 2011

Table 1 Project timeframe

7.2 Introduction to the selected company

The automation industry was selected for this case study because it is one of the largest in the world, generating annual sales of Brazilian Real (BRL) 655 billion in 2008. It provides almost all other industries with measurable productivity and safety gains. The sector's 1.7 million employees work in more than 5 000 companies worldwide. Highly specialized small businesses account for a large share of the industry (Roland Berger, 2010).

Emerging markets, especially Brazil, India and China are expected to lead industry growth in the next few years. Markets such as the United States, Germany, and Japan have been stagnating in recent years, with only low single-digit growth. Since these three markets decreased by 20 % in 2009, there are doubts that they will return to their pre-downturn levels before 2015.

In Brazil, the government has announced massive investments through its Plan for Growth Acceleration (PAC) initiative, and private investments in sectors like electricity and petroleum exploration (Pre-salt Programme). PAC will invest a total of BRL 503.9 billion in transportation, energy, sanitation, housing, and water resource infrastructure over four years. The investments are destined for three main areas: (i) logistical infrastructure, involving the construction and expansion of highways, railways, ports, airports and waterways;

(ii) energy infrastructure, representing generation and transmission of electricity, and production, exploitation and transportation of oil, natural gas and renewable fuels ; (iii) social and urban infrastructure, covering sanitation, housing, subways, urban trains and electricity access for remote areas (" Light for All " Programme).

In addition, large engineering projects will be implemented for the 2014 FIFA World Cup in Brazil, and the 2016 Olympic Games in Rio de Janeiro.

Also, there are several initiatives that potentially contribute to the growth of the automation industry in Brazil, in the form of a large loan programme by the National Bank for Economic and Social Development (BNDES), and tax cuts for capital goods.

These investments and initiatives present an optimistic scenario for the Brazilian industrial automation sector for the next few years. The oil and gas, sugar and alcohol, mining and steel, automotive, paper and cellulose sectors continue to represent a high demand for automation solutions and products

It is important to mention that the hydraulic, pneumatic, and industrial automation (HPA) segment was negatively affected in 2009, after a 33 % downfall in the Brazilian machinery sector due to the revision of Brazilian regulation concerning machinery imports. Although recovering in 2010, some effects of this downfall are expected to remain in the HPA segment in 2011 (Abimaq, 2010).

In spite of this recent HPA situation, there are positive expectations concerning the recovery of the segment, since Brazilian HPA companies supply the buoyant customer industries mentioned above. Additionally, the Brazilian Machinery and Equipment Association (ABIMAQ) has been working on projects related to the HPA segment, aimed at reinforcing the hydraulics and pneumatics technological infrastructure

in the country. There is a joint effort between ABIMAQ and ABNT with the purpose of publishing new standards for this segment.

Festo Brasil was selected in view of the growth prospects for the industrial automation sector, and with the support of the related ABNT Technical Committee. The decision was mainly based on the following criteria:

- A positive attitude towards standardization
- Intensive use of standards
- Proactive participation in international and national standardization development
- An open attitude to providing the information needed in building the case study
- Quality system certification
- A focus on process management
- Good performance as indicated by market share and financial results
- Excellence in innovation.

Festo Brasil is headquartered in São Paulo and has a modern industrial park of over 43 000m^2 - one of the largest outside of Germany. In addition to serving the Brazilian market, the company exports its products to other subsidiaries and also to its German parent. Festo also covers the entire home territory via 125 service points, including branches, distributors and representatives, providing complete solutions in automation for more than 30 000 clients.

With over 40 000 products in catalogue and around half a million possible variations, its engineering and product development can customize items according to customer needs. Festo Brasil offers a large spectrum of products, from valves to more complex automation solutions for increasing productivity, ensuring better quality and safety in industrial processes.

In 42 years of operation in Brazil, Festo has implemented more than 50 000 projects, installing about 100 million valves. Its sales engineers offer special solutions for specific projects, which are adapted to any type of need, providing customers all necessary support (Festo, 2010).

It is the national market leader in industrial automation, supplying the most important economic sectors, such as automotive, food, packaging, plastics, and electronics, and has a substantial interest in the petrochemical and sugar and alcohol sectors. Annual company revenue reached BRL 239 million in 2010.

Festo Brasil is responsible for worldwide development of valves and, in 1993, was one of the first companies in Brazil to achieve ISO 9001 certification. The company was certified to ISO 14001 in 2003, and OHSAS 18001 and TS 16949 in 2004. It is one of the four Festo IT Competence Centres in the world and is responsible for supporting Festo's subsidiaries in South America.

In addition, it performs an important role in Abimaq's HPA Sectorial Chamber (CSHPA). Festo Brasil's president is the current CSHPA president. **Table 2** summarizes Festo Brasil's key data.

Item	Description
Company name, location and address	Festo Brasil Ltda, Rua Giuseppe Crespi, 76 São Paulo, SP, Brazil.
Main product classes	Pneumatic drives, pneumatic valves, valve terminals, air preparation, handling, servo-pneumatic positioning systems, sensors, pneumatic accessories, learning systems
Annual revenues	BRL 239 million (as on 31.12.2010)
Number of staff	503 employees (as on 31.12.2010)
Number of units and respective locations	Seven units, located in : São Paulo – SP (industrial unit) ; Belo Horizonte – MG ; Rio de Janeiro – RJ ; Campinas – SP ; Joinville – SC ; Curitiba – PR ; and Porto Alegre – RS (sales and storage units)
Foreign markets	Exports for Germany, India, China, and USA
Market share in key products	Not disclosed by Festo Brasil

Main types of suppliers : domestic and foreign	Metallic bars and profiles (from steel, copper, aluminium, and brass) ; electric and electronic components ; electric wires ; mechanical components (screws, nuts, and bolts, in general) ; grease ; and plastics (e.g. polyurethane)
Main competitors in the markets	Parker Hannifin, SMC, Norgren, and Bosch
Health, safety and environmental (HSE) aspects	ISO 14000 and OSHAS 18000 certifications since 2003 and 2004 respectively

Table 2 Festo Brasil : key data

7.3 Attitude of the company towards standardization

According to Festo Brasil, its operations are focused on high product quality and reliability, ready availability through efficient logistics, innovative excellence, and ability to match customer needs through specialized projects.

Standardization has been perceived as a key element in support of company operations, and in helping align them to the value drivers in **Table 4.** Standards impact procurement, production/operations and engineering functions, as indicated in Section 7.8, and are viewed by the company as a cornerstone of its sustainable success.

Festo's positive attitude towards standardization has been proven by its involvement in standards development at national and international levels. At national level, it has been active in ABNT CB 4, SC 04007, *Hydraulics, pneumatics, and automation* ; and in ABNT/CE 4718, *Hydraulic and pneumatic systems*. At international level, it supports the Brazilian participation in ISO/TC 131, *Fluid power systems* and its subcommittees.

- Despite Brazil's current observer-member status in ISO/TC 131, Festo Brasil's representatives have voted on all documents submitted for balloting. During the interviews, they expressed their

intention to become participating members of these committees in the near future.

- The company uses several standards to manage its business internally, and to meet the strictest requirements of its industrial suppliers and customers in domestic and foreign markets. It has implemented an integrated quality and environmental management system according to International Standards ISO 9001, VDA 6.4, ISO/TS 16949, and ISO 14001.
- It is worth mentioning that the employees interviewed demonstrated a high level of interest in the results of this economic benefits assessment (in the **Annex** a list of the persons interviewed is given). Many commented that the questions raised during the interviews helped them to rethink specific issues and standardization topics.

7.4 Analysis of the value chain

7.4.1 4.1 Industry value chain

Figure 1 represents the automation industry's value chain and scope of Festo Brasil's activities.

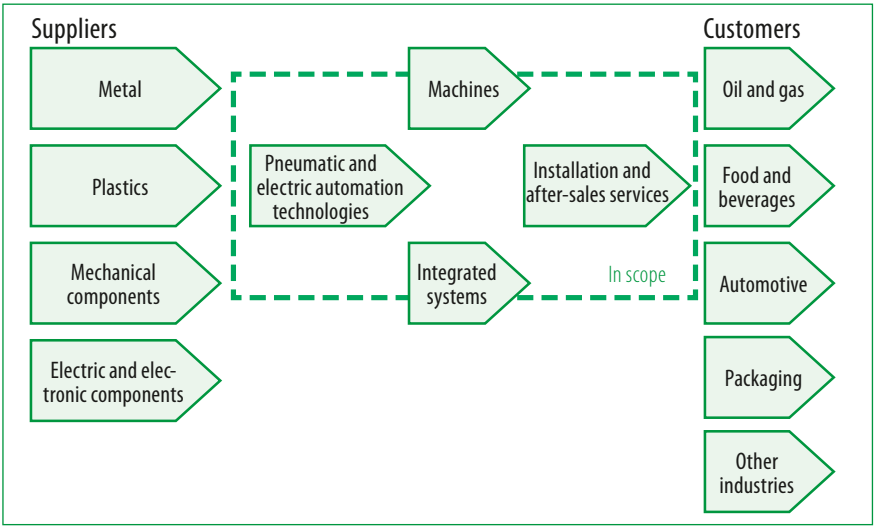

Figure 1 Automation industry value chain and scope

The automation industry's value chain is defined here as a sequence of interdependent operations aiming at providing technologies embedded in products, solutions, and services for industrial automation. Namely, automation for machines and integrated systems ; integrated systems *per se* ; installation and post-sales support and services.

The automation industry value chain involves different actors, ranging from raw materials suppliers (metals, and plastics producers, for example) ; mechanical and electrical/electronics component suppliers, automation enterprises, systems integrators, logistics enterprises, dealers, sales representatives and final customers.

According to Roland Berger's study (2010), the automation industry is highly specialized and small businesses account for a large share. Yet there are also a handful of big players whose products range from Human Machine Interfaces (HMI) devices to sensors and software. These heavyweights have scale that can support worldwide distribution.

Automation is a fragmented business, with each product segment generating relatively small volume. Grouped together, however, these product segments can form sizeable businesses, as Honeywell, ABB, Siemens, Mitsubishi Electric and Emerson attest. These five largest players account for about a quarter of the world market. Other big names in the industry include Schneider Electric, Festo, Parker Hannifin, Omron, Endres+Hauser, Bosch Rexroth, SMC, Norgren and Invensys.

The main customers are large companies from the oil and gas, food and beverage, automotive and package sectors.

As shown in **Figure 1,** the scope of this case study covers four segments of the industry value chain : pneumatic and electric automation technologies ; machines ; integrated systems ; and installation and after-sales services.

7.4.2 Company value chain

Porter's value chain model with its nine business functions was conceived for manufacturing companies (Porter, 1980 ; 1985). Since Festo Brasil belongs to this category, no adaptation of Porter's generic model was necessary. **Figure 2** represents Festo Brasil's value chain of internal activities.

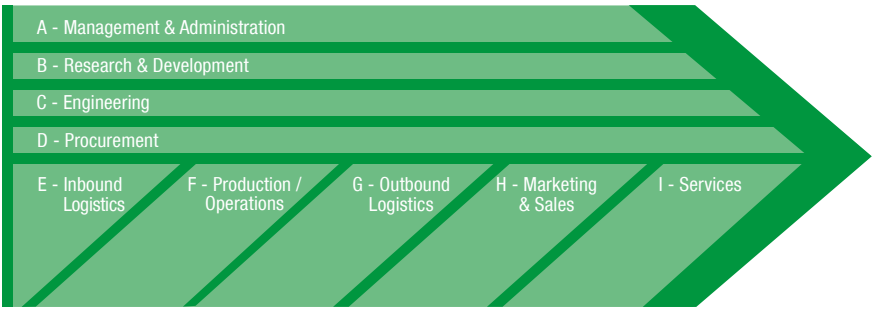

Figure 2 Festo Brasil's value chain

The operations are subdivided into nine key business functions A to I. Each is associated with a set of specific value chain activities. For example, those concerning product development ; automation systems development ; product tests ; master data administration for Festo's ERP system, standards' database administration, management of engineering documents and patents portfolio management are undertaken within the " engineering " business function.

According to Porter, the horizontal functions (E to I) are defined as primary functions, while the vertical ones (A to D) are called support functions. In the present case, all products and automation solutions provided by Festo Brasil are processed through the primary business functions (E to I). The support functions, such as procurement and engineering, influence the primary functions and support their execution.

Table 3 summarizes the main activities of each business function in the value chain.

Business function	Activities
Management and administration	Financing ; accounting ; controlling (planning, forecasting) ; tax ; reporting ; government interaction ; legal ; institutional communication (internal and external) ; risk management ; human resources ; information and communication technologies.
Research and development	Knowledge management ; applied research ; product development.
Engineering	Product development ; automation systems development ; product tests ; master data administration for Festo's ERP system ; standards database administration ; management of engineering documents ; patents portfolio management.
Procurement	Screening of suppliers ; selection of suppliers ; negotiating and contracting ; monitoring.
Inbound logistics	Supply management ; in-house logistics ; warehousing.
Production/operations	Production planning ; order processing ; processing ; quality assurance, including standards' adoption and implementation ; health, safety and environment (HSE).
Outbound logistics	Packing/shipping ; distribution ; transport ; order tracking.
Marketing and sales	Market intelligence ; marketing planning ; marketing activities ; client acquisition/development ; contracting.
Services	Customer care ; technical support.

Table 3 Business functions of Festo Brasil's value chain

7.4.3 Key value drivers

Festo Brasil has a library of approximately 150 technical standards, which are primarily product and test standards. More than 80 % are standards from ISO, EN, DIN, ASTM, etc. For example, ISO 9001, ISO 14001, and TS 16949 are implemented systematically.

Based on preliminary business function analysis and on the Standards Impact Map (ISO, 2010) used as a checklist, those functions most significantly impacted by standards are : procurement, engineering and production/operations. Key value drivers associated with these business functions are described in **Table 4** (column 3).

7.5 Scope of the pilot project assessment

As indicated in **Figure 3,** the value chain functions selected for this case are : procurement, production/operations and engineering.

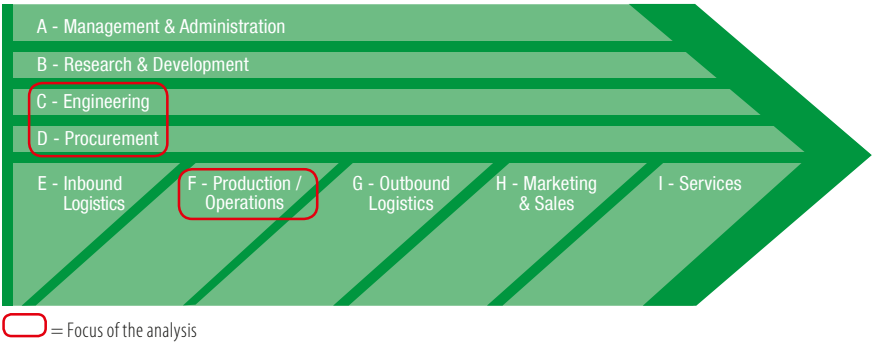

Figure 3 Scope of the assessment

7.6 Use of standards in the company value chain

Table 4 describes the business functions in the value chain, including those selected for the assessment, and the standards used in those functions.

1	2	3	4
Selected business functions (BF)	**Related activities**	**Value drivers**	**Standards used**
Management and administration	Financing ; accounting ; controlling (planning, forecasting) ; tax ; reporting ; government interaction ; legal ; institutional communication (internal and external) ; risk management ; human resources ; information and communication technologies.	Higher sales ; better quality management ; better health/safety/environmental compliance ; reduced liability costs ; reduced operational risk.	ISO 9001 ; ISO/TS16949 ; ISO 14001 ; OHSAS 18001 ; and some ABNT NBR standards.

1	2	3	4
Selected business functions (BF)	**Related activities**	**Value drivers**	**Standards used**
Research and development (R&D)	Knowledge management ; applied research ; product development.	Clearer product specifications ; more efficient internal standardization ; more efficient product development ; reduced variation ; and better internal information transfer.	None.
Engineering	Product development ; automation systems development ; product tests ; master data administration for Festo's ERP system ; standards database administration ; management of engineering documents ; patents portfolio management.	Better internal information transfer ; reduced variation ; clearer product specifications ; more efficient contractual agreements ; greater competition among suppliers ; higher output (scale) ; better training.	UL, RoHS, ATEX, EN 13980 ; ISO 15552 ; ISO 6431 ; ISO 21287 ; ISO 6432 ; ISO 15407 ; ISO 5599 ; ISO 2768 ; ISO13715 ; ISO 16016 ; ISO 1219 and several DIN standards.
Procurement	Screening of suppliers ; selection of suppliers ; negotiating and contracting ; monitoring.	More efficient receipt of supplies ; reduced variation ; better product availability ; better internal information transfer ; better training.	AISI 420 ; DIN 2093 ; DIN 125 ; DIN 127 ; DIN 137 ; DIN 1481 ; DIN 1755 ; DIN 17615 ; DIN 1798 ; DIN 3405 ; DIN 433 ; DIN 439 ; DIN 470 ; DIN 471 ; DIN 472 ; DIN 5401 ; DIN 546 ; DIN 625 ; DIN 670 ; DIN 6799 ; DIN 6799 ; DIN 6885 ; DIN 7349 ; DIN 7984 ; DIN 7993 ; DIN 8140 ; DIN 906 ; DIN 908 ; DIN 912 ; DIN 913 ; DIN 931 ; DIN 933 ; DIN 934 ; DIN 963 ; DIN 985 ; DIN 988 ; SAE 1010/20, SAE 1035.

1	2	3	4
Selected business functions (BF)	**Related activities**	**Value drivers**	**Standards used**
Inbound logistics	Supply management ; in-house logistics ; warehousing.	Better quality of equipment and supplies ; more efficient assembly ; better quality management ; better training ; health/safety/environmental compliance ; reduced variation ; better internal information transfer.	None.
Production/operations	Production planning ; order processing ; processing ; quality assurance, including adoption and implementation of standards ; HSE (health, safety and environment).	More efficiency ; reduced variation ; better internal information transfer ; better training.	ISO 12179 ; ISO 2768 ; DIN 223 ; DIN 327 ; DIN 333 ; DIN 345 ; DIN 371 ; DIN 376 ; DIN 6343 ; DIN 844.
Outbound logistics	Packing/shipping ; distribution ; transport ; order tracking.	Higher sales ; better competitive position ; reduced time-to-market ; better internal information transfer ; better competitive intelligence ; more efficient contractual agreements ; better customer information ; reduced variation ; better training.	None.
Marketing and sales	Market intelligence ; marketing planning ; marketing activities ; client acquisition/development ; contracting.	Better quality ; reduced variation ; better internal information transfer ; better customer communication.	ISO 15552 ; ISO 6431 ; ISO 21287 ; ISO 6432 ; ISO 21287 ; ISO 15407 ; ISO 5599.

1	2	3	4
Selected business functions (BF)	**Related activities**	**Value drivers**	**Standards used**
Post-sales services	Customer care ; technical support.	Better internal information transfer ; reduced variation ; clearer product specifications ; more efficient contractual agreements ; greater competition among suppliers ; higher output (scale) ; better training.	DIN ISO 8579.

Table 4 Standards used in the company value chain

7.7 Selection of operational indicators to measure the impact of standards

Table 5 maps the selected business functions, describes associated activities, their value drivers and standards used. It also defines operational indicators to measure the impact of standards used by Festo Brasil.

1	2	3	4	5	6
Selected business functions (BF)	**Related activities**	**Value drivers**	**Standards used**	**Operational indicators**	**Definition of the indicators**
Procurement	Screening of suppliers ; selection of suppliers ; negotiating and contracting ; monitoring	More efficient receipt of supplies ; reduced variation ; better product availability ; better internal information transfer ; better training.	Several standards (ISO, DIN, SAE) are used as a basis for material and parts specifications, primarily metals.	Work savings	Hourly cost of concerned personnel (HH/year) Time reduction for processing orders (%) Time-to-market (days)
				Purchase savings	Purchase cost reduction (BRL/year)
Production/ operations	Production planning ; order processing ; processing ; quality assurance, including standards' adoption and implementation ; HSE (health, safety and environment)	More efficiency ; reduced variation ; better internal information transfer ; better training.	ISO 12179 ; ISO 2768 ; DIN 223 ; DIN 327 ; DIN 333 ; DIN 345 ; DIN 371 ; DIN 376 ; DIN 6343 ; DIN 844.	Production efficiency gain	Production costs reduction (BRL/year)

1	2	3	4	5	6
Selected business functions (BF)	**Related activities**	**Value drivers**	**Standards used**	**Operational indicators**	**Definition of the indicators**
Engineering	Product development ; automation systems development ; product tests ; master data administration for Festo ERP system ; standards' database administration ; management of engineering documents ; patents portfolio management.	Better internal information transfer ; reduced variation ; clearer product specifications ; more efficient contractual agreements ; greater competition among suppliers ; higher output (scale) ; better training.	UL, RoHS, ATEX, EN 13980 ; ISO 15552 ; ISO 6431 ; ISO 21287 ; ISO 6432 ; ISO 15407 ; ISO 5599 ; ISO 2768 ; ISO13715 ; ISO 16016 ; ISO 1219 and several DIN standards.	Work savings (design time)	Hourly cost of employees involved (HH/year)
				Savings due to lower project time	Hourly cost of employees involved ; Total reduction of time (%) Time-to-market reduction (%)

Table 5 Operational indicators to measure the impact of standards on Festo Brasil

7.8 Calculation of the economic benefits of standards

The purpose of the whole assessment process is to determine the impact of the use of standards, as measured through operational indicators, which are defined in **Table 5.**

Depending on the operational indicators, the financial impact may be measured directly, or may be calculated on the basis of other internal data. For example, costs saving for the procurement function is an operational indicator, which can be directly measured in financial terms. On the other hand, savings due to reduction in engineering project time is an operational indicator that needs to be converted

into estimated cost savings based on other company data, such as the average cost of personnel and number of projects.

This section presents the calculation of financial benefits from the use of standards by Festo Brasil in its procurement, production/operations, and engineering functions.

7.8.1 Procurement

The total cost of procurement, including materials and components, is BRL 143 million per year. Several standards, primarily ISO, EN and DIN, are used in Festo Brasil as a basis for material and component specification – basically metals. The total cost breakdown into material and component costs is the basis for quantifying the economic benefits of such standards in the procurement function, as follows:

- Metals: 30 % of total procurement cost of:
  - Aluminum alloys for injection molding
  - Stainless steel bars for machining process
  - Aluminum bars (stainless aluminum bars for machining)
  - Mechanical components for the machining process: 50 % of total cost
- Plastics and other items: 20 % of total cost.

The impact of standards on the procurement function has been identified in (i) work savings, and (ii) purchase savings.

As far as work savings are concerned, the amount of work needed to complete Festo Brasil's purchasing process for non-standards based metals is estimated to be five times higher than for standards-based metals.

Orders for standards-based metals represent about 7.5 % of total orders.

Personnel cost for the purchasing department is 40 % of BRL 13 million, that is, BRL 5.22 million.

Savings due to the use of standards in processing orders can therefore be estimated as 80 % of 7.5 % of BRL 5.22 million, or about BRL 312 912 per year.

In purchase savings - the second standards impact - standards-based goods cost on average 30 % less than non-standard-based ones. Orders for standards-based metals represent about 7.5 % of total orders. Savings due to the use of standards-based metals can therefore be estimated as 30 % of 7.5 % of BRL 143 million, or about BRL 3 219 750 per year, or 2.25 % of procurement costs.

7.8.2 Engineering

The work of the engineering function at Festo Brasil is based extensively on standards. The engineering function interviews focused on assessing the impact of standards introduced recently by the company. In this sense, it was possible to evaluate the impact of standards for geometrical and positional tolerances, such as ISO 5458:1998 and other standards from ISO/TC 213, *Dimensional and geometrical product specifications and verification*. These have replaced standards for dimensional tolerances in the past two years.

Among the benefits of implementing these standards are :

- Savings in engineers design time
- Reduction in projects time and work
- Reduction in time-to-market
- Improved communication between engineering and manufacturing (enabling more rapid machine set-up and shorter production time)
- Increased manufacturing reliability.

Two types of impacts have been identified in the engineering function : (i) work savings (design time) and (ii) savings due to reduction in project time.

Savings in design time due to implementing the standards listed impacted about 33 % of engineering manpower. In addition :

- Estimated design time savings were about 10 %
- Personnel cost for the engineering department is 50 % of BRL 7.16 million, i.e. BRL 3.58 million per year
- Savings due to the use of standards for geometrical and positional tolerances can therefore be estimated as 10 % of 33 % of BRL 3.58 million or BRL 118 058 per year, or 1.6 % of the cost of the engineering function.

For savings from reduction in project time :

- The total amount of engineering hours per month required from product design to production set-up was estimated at 2 670 hours
- Estimated total time reduction was 5 %
- Hourly cost of personnel was BRL 127
- Total cost of personnel was BRL 338 670 per month, or BRL 4.07 million per year
- Savings from using standards for geometrical and positional tolerances can therefore be estimated as 5 % of 4.07 million which amounts to around BRL 203 202 per year.

7.8.3 Production/operations

Festo Brasil is strongly committed to continual improvement. An ISO 9001-based quality management system was introduced in 1994, but a major process redesign took place from 2006, when the company became involved in the Festo Group's " Made by Festo " global manufacturing programme.

The major impact of the programme was on the production business function, including :

- Development and implementation of new procedures, including more stringent KPIs (Key Performance Indicators) and higher controls
- Establishment of self-regulated production teams as a support mechanism for implementing new procedures, with each focused on six performance indicators : quality ; productivity ; cost ; organization ; safety/environmental improvements ; employee development.

Examples of specific improvements achieved in the past two years include :

- The production of " circle lips " has been re-engineered so that standard components can be used. Now the operation can be carried out in 50 % of the time
- The production cycle of " caps " has been optimized and the efficiency gain has enabled the elimination of one night shift.

The major impact of standards on the production/operations function has been in production efficiency gains. Here, the mix of measures introduced through the standards-driven continual improvement process has enabled the company to achieve BRL 1.59 million savings in production costs (about 13 % of total 2010 production).

The implementation of standards was estimated to have contributed about one third of this improvement, or about BRL 524 700.

7.8.4 Financial impact of standards on business functions assessed

In this section, impacts by operational indicator are expressed in financial terms using the key indicator " Earnings Before Interest and Tax " (EBIT). This indicator expresses the gross profit of a company, that is, revenues minus costs, at a given point in time. The financial impact of standards on Festo Brasil is presented in **Tables 6 and 7**, as follows.

1	5	7
Selected business functions (BF)	**Operational indicators (to measure the impact of standards)**	**Financial impact for the operational indicator (BRL per year)**
Procurement	Work savings	312 912
	Purchase savings	3 219 750
Engineering	Work savings (design time)	118 058
	Savings due to reduction in project time	203 202
Production/operations	Gain in production efficiency	524 700

Table 6 Financial impact of standards by operational indicator

Table 7 shows the total financial impacts of standards on the business functions, and indicates that total EBIT impact of standards is estimated at BRL 4 378 622 per year. This corresponds to 1.90 % of company turnover (BRL 239 million per year).

1	8
Selected business functions (BF)	**Financial impact of standards on each BF (BRL per year)**
Procurement	3 532 662
Engineering	321 260
Production/operations	524 700
Total EBIT impact of standards	**4 378 622**

Table 7 Financial impact of standards by business function

7.9 Qualitative and semi-quantitative considerations

In addition to the measurable results shown in **Tables 6 and 7**, there are many examples of benefits from the use of standards that cannot be directly quantified.

The managerial perception in Festo Brasil - captured during the interviews - is that a more intensive use of standards by the company could lead to :

- Better environmental compliance, which positively impacts the company image in the market, and consequently its business performance
- More efficient product development
- Savings due to purchasing time and time-to-market reductions as a result of optimized use of standardized components
- Better use of employee work time due to time saving
- Increased customer satisfaction and subsequent increase in market share, due to reduced time-to-market
- Higher quality of supplier's materials
- Less component variation in stock
- Lean manufacturing
- Faster customer service through standardized components.

7.10 Evaluation of results

Festo Brasil uses product, process and management system standards intensively. In Section 7.8, the impacts from the use of standards were aggregated to give an overall EBIT for the business functions being assessed. Nevertheless, it is thought that there are still many opportunities for the company to benefit from standards in other business functions.

Greater use of standards would surely lead to more efficient processes, faster product development, reduced time to market, more customers and sales, better environmental performance, savings in work time, and better quality of life for employees.

According to the respondents, increasing employee interest in the use, economic impacts and benefits of standards would be an excellent

way to make the workforce aware of the daily importance of standards. They believe that assessment of the economic impacts of standards adopted by Festo Brasil will help management strengthen the culture of standardization at all levels, from factory floor to top management.

7.11 Conclusions

This study has confirmed that standards significantly affect the procurement, production/operations, and engineering functions of Festo Brasil, as follows:

Procurement function:

- Standards help make the procurement process more efficient in terms of work savings. The amount of work needed to complete Festo Brasil's purchasing process for non-standards based metals was estimated to be five times greater than that for standards based metals. Work savings due to the use of standards in processing orders were estimated at BRL 312 912 per year;
- Standards also contribute to purchase savings. On average, standards-based goods cost 30 % less than non-standard-based ones. Savings due to the use of standards-based metals were estimated at BRL 3 219 750 per year, representing 2.25 % of procurement costs.

Engineering function:

The main benefits identified during the interviews were: savings of design time for the engineers; reduction in project time and related work; reduction in time-to-market; improved communication between engineering and manufacturing, and increased reliability of manufacturing. In particular, savings in design time through geometrical and positional tolerance standards impacted about 33 % of

engineering manpower, and could save an estimated BRL 118 058 per year, or 1.6 % of engineering function costs.

In addition, savings in engineering project time due to such standards were estimated at BRL 203 202 per year.

Production/operations function :

It was assumed that standards helped production efficiency gains as showed in Section 7.8. The mix of measures introduced through the standards-driven continual improvement process has enabled the company to achieve BRL 1.59 million savings in production costs (about 13 % of total 2010 production costs). The use of standards was estimated to have contributed about one third of this improvement, about BRL 524 700.

Using interview data, two types of data aggregation and estimates have been calculated, namely : (i) financial impact associated with operational indicators in each business function assessed, and (ii) overall EBIT impact from the use of standards for each function - procurement, engineering and production/operations. The resulting estimates indicated that the total EBIT impact of standards covering the three business functions in Festo Brasil was some BRL 4 378 622 per year. This corresponds to 1.90 % of the company annual turnover of BRL 239 million.

Finally, the application of the ISO Methodology in Festo Brasil's organizational context helps people involved in this pilot project to achieve three main purposes. Firstly, to analyse and clarify the contribution of voluntary, consensus-based standards to the performance of the selected company in a systematic way. Secondly, to bring empirical evidence of economic benefits of standards from a Brazilian industrial sector which is an intensive user of voluntary standards, and thirdly, to develop an academic project regarding an M.Sc. dissertation at the Metrology Program (PosMQI) at the Pontifical Catholic University of Rio de Janeiro (PUC-Rio).

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Annex Schedule of interviews at Festo Brasil

Time	24 Nov 2010 Contact centre room (2nd Floor)	25 Nov 2010 Sales engineering room (2nd Floor)	26 Nov 2010 Contact centre room (2nd Floor)
08:00			**Services** Anderson Franco – Post-sales Services Coordinator
08:30			
09:00		**Product engineering** Paulo Roberto do Santos - Engineering Director Fernando Mascarenhas – Master Data Administration and Project Detail Coordinator Mauro Sandri - Laboratories, Innovation Program and Project Management Coordinator	
10:00			**Maintenance** Rogério Tavares - Maintenance Coordinator Robinson Santos – Administrative Assistant Adilson Soares - Maintenance Supervisor
10:30		**Sales** Homero Paulino - Product Application Consultant Viviane Maschio - Product Application Consultant	**Guided visit to Festo Brasil's divisions.**
11:00			
11:30			
12:00		Lunch time	
12:30			
13:00		**Marketing intelligence** Osvaldo Sato – Business Manager (Pneumatic Technologies Segment) **Latin America marketing** Weeney Bolfaine – Marketing Manager	**Quality assurance** André Galhumi - Quality Assurance Manager
13:30			
14:00	**Company overview** Paulo Roberto do Santos – Engineering Director Fernando Mascarenhas – Master Data Administration and Project Detail Coordinator		**Production/operations** Carlos Valentim - Production Process Coordinator
14:30			
15:00			
15:30		**Occupational safety** Cláudio Lara – Occupational Safety Coordinator	
16:00	**Procurement, inbound and outbound logistics** Alessandro Coppo - Logistics and Supply Chain Manager		
16:30			
17:00			

Gerfor, Colombia

"In memory of Mr. Fernando Aya Duarte, whose dedication and commitment to standardization outweigh the economic benefits identified in this study that resulted largely from his management and leadership in Gerfor"

Note : Information on the project team is given at the end of this report (p. 160)

8.1 Objectives and organization of the pilot project

8.1.1 General objective

To allow interested parties from the private and public sectors to appreciate the economic and social impact of standards, and raise the awareness of political and business leaders about the benefits of implementing such standards.

8.1.2 Specific objectives

- To understand the value of using standards in the organization, and the importance of participating in standardization activities
- To understand how standards affect the key processes of the organization's value chain
- To quantify the economic impact of standards in the organization.

8.2 Introduction to the selected company

8.2.1 Presentation and track-record of the company

Gerfor is a multinational Colombian company participating in the plastics and synthetic fibres sector of the petrochemicals industry, and a leader in the production and commercialization of PVC and CPVC piping and fittings. Its headquarters and manufacturing plant are located close to Bogotá, where it employs 850 people.

The company started operations in 1967, commercializing metal taps and fittings. By the end of the 70s Gerfor began manufacturing plastic taps and PVC fittings, and PVC piping in 1985. To fulfill its key

objective of customer satisfaction, the company has since developed a wide product portfolio in conformity with quality standards.

Today, Gerfor is a multinational company with a presence in several Latin American countries. It is focused on further expansion in Latin America as a starting point to extending coverage in world markets.

As a result of its ability to deliver high product quality, Gerfor is now the leading Colombian industrial group in the production and commercialization of:

- PVC and polyethylene piping and fittings for the construction and sewerage industries, plus aqueduct nets and telecommunication systems
- Plastic and metallic household taps
- PVC covers
- Solvent cement.

Gerfor's long tradition in developing and applying standards to improve competitiveness was a key reason for its participation in the pilot study. Having been involved in the development of technical standards for the piping sub-sector for more than twenty years, the company plays an active role as Chair of the Colombian technical committee for standardization of piping, ducts and plastic fittings and also participates in other technical committees. Gerfor is certified to ISO 9001, all production is based on product standards, and it has quality certifications for most of its pipe lines (see Section 8.3).

8.2.2 Role and position in the market

Gerfor is consolidating its position as a multinational company and has subsidiaries in much of Latin America, as indicated below:

- Centroamericana de PVC S.A., opened in 1998 in Guatemala to cover the Central American market
- Centroamericana PVC S.A. de C.V., opened in 2004 as a distribution centre for El Salvador
- Centroamericana de PVC S.A. de C.V., distribution center for Honduras
- P.V.C Gerfor Peru S.A.C, opened in 2010 to promote commercialization in South America
- Currently, 97 % of the company's sales are achieved in Colombia, where customers are grouped in three sectors : infrastructure, construction and irrigation, and 3 % abroad (Bolivia, Chile, Costa Rica, Ecuador, Guatemala, Honduras, Panamá, Puerto Rico, Salvador, Venezuela).

It holds about 26 % of the national market for its three product lines : 75 % of which is PVC pipes, 12 % taps and 12 % tiles.

The most important product line (PVC pipes and fittings) covers three main market segments : construction (45 % of sales), infrastructure (aqueduct and sewerage in governmental projects) (40 %) and irrigation (15 %). The latter is considered by Gerfor as the segment with highest potential. Annual income in 2009 was about USD 105 million.

8.3 Attitude of the company towards standardization

8.3.1 Attitude of Gerfor management and personnel towards standardization

Gerfor can be described as a leader in its attitude to standards. The company is a serious implementer of standards and contributes to their development through active participation in standardization

technical committees. The company is not simply an operational user of standards but derives strategic advantage from them, seeing standards as fundamental commercial tools to help gain access to markets.

Standards are part of the company's daily activities, with processes and personnel relying on them. They are applied daily by most of Gerfor's business functions, including notably procurement, engineering, production, and marketing and sales.

Gerfor is a member of ICONTEC Technical Committee 91, *Plastic piping, ducts and fittings*. This participation helps the company simplify the research and development of new products, pursue a better approach to customer service, interact with governmental entities, and take advantage of early access to information such as technical regulations.

It also participates in more than 10 technical committees developing standards for occupational health, industrial safety, ceramic and refractory construction products, geosynthetics, raw materials for the plastics industry, non-ferrous metals, and hydraulic and sanitary installations, among others.

8.3.2 Gerfor's experience in using standards to manage its business processes, suppliers and customers

Gerfor's experience in applying standards began with the implementation of product standards. Today, the company develops and certifies all its products in conformity with Colombian standards.

Pipe manufacture, commercialization and use are also governed by, and certified to, a number of technical regulations. Some of these regulations include references to standards for certification (10 in

total), which are referenced fully or partially (some requirements in the standards only) in the regulations.

In addition, the company is certified to Colombian quality management standard NTC-ISO 9002:1994, awarded by ICONTEC in 1998 in the scope of " Manufacturing and commercialization of PVC piping and fittings and household faucets. Manufacturing and commercialization of PVC solvent cement ". Since then it has maintained certification through regular audits. Gerfor has also made the transition to the NTC-ISO 9001 versions.

Currently Gerfor is implementing NTC-ISO 14001:2004 and NTC-OHSAS 18001:2007, with the aim of certification.

These certifications have helped the company to compete in the construction, infrastructure and irrigation sectors, and position itself as a leader in the Colombian fluid management solutions market, by assuring that its products meet the highest quality levels.

8.4 Analysis of the value chain

8.4.1 Analysis of the value chain of the plastics and synthetic fibres sector

8.4.1.1 Identification of the value chain

Gerfor is part of the value chain of the plastics and synthetic fibres sector of the petrochemical industry. This chain covers a wide range of specializations from gas exploitation and crude oil refining to the production of basic petrochemical raw materials (aromatics and olefins), intermediates (polyethylene, polyvinyl chloride), polypropylene, resins, etc, and transformed and finished plastic goods. These finished

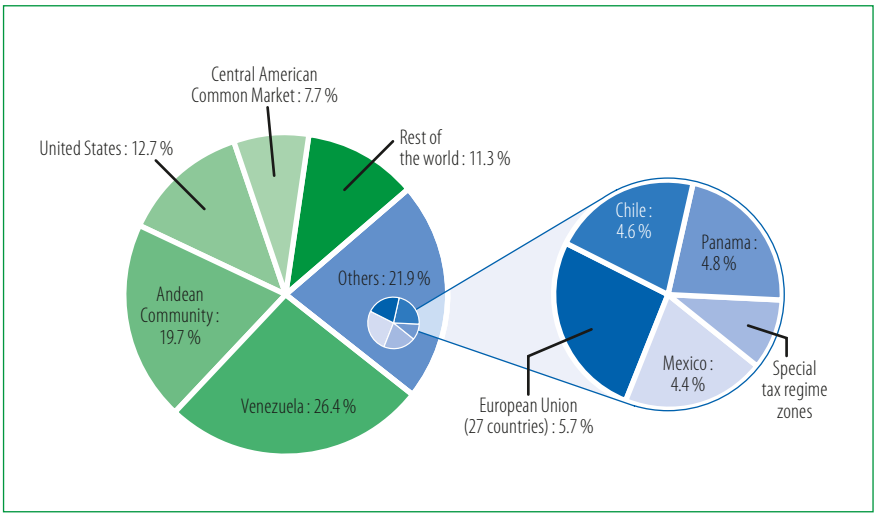
plastic products are destined for the infrastructure, construction and agriculture industries, and for end-uses such as automotive spare parts, toys and household goods.

The chain is characterized by differences in the production processes of companies operating in a highly competitive market composed mainly of small and medium enterprises. Most of this production is aimed at the domestic and retail market with little involvement in standardization. The leading companies, on the contrary, have a proactive attitude toward standards, because they help to open doors to foreign markets and to strategic industries such as construction and agriculture.

8.4.1.2 Balance of trade in the plastics and synthetic fibres sector

The main destinations of Colombian plastic product exports between 2007 and 2009 were the Andean Community, the Central American Common Market, Chile, the European Union, Mexico, Panama, USA, Venezuela and special tax regime zones in Colombia.

Of these, the top importers were Venezuela with a 31.8 % share in 2007, 30.2 % in 2008 and 26.4 % in 2009; the Andean Community with 16.2 % in 2007, 18.4 % in 2008 and 19.8 % in 2009; and the USA with 14.7 % in 2007, 13.2 % in 2008 and 12.8 % in 2009. (See **Figure 1)**.



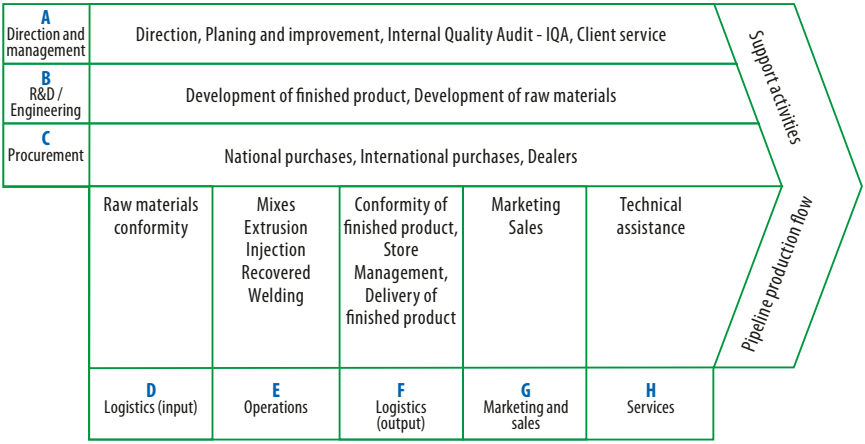
Fuente : DANE – Acoplasticos

Figure 1 Destination of Colombian plastic product exports in 2009

These figures highlight the importance of the regional markets in Latin America and Caribbean, which represent 73.7 % of total exports of basic chemicals, 81.6 % of other chemicals, 92 % of synthetic and artificial fibres, 69 % of plastic products, 90 % of woven textiles, 87 % of footwear, and 75 % of electrically insulated cables.

8.4.2 Analysis of the company value chain

To analyze the Gerfor value chain we used the traditional model with nine business functions, taken from the research methodology, but adapted to the company's processes based on field interviews. Basic functions in relation to these processes are shown in **Figure 2.**



Source : ICONTEC-USTA pilot project team

Figure 2 Gerfor's value chain

8.4.3 Value drivers

Gerfor's value drivers are :

- Distribution channels
- Customer service
- Product quality
- Production capacity
- Process efficiency.

They are related to the company's strategy which is based on selling exclusively through indirect sales channels, supported by high quality products at competitive prices and a higher level of service than competitors.

8.5 Scope of the assessment

The business functions in GERFOR's value chain included in this assessment are those which combine significant use of technical

standards with high correlation with the company's value drivers, i.e. Production and Marketing and Sales.

Additionally, interviews have been organized with staff from the following business functions: Direction and Administration, Research and Development, Procurement, Inbound Logistics, Outbound Logistics. For these functions, interesting qualitative and semi-quantitative considerations about the impact of standards have been derived and are presented under section 8.9.

8.6 Use of standards in the company value chain

More than 200 standards are used by Gerfor. A list was prepared correlating each standard to the business functions identified in the value chain, to assess the economic contribution to each function.

8.7 Selection of operational indicators to measure the impact of standards

The operational indicators selected to measure the impact of standards are shown in **Table 1** describing:

- The business functions selected within the scope of the assessment
- The value drivers applied to each function
- The impacts of standards on the activities in the business functions
- The operational indicators used to measure the impacts of the standards and their definition
- The financial impacts of standards (in USD).

Data on the impact of standards were collected directly by Gerfor managers and directors, calculated on the basis of the operational indicators available in the organization.

Business function	Value drivers	Impact of standards on activities	Operational indicators	Indicator result (USD)	Gross profit (USD) 2010	% EBIT	Value in USD
Operations	Perceived product quality Production capacity Process efficiency	Better quality management : process improvement in product lines where quality management practices have been implemented based on standards.	Operation control : Reduction in excess weight due to process quality management. Variation in USD between 2009 and 2010.	1 328 650	14 369 164	9,25 %	1 328 650
Marketing and sales	Distribution channels Customer service	Higher sales due to customer trust in standardized products and services. Standards enable access to more demanding markets (construction companies, etc.).	Sales derived from contracts for which compliance with standards was not obligatory but was considered essential to gain the sale. (Especially ISO 9001).	33 267 042 (i.e. 47 % of total sales)	14 369 164	47 %	6 723 269
						56,25 %	8 051 919

Note : For simplicity, a fixed gross profit ratio is assumed – therefore, 47 % of sales generate 47 % of the company's EBIT

Table 1 Operational indicators to measure the impact of standards

8.8 Calculation of the economic benefits of standards

8.8.1 Calculation of the indicator " operation control – overweight "

Gerfor's production process indicators (consolidated every month), were taken as the basis for calculation. Data analyzed correspond to the annual overweight average in kilograms.

These values were multiplied by the average value of raw material for 2010 in order to obtain a standardized monetary value for comparison. The difference between 2009 and 2010 was then determined, observing cost savings due to the reduction in the overweight average value. According to company experts, the reduction is attributable to operations improvement derived from its ISO 9001-based quality management system. This value was then expressed as a percentage of the company's EBIT.

8.8.2 Calculation of the sales indicator

In the marketing and sales function, company experts estimated that 47 % of the total sales revenue were sales derived from contracts for which compliance with standards (especially, ISO 9001) was not compulsory but considered essential to win the sale. The critical role of standards' compliance to gain contracts was confirmed by several managers of the company, also from other business functions.

Assuming a constant gross profit ratio for the company (which is the most reasonable assumption and justified by the fact that there are no particular differences in the product mix and profitability of contracts for which standards' compliance is essential), 47% of sales generate 47% of the company's EBIT, i.e. 6.723.269 USD.

8.9 Qualitative and semi-quantitative considerations

There were examples of Gerfor's business functions where benefits derived from using standards were found, but where it was not possible to obtain the detailed data needed to perform the quantitative economic analysis. For this reason they are included as qualitative or semi-quantitative examples identified within the frame of the economic benefits of standards.

8.9.1 Research and development/engineering

a) Design of new products – " piping for irrigation "

Gerfor experts estimate that without standards product design would take **10** times longer than average, and the corresponding cost **would be five** times higher.

Using basic figures for the design function (annual labour costs of USD 300 000 and approximately 90 projects per year), equates to an average monthly labour cost per project of USD **3 333**. A project requiring 10 times more work generates labour costs of **USD 33 333** (and also possible higher cost for equipment and services, although this was not determined).

Additionally, a higher number of projects based on customized specifications would also have a major impact on the use of the available resources at Gerfor : Currently Gerfor runs 90 projects, but would only be able to operate 9 projects with the current resources if they were based on completely customized specifications.

b) Plastic tiles – waste

The development of improvement plans within the requirements of the company's ISO 9001-based quality management system has

yielded significant savings. An example was the plastic tile production process where a reduction in waste from 15 % to 3 % was achieved thanks to redesign. This generated a production increase from 220 Kg/h to 440 Kg/h.

8.9.2 Procurement – inbound logistics / Conformity of raw material and consumables

Gerfor divides its purchases into two groups : raw materials and consumables. The former are those with higher volume and value and, in general, are backed by standards supporting procurement.

Consumables, on the other hand, are purchased in lower volumes, represent only 5 % of the total cost of goods, and generally are not supported by standards.

Through interviews it was determined that 60 % of the total review time was dedicated to consumables and 40 % to raw materials.

The reasons why the verification of consumables requires more resources are :

- Product specifications are written with little or no initial information, so more time is required for investigation
- More time is required for interaction with suppliers (to clarify requirements)
- Products need to be tested because general test protocols are missing.

This gives an idea of the labour savings when standardized supplies are ordered. In the next example, the inspection times needed for PVC resin, with and without standards, are compared :

PVC resin inspection.

Estimated time : comparison of the certificate with the specification : **15 minutes**

Without using standards : the raw material inspector removes a sample from each lot received and carries out the analysis to verify the conformity of raw materials.

Estimated time :

1. Analysis of the K value : **2 hours**
2. Analysis of volatile material : **1 hour and 30 minutes**
3. Apparent density : **30 minutes**

Total inspection time using a standard : 15 minutes

Total inspection time without using a standard : 4 hours

Labour cost for inspection using a standard : USD 0.57

Labour cost for inspection without using a standard : USD 9

Review of consumables and raw materials without standards generates a labour cost overrun.

8.9.3 Production

Scrap

Based on the production indicators for 2009 and 2010 related to the average percentage of scrap, it could be deduced that the results were practically the same from one period to another in spite of the increase in product lines. The results of the scrap indicators for each year are shown below :

	2009	2010	Variation
Scrap	21,52 %	21,65 %	0,60 %

Table 2 Percentage of scrap

8.10 Conclusions

8.10.1 General conclusions

- This study confirmed that standards are part of the company's daily activities, and that processes and personnel rely on them. Standards are applied daily to most of Gerfor's business functions, notably procurement, engineering, production, marketing and sales.
- However, the strategic value of standards to the company is derived from the **continual improvement of operations** and, above all, **the essential contribution to sales and market access**. Compliance to standards is often essential to close deals, and constitutes an element of competitive advantage for Gerfor.
- Specifically, the economic contribution of standards to the EBIT is 56,25 %, equivalent to USD 8 051 919 in 2010 – this also represents 7,7 % of total company turnover.
- In processes such as product design and development, non-availability of standards at the beginning of the process may generate cost overheads of five times the average for the activity, and up to 10 times increase in time. Similarly, in activities related to the inspection of raw materials and consumables, it was found that time used to verify non-standardized products was about 60 % of the total time, simply as a result of the lack of standards.
- In view of the fact that Gerfor has applied standards since the beginning, it is difficult to establish a baseline period without standards against which to measure and identify any benefits accruing from their use.
- Significant impacts from applying standards were seen in some of the company's activities which could not be quantified due to

the lack of data. Therefore, this information was only reported at qualitative or semi-quantitative level.

8.10.2 Key recommendations for next steps in using the methodology

- It is essential to present the detailed methodology and its stages and objectives to project leaders in selected organizations so that they can organize information and guide data collection better.
- Supplementary information should be added to the description of the value chain methodology to simplify identification of the organization's activities.
- The methodology should also include basic guidance and an example of a previous study, to help the organization decide which information will be required to make information collection or early preparation easier. It should also include a list of the minimum prior information required for the interview stage. Likewise, to aid interview coordination, it would help if questionnaires were sent in advance so that interviewees are well prepared, and can identify any problems before starting.
- The methodology should indicate how to consider and analyze data during periods in which significant organizational changes occur.
- The report should include the impact map of standards and their prioritization since this is fundamental to the direct relation between impacts and standards.
- In order to simplify the understanding and application of the methodology, ISO should consider translation of the final version and its application tools into other languages of significant use in developing countries (for example, Arabic and Spanish), where there is urgent need to create awareness of the importance of standards.

- Even though the methodology helps to determine the economic benefits of standards, it will only be useful if there is a strong measurement culture in the organizations studied.
- The methodology and experience gained should be used to develop a guideline standard to measure the economic benefits of standards (regardless of whether it applies to management, products or testing), similar to NTC-ISO 10014:2006, *Quality management – Guidelines for realizing financial and economic benefits*.
- The methodology starts from the premise that the application of standards generates a positive economic benefit, which is not necessarily true. In many cases it is more economical to produce without quality than with quality. The methodology should present information related to the treatment of such cases.
- In cases where cost overruns are generated as a result of not using standards, and are identified and controlled by the organization, it is often not possible to assign an EBIT percentage to these values. They should simply be reported as semi-quantitative cases.
- Project teams should include a representative of the financial department to support data collection and interpretation.

Country : Colombia
ISO member body : Instituto Colombiano de Normas Técnicas y Certificación (Colombian Institute for Technical Standards and Certification) (ICONTEC)
Project team :
Project leader : Ms. Marta Lucia Castro (ICONTEC)
Member : Ms. Constanza Dias (Santo Tomas University, Bogota, Master student, Engineering faculty, MSc in Quality and Management)
Member : Ms. Alicia Jaramillo (ICONTEC)
Member : Ms. Lilian Secron (ABNT)
ISO Central Secretariat advisor : Daniele Gerundino
Duration of the study : August 2010 – March 2011

9

DanPer Trujillo and Civil Association FríoAéreo, Peru

Country : Peru
ISO member body : Instituto Nacional de Defensa de la Competencia y de la Protección de la Propiedad Intelectual (National Institute for the protection of competition and intellectual property) (INDECOPI)
Project team :
Project leader : Ms. Rosario Uría, Technical Secretary of the Standardization and Non-tariff Barriers Surveillance Commission (INDECOPI)
Member : Mr. Rodolfo Tupayachi, Economic Research Division (INDECOPI)
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Member : Mr. Juan de la Cruz, Economic Research Division (INDECOPI)
Member : Ms. Patricia Castro (INDECOPI)
ISO Central Secretariat advisor : Daniele Gerundino
Duration of the study : October 2010 – May 2011

9.1 Introduction

Asparagus is the star product among non-traditional agricultural exports (NTAX's) in Peru. The country is one of the leading exporters of asparagus and recognized worldwide for the quality of its products.

The privileged position of Peru in international markets for asparagus is the result of private and public efforts to develop competitive advantages in a context characterized by strong international competition, strict sanitary and phytosanitary market access requirements, growing private demand for high-quality and safe products and traceability requirements.

How has this industry managed to achieve such a level of success in an increasingly demanding and competitive global market? And, what are the reasons and change factors that have encouraged the development of a sustainable industry that has a significant impact on the Peruvian economy?

The success of the sector can be explained by a combination of factors among which the implementation of standards has played an important role by facilitating the adoption and transfer of knowledge and technology at intra-company as well as at inter-company levels.

The asparagus industry has made significant progress in the implementation of good manufacturing practices and management systems for safety and quality – starting with the HACCP (Hazard Analysis Critical Control Point) system, which was followed by the implementation of other management systems, focused on supporting integrated quality assurance.

To analyze the contribution of standards, INDECOPI [1] and the Standardization and Non-tariff Barriers Surveillance Commission [2] of Peru decided to apply a methodology recently developed by ISO to assess the economic impact of standards.

The methodology focuses on microeconomic analysis of the activities of businesses or industries and provides a useful insight into how to consider the multiple ways in which the adoption of standards can promote the development and growth of companies or sectors. In essence, the approach focuses on the value chain analysis, on the identification of key value drivers that characterize a company or an industry, and on the relationship between the application of standards and the creation of value. The impact of standards is determined by measuring how they affect relevant operational indicators for the various business functions, and then translated in monetary terms.

Considering the Peruvian asparagus value chain, INDECOPI and the Standardization and Non-tariff Barriers Surveillance Commission of Peru decided to analyze two companies to represent the sector. The first is a leading agro-exporter, DanPer Trujillo [3] (located in Trujillo, in the North of Peru) and the second a logistics consortium, Civil Association FríoAéreo (located in Lima), which plays a critical role in the sector's logistics, by handling nearly all the Peruvian fresh asparagus shipments by air.

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1 Instituto Nacional de Defensa de la Competencia y de la Protección de la Propiedad Intelectual (INDECOPI) – the main national institution in charge of standardization, accreditation and metrology in Peru.

2 The Commission is responsible for developing regulatory activities nationwide in its capacity as National Regulatory Agency. It supervises the subsequent control and elimination of non-tariff trade barriers, according to commitments made in the framework of the World Trade Organization, free trade agreements and the corresponding supranational and national regulations. It is also in charge of managing the official electronic signature infrastructure.

3 For further information, please consult : http://www.danper.com/Web/en/Default.aspx. Address : Carretera Industrial s/n Sector Barrio Nuevo Moche – Trujillo, Peru.

The idea was that the analysis of these two organizations would allow significant insight into the whole sector – without engaging in a complex sector study which would have required more time and resources.

While the quantitative assessment was only completed for DanPer (as explained in the following sections), the combination of DanPer's quantitative results and the qualitative findings concerning both organizations, allowed us to consider factors and trends applicable to the whole sector.

Finally, it is important to note that the analysis is focused on the assessment of the standards contribution to Danper's **asparagus business**, which represent about 50 % of its revenue.

9.2 The selected companies

DanPer began operating with great success in February 1994 as an international joint venture with Danish and Peruvian capital (see **Table 1)**. The company's agricultural operations cover 5 000 hectares, where asparagus (green and white), artichokes, pepper (*jalapeño* and *piquillo*), string beans, mango and papaya [4] are cultivated.

Around two-thirds of the land under cultivation is owned by DanPer and the remaining one third is owned by external suppliers. It is worth noting that DanPer only started production from its own fields in 2003, although this has expanded substantially since then. However, the quantities from external suppliers are also growing, due to the development of the market and the expansion of DanPer's sales.

4 Asparagus represents about 44 % of the land under cultivation, while 47 % is dedicated to artichokes, 8 % to peppers, and the remaining area to fruits.

Name	DanPer
Location	Trujillo and Arequipa, Peru
Established	February, 1994
Production lines	Preserved, fresh and frozen
Products	Asparagus (white and green), artichokes, peppers (jalapeño and piquillo), beans, mango and papaya
Turnover/Sales	USD 88 million (2010)
Asparagus exports	USD 36,5 million (2010)
Key markets	North America (USA) and Europe (France and Spain)

Source : DanPer

Table 1 DanPer – Key facts and figures

DanPer is one of the largest agro-exporter companies in Peru, with total revenues of USD 88 million in 2010, resulting almost entirely from export. About 45 % of its export is directed to the USA, 30 % to Europe and 25 % to other regions (Asia, Oceania, Africa and Latin America).

DanPer has three process plants for preserves, one packaging line for fresh asparagus, and one frozen process plant (IQF tunnel). Recently, it has extended operations to Arequipa in the South of Peru where it has set up a plant for preserved goods. The company business comprises three major lines : preserved goods (about 77 % of sales), fresh products (21 % of sales) and frozen products (2 % of sales). Frozen and preserved products are delivered by sea, while fresh products are delivered by air (two-thirds of the total) and sea.

DanPer maintains a work force of about 6 thousand people, in two locations (Arequipa and Trujillo). The company has a portfolio of approximately 350 customers and 150 suppliers.

FríoAéreo[5], established in 1998 with the support of the Peruvian Export Promotion Agency (PROMPEX), is an association formed by

5 For further information, please consult : http://www.frioaereo.com.pe/. Address : Av. Avenida Elmer FaucettCdra. 30 #s/n, Callao – Peru.

exporters of perishable products (fruits, vegetables and flowers), primarily serving those companies requiring post-harvest management of their products up to pre-shipment stage.

Thanks to the establishment and growth of FríoAéreo, the airport Jorge Chavez in Lima has today the largest perishable-goods centre in Latin America, with modern equipment and a logistics system that provides optimal conditions to handle and store products. The cold terminal has filled a gap in the exporters' supply chain, since, prior to its establishment, perishable products faced serious risks of deterioration due to a break in the cold chain.

FríoAéreo was established by nine member companies, which represented 40 % of the Peruvian agro-export industry. Today, 33 companies are members of FríoAéreo, representing 80-90 % of the industry. Around 80 % of the total Peruvian exports of perishable products dispatched by air pass through its cold chain management facilities.

Since its inception, FríoAéreo has contributed greatly to reducing inefficiency in the perishable products logistic chain, particularly in reducing quality losses and long loading times (from 4 hours in 1998 to 1.5 hours in 2005). The company also provides reliable information to the industry, enabling export companies to improve strategic planning.

9.3 Attitude of the companies towards standardization

The success achieved by the Peruvian asparagus industry in international markets depends on its ability to supply trustworthy, safe products of high quality.

In 1998, the private and public sector, with the support of INDECOPI, promoted the creation of the Asparagus National Technical Com-

mittee of Standardization (ANTCS) as a way to develop standards that would strengthen safety and other product and process quality attributes, responding effectively to the requirements of importers and national regulatory authorities of importing countries. To achieve this, the national standards for asparagus published by ANTCS were harmonized with Codex Alimentarius [6] standards.

Private certification schemes have also become increasingly important requirements demanded by international markets, to which Peruvian exporters have responded proactively.

Standards implementation and certification has considerably influenced the evolution of the Peruvian agro-export sector in terms of product quality, environmental sustainability of the production systems, and better social welfare conditions.

9.3.1 Standards context

The role of these companies within the industry value chain is important and has an influence on the use of standards by suppliers and logistics operators.

For DanPer, products and services provided by suppliers (farmers) and logistic operators are key to meeting the requirements of foreign markets. In this sense, the use of quality and safety standards by DanPer influences the improvement of suppliers' operations and their deliverables (upstream) – as a large buyer of supplies it can push the use of certain standards by its suppliers.

6 The Codex Alimentarius Commission was created in 1963 by FAO (Food and Agriculture Organization of the United Nations) and WHO (World Health Organization) to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. More information on: http://www.codexalimentarius.net/web/index_en.jsp#

For FríoAéreo, as a downstream service provider of storage (cold chain management facilities), the use of standards is critical to reducing the risks of inadequate handling of products. Given its position in the market, it can influence the implementation of process, safety and quality standards by its customers, to optimize the quality of exported products.

9.3.2 Standards capability

DanPer Trujillo has an important history in dealing with standards and, since its establishment, has maintained a strategic and very proactive attitude toward standards[7]. In DanPer's vision, adapting to new standards is seen as an opportunity to improve production processes and to open new markets, which is worth the cost (in time and in money) incurred.

In a decade, FríoAéreo has successfully adopted standards for all its processes, and promoted the implementation of standards such as NTP 011.109:2008, *ASPARAGUS – Asparagus fresh – Requirements*, which have played a key role in promoting the use of standards throughout the industry. Its experience with the implementation of standards has allowed FríoAéreo to develop indicators and control systems for quality attributes that allow asparagus producers to monitor their quality performance, and introduce corrective measures as required.

7 DanPer Trujillo is part of ANTCS, the consortium of firms that have created IPEH and FríoAéreo.

9.4 Analysis of the value chain

9.4.1 Industry value chain

Two chains have been outlined In this section. The first (see **Figure 1)** highlights the asparagus production chain, and the second (see **Figure 2)** describes the main stages for fresh green asparagus [8] export. These chains are useful in understanding the value chain of the Peruvian asparagus [9] industry.

According to FAO (2007), the fresh asparagus supply chain involves several steps from production to export.

"The process begins with selection of varieties, nursery, planting, application of chemical inputs and irrigation, disease control, and harvesting. Timing is fundamental to maintaining a quality product, for example, harvesting is a very coordinated activity, no more than 30 minutes are allowed from harvest to arrival in the packing house in order to avoid deterioration of quality. In the logistics/post-harvest component, fresh asparagus is loaded, weighed, cut, washed, and then sorted, graded, and bunched. Next, the asparagus is packed in specialized cartons (5-12 kg), pre-cooled and loaded onto refrigerated trucks. It then passes through customs clearance, cold storage and airport handling, and is finally shipped by air, and more recently, also by sea.

The marketing component consists of identification of, and negotiation with, buyers, market research information, and ensuring completion of the sale, etc."(FAO, 2007 : p. 27)

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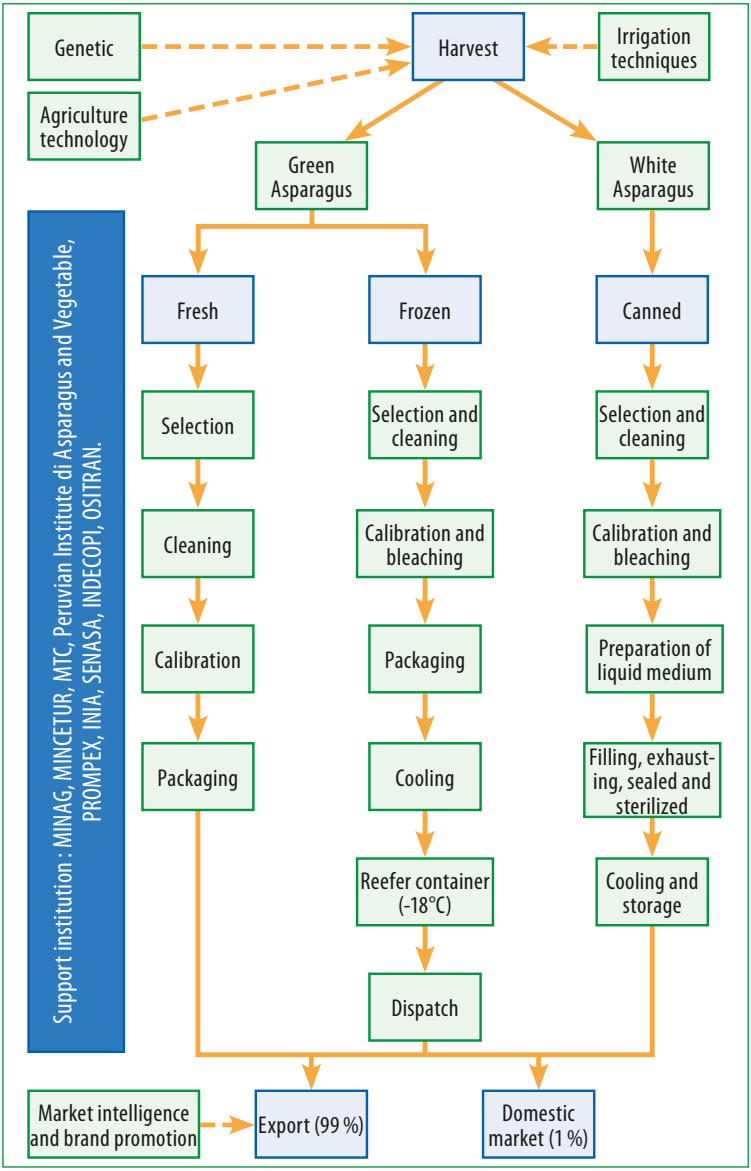
8 Ositran (2009), this document analysed the logistic chain of green asparagus with a key focus on the use of transport infrastructure for export. The goal was to identify the main bottlenecks that could affect business sustainability within this sector

9 Green asparagus is the main variety produced in Peru, representing more than 80 % of total production.

In general, processing plants are close to cultivation areas [10], except when transportation and processing costs are larger in comparison to field costs.

10 The main cultivation areas are located in Junín, Trujillo, Lima and Ica.



Source : ACORDE

Figure 1 Asparagus production chain

The processing plant involves different processes (see **Figure 2)**, which include cutting, weighing, sorting, wrapping, hydro-cooling and packing pallets for shipping by air (fresh asparagus) or in containers for shipping by sea (asparagus, canned, bottled, etc.).

Once selected, fresh asparagus is transported to Lima Airport for export through FríoAéreo which covers over 95 % of export traffic (Talma and Swissport also have a very small share of the market).

FríoAéreo, Swissport or Talma are in charge of storage, refrigeration, palletization and containerization of the pallets, which are in batches containing bundles of asparagus. The containers are then moved to cargo or passenger aircraft ready for take off.

The storage company requires a ramp operator like Talma, Swissport or Globeground to ship the asparagus to its destination. After landing, the asparagus container is stored in the airline warehouse for onward transfer to the trader.

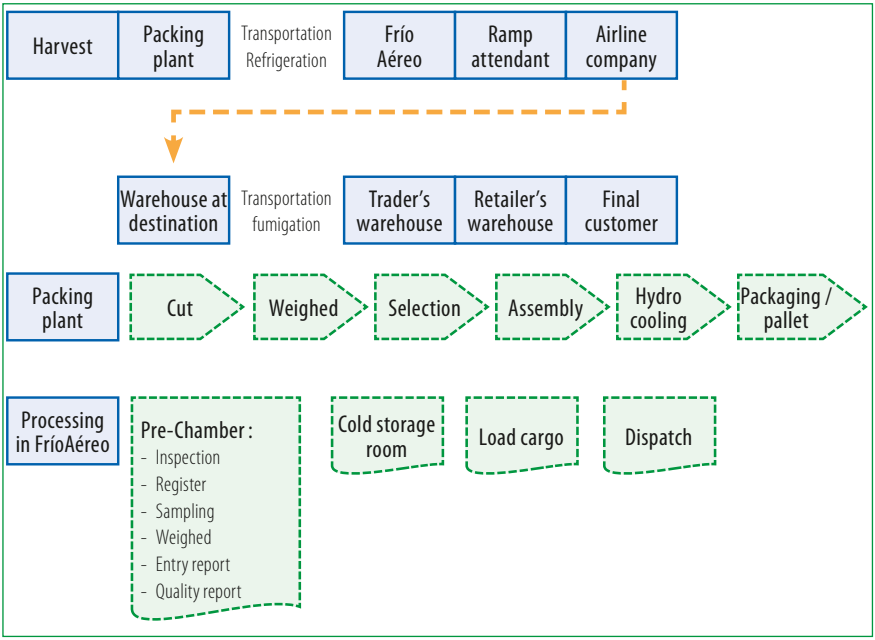


Figure 2 Main export stages for fresh green asparagus

9.4.2 Company value chain

DanPer, Trujillo and FrioAéreo operate at different stages of the industry value chain and their operations are complementary, particularly in the case of fresh asparagus. DanPer is involved at every stage of the chain from field production to export, while FrioAéreo is positioned in the final stage providing logistical support to exporters.

According to **Figure 3,** production planning is the business function in charge of planning the crop for the year on the basis of information provided by the customer requirement and marketing and sales functions. The latter also identifies all the inputs required by the company to achieve the production goals.

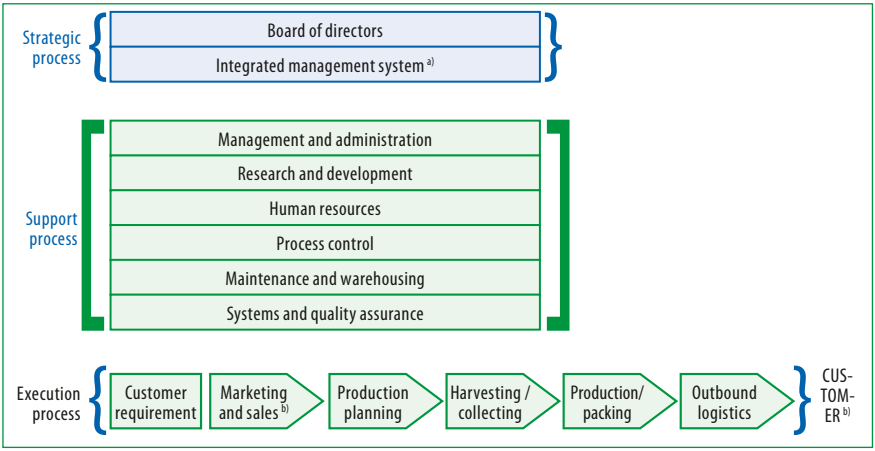
The harvesting/collecting function implements the requirements of the production planning function in the field. This stage is critical because harvesting/collecting supplies the production process, including that provided by third parties. In the production/packing function, the asparagus is then processed and packed according to customer requirements. It is important to mention that at this stage DanPer operates three asparagus production lines : fresh, frozen and preserved[11].

Outbound logistics is another stage critical to the export process, mainly for fresh asparagus. At this stage proper handling of the fresh product from factory to port or FríoAéreo warehouse must be ensured, along with temperature control.

The support and strategic processes complement the activities of the execution process. Within these secondary activities, the key functions are research and development (R&D), process control, systems and quality assurance, and human resources. R&D is responsible for developing new products or upgrading existing ones, as well as for improving the production process. Process control and systems and quality assurance are in charge of product sampling and testing product compliance with specified requirements.

Finally, human resources has become a very important function for DanPer. This business is highly labour intensive and the implementation of programmes to improve labour conditions is essential. Employee involvement and individual contributions to the company's continual improvement philosophy, have been key factors in the rapid growth of DanPer.

11 Fresh asparagus represents around 20 % of sales, whilst preserved asparagus accounts for 70 %, and frozen for 10 %.



a) Involves the strategic planning and direction revision.

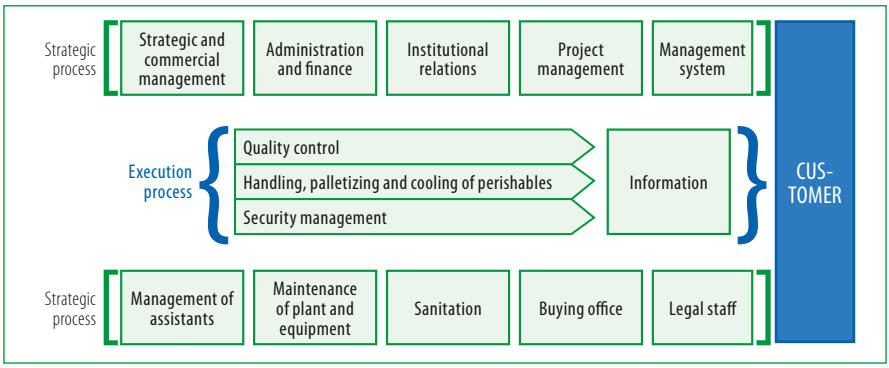
b) Customer (satisfaction) includes some activities of sales (post-sales).

Source : DanPer Trujillo

Figure 3 The DanPer Trujillo value chain

Figure 4 outlines the FríoAéreo value chain. Satisfying customer requirements by providing storage and cold services is the core business. In the execution stage, storage and cold services are provided, supplemented by quality control and product control. Quality control covers product sampling and analysis of asparagus characteristics, whereas product control is applied to trace temperature and to monitor the humidity of products until they are loaded onto the aircraft. The information gathered through this process is used to develop reports describing product quality and rankings that are then distributed to FríoAéreo's associates.

The functions belonging to the Support Process provide services to the execution process, including maintenance of facilities and equipment.



Source : FríoAéreo

Figure 4 The FrioAéreo value chain

9.4.3 Key value drivers

The key functions within the DanPer execution process are production planning, production/packing and outbound logistics, while quality assurance, human resources and research and development are the most important support functions.

FríoAéreo acts as an" outbound logistics " service provider and its execution process, as a whole, is critical. In addition, FríoAéreo provides procurement services for selected goods (e.g. pallets), with a view to offering cost reductions for its associates.

For the asparagus industry, *efficient methods to control pests and diseases, quality of production processes and service* and *client focus* were identified as key value drivers. The highly competitive international markets require strict and efficient control systems for hygiene, handling and product quality. This implies significant investment in R&D for innovation and continual improvement of production processes.

In DanPer's case, *efficient pest and disease control methods, vertical integration, standardization, client focus and personell recruitment* were

identified as key value drivers. Many are related to the ability to ensure reliable asparagus supply, a key success factor for this industry. DanPer is keen to establish relationships with farmers and suppliers in order to standardize process and quality, and to assure a fast, reliable and flexible service to customers.

In FríoAéreo's case, *quality service* and *service efficiency* were identified as key value drivers. Performing cold chain management is essential for agro-exporters of fresh products, and the company efforts focus on maintaining outstanding service and process control. To support continual quality improvement, quality reports are regularly delivered to associates and awards assigned.

9.5 Scope of the assessment

DanPer Trujillo takes part in almost all stages of the industry value chain, which involve the processes from harvesting to export (product placed on port), whereas FríoAéreo[12] operates as a service provider in the delivery of the product to its final destination, when the product is loaded on the aircraft (see **Figure 5)**.

12 The goal of the service provided by FríoAéreo is to maintain the quality of the product by ensuring the handling and cold chain protection during transit of the product through the airport.

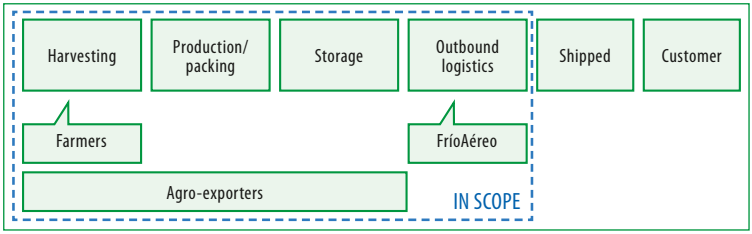


Figure 5 Fresh asparagus industry value chain

Therefore, the assessment can focus on the functions related to inbound and outbound logistics, production/operations and marketing and sales, which are the main functions of the industry. However, human resources and research and development can be included as complementary functions in the development of the industry. The main reason why only certain business functions were selected is explained by the leading role that standards seem to play in the development of the production process.

9.6 Use of standards in the companies value chains

The most important standards and certifications and, separately, regulations, applied by DanPer, are provided in the list below.

DanPer : Standards and certifications

NTP 011.109 (2008), *ASPARAGUS – Asparagus fresh – Requirements* ; NTP 011.116 (1991), *ASPARAGUS – Refrigerated Transportation Guide* ; NTP 209.401(2001), *ASPARAGUS – Hygienic practices for processing of fresh asparagus* ; 21 CFR 110 : NTP 209.402(2003), *ASPARAGUS – Good Agricultural Practices* ; Certifications to ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007, SA 8000 (Social Accountability International), Globalgap version 03, USGAP Version 08.06, BASC version 03-2008.

DanPer : Regulations

The Control of Pesticides Regulation 1986, CAC / Vol. III Second Edition 1993. Maximum Limits for Pesticide Residues, UK Statutory MRLs, Regulation EU Nº 765/2010, European Biocides Scheme – Biocidal Product Directive 98/8/EC, Directive 79/117/EEC : Active substances prohibited, Certification HACCP according to Codex Alimentarius annex to CAP/RCP 1-1969 (Rev 04 – 2003).

In DanPer's case, most of the standards, certifications and regulations are applied by each operational business function (see **Table 1)**. Governments and traders are highly demanding in terms of compliance to health, safety and environmental protection requirements for agricultural products entering their countries.

Inbound logistics and productions/operations make significant use of standards certifications and must comply with the regulations of importing countries, concerning primarily good manufacturing practices, control of pesticides, maximum levels of contaminants or phytosanitary aspects.

It is important to note that **for DanPer it is virtually impossible to separate the impact of voluntary standards and certifications, from that of regulations**. Considering that regulations do not have a dominant role (in terms of number or relative influence) and that all types of requirements are treated in the same way through the company processes, the assessment has been conducted in consideration of the full set of normative documents.

In FríoAéreo's case, quality and environmental management (ISO 9000 and ISO 14000) are the main standards used by the management and administration and production/operations business functions. The production/operations and post-service business functions also use national standards covering fresh asparagus requirements and sam-

pling procedures, which are very important to their activities. Finally, the certification BASC[13] which addresses the problem of concealing contraband in commercial trade is employed in the operations of procurement, production/operations and post-service.

FríoAéreo': Standards and certifications

NTP 011.109 (2008), *ASPARAGUS – Asparagus fresh – Requirements*; NTP-ISO 2859-1:1999, *Sampling procedures for inspection by attributes*; NTP-ISO 9000:2007, *Quality Management Systems – Fundamentals and Vocabulary*; ISO 9001:2008, *Quality Management Systems – Requirements*; ISO 14001:2004, *Environmental Management Systems – Requirements with guidance for use*; ISO 14004:2004, *Environmental Management Systems – General guidelines on principles, systems and supporting techniques*; Certifications: Business Alliance for Secure Commerce (BASC); Directorate General of Civil Aviation (DGAC); GS1: Global Traceability Conformance.

The standards impact map used by the companies

The main impacts of standards on the activities of each business function are summarized in **Tables 1 and 2** (a more comprehensive list of the standards impact map can be found in the full report).

In DanPer's case, the implementation of national and international standards such as NTP 011.109, NTP 209.401, ISO 9001 and ISO 14001, has had a substantial impact on the development of its operations, helping to organize processes in compliance with regulations and to continually improve process efficiency.

However, the most important impact of standards was identified in the marketing and sales department. Conformity to standards

13 BASC's security standards are designed to significantly improve security practices and in the process deter contraband smugglers and terrorists from using their companies to introduce contraband and implements of terror in legitimate shipments.

and certification against major standards (such as ISO 9001, HACCP, Global GAP, and others) is considered critical because it supports the customers' perception of the company's commitment to quality, safety and good practices, helping to build confidence and access to new markets.

Function	Activities	Impacts	Description
Production / operations	HSE (health, safety and environment)	Easier compliance with regulatory requirements	Influence in standards-setting process and proactive application of standards helps to reduce potential disadvantages from regulations
		Better health/safety/ environmental compliance	HSE management based on standards can be implemented more effectively
Marketing and sales	Marketing activities, client development	Better customer information	Communicating product and service specifications and requirements to potential customers is more effective when referring to standards
	Sales	Higher sales	Sales are higher due to customer confidence in standardized products and services

Source : DanPer Trujillo, ISO Methodology

Table 1 DanPer's standards impact map

In FríoAéreo's case, the application of standards like NTP 011.109, NTP-ISO 2859-1 and ISO 14001 has had a significant impact on the operations process – the procedures to achieve compliance with customer requirements regarding humidity and temperature of the products stored and handled prior to shipment to their final destination, are now implemented in a more effective way.

The adoption of those standards has also allowed FríoAéreo to exploit the information generated during production, to develop better communication with its clients and help raise the competitiveness of the industry.

Function	Activities	Impacts	Description
Production / operations	Environmental conditions assurance	Better environmental management	Environmental management based on standards can be implemented more effectively in order to maintain the correct temperature and humidity levels
Service	Customer care and technical support	Better customer communication	You can communicate information about products and services to customers more effectively by using standardized specifications

Source : FríoAéreo, ISO Methodology

Table 2 FríoAéreo's standards impact map

9.7 Selection of operational indicators to measure the impact of standards

Tables 3 and 4 present a list of operational indicators obtained from interviews with each company. The quantification of the impact of standards on them (actually on the subset for which it was possible to gather relevant data) leads to the assessment of the standards value for the company.

Selected business functions (BF)	Related activities	Value drivers	Standards and regulations used	Operational indicators	Definition of the indicators
Field operations	i. Planning ii. Irrigation iii. Pest control iv. Operations (from planting to harvesting) v. Personnel management	• Quality and safety of products • Optimal crop yield • Personnel involvement	• HACCP (Codex) • Codex Stan 193-1995 • ISO 9001	1. Quality of harvested crops 2. Field productivity 3. Waste 4. Personnel qualification, motivation and satisfaction	1. % of products by category of quality 2. Volume of harvested product/cost 3. % of waste 4. Based on personnel surveys and other (e.g. training)

Selected business functions (BF)	Related activities	Value drivers	Standards and regulations used	Operational indicators	Definition of the indicators
Procurement (crops)	i. Planning ii. Quality control iii. Procurement of crops	• Quality control • Cost effectiveness	• NTP 209.401 : 2001 • NTP 209.402 : 2003 • Regulation (EC) No 2073/2005 • Regulation (EC) No 178/2002 • The Control of Pesticides Regulation 1986 • HACCP • ISO 9001 • ISO 14001 • OHSAS 18001 • SA 8000 • Codex Stan 192-1995	1. The actual kilogram recorded to the total kilogram forecasted ; 2. The actual kilogram recorded from own fields over the total kilogram recorded ; 3. Number of orders that do not meet the specifications as a percentage of total number of orders	1. Assesses the compliance of raw material supply against plan ; 2. Assesses the percentage of inputs from the company's own fields in relation to third-party fields ; 3. Measures the level of non-conformity of suppliers
Logistics/ procurement	i. Procurement (all goods except crops) ii. Handling incoming materials and products iii. Transportation	• Quality of supply/ suppliers • Cost effectiveness • Efficiency of transport	• ISO 9001 • CAC/RCP 60-2005 • Regulation (EC) No 2023/2006	1. Selection of suppliers 2. Cost	1. Ratio of suppliers in top quality ranking (category A and B) 2. Cost of purchased goods

Selected business functions (BF)	Related activities	Value drivers	Standards and regulations used	Operational indicators	Definition of the indicators
Production / operations	i. All activities ii. Processing – fresh iii. Processing – canned iv. Processing – frozen v. Quality assurance vi. HSE (health, safety and environment)	• Quality and safety of products • Efficiency of processes • Standardization	• NTP 011.109:2008 • NTP 209.401:2001 • NTP 209.402:2003 • 21 CFR 110 • Regulation (EC) No 2073/2005 • The Food and Environment Protection Act 1985 • The Food Safety Act 1990 • HACCP • ISO 9001 • ISO 14001 • OHSAS 18001 • SA 8000 & ETI • Codex STAN 1-1985	1. Actual production costs over the planned production cost (labour force, input material) 2. The ratio of the top quality (Category I) to total production 3. Leftover or discarded rate 4. Profitability of each product category 5. Production efficiency re asparagus (volume of production per worker) 6. Production volume over labour cost or capital cost	1. Measures the efficiency of production (deviation from plan) 2. % of high-quality products over the total 3. Self-explanatory 4. Self-explanatory 5. Assesses the productivity of workers 6. Assesses the overall productivity
Research and development	i. Investigation of harvest ii. Production process improvement iii. Product development	• Customer orientation • Efficiency of production processes • Standardization	• NTP 209.401:2001 • NTP 209.402:2003 • 21 CFR 110 • The Food Safety Act 1990 • HACCP • ISO 9001 • ISO 14001 • OHSAS 18001	1. Number of new products accepted by customers over the number of products proposed by DanPer 2. Complaints re new products 3. Number of projects initiated per month 4. % of projects completed on time 5. Number of new processes deployed divided by the number of new processes developed	1. The first two indicators seek to assess the effectiveness of new product development 2. Indicators 3 and 4 concern the efficiency of R&D work 3. The fifth indicator assesses the effectiveness of R&D's process improvement activities

Selected business functions (BF)	Related activities	Value drivers	Standards and regulations used	Operational indicators	Definition of the indicators
Marketing and sales	i. All activities ii. Marketing activities, client development iii. Market analysis, research iv. Contracting v. Sales	• Customer focus, customer service • Sales effectiveness • Social responsibility • Innovation effectiveness • Market knowledge	• NTP 011.109:2008 • NTP 209.401:2001 • Regulation (EC) No 2377/1999 • HACCP • ISO 9001 • ISO 14001 • OHSAS 18001 • The Food Safety Act 1990	1. Volume of sales per person 2. Average growth in profits 3. Actual sales over forecasted sales 4. Total DanPer exports over total industry exports 5. Number of customer complaints (fresh or preserved products)	1. The first and third indicators assess the productivity of the sales function 2. The third indicator assesses the company's profitability 3. The fourth indicator assesses Danper's market share 4. The fifth indicator assesses the degree of customer dissatisfaction
Human resources	i. Recruitment ii. Salaries iii. Personnel management iv. Training v. Employees and social programmes	• Transparency • Personnel involvement and development	• SA 8000 • OHSAS 18001 • ISO 9001	1. Personnel enquiries : working environment 2. Number of employees or contract workers to the total number of personnel required on time 3. Salary increase 4. Personnel improvement (training) 5. Retention of employees	1. Measures personnel satisfaction 2. Measures the efficiency of sourcing 3. Self-explanatory 4. Measures investment in personnel improvement 5. Indirect measure of personnel satisfaction

Source : DanPer, ISO Methodology

Table 3 DanPer's operational indicators

Selected business functions (BF)	Related activities	Value drivers	Standards and regulations used	Operational indicators	Definition of the indicators
Production / operations	i. All activities ii. Quality assurance iii. Environmental conditions assurance iv. HSE (health, safety and environment)	• Client focus • Quality of production processes • Quality of service • Service efficiency	• NTP 011.109:2008 • NTP-ISO 2859-1:1999 • NTP ISO 9000:2007 • ISO 9001:2008 • ISO 14001:2004 • ISO 14004:2004 • GS1 : Global Traceability Conformance • BASC • DGAC	1. Average rating of quality Inspectors 2. Microbiological contamination control in a controlled environment 3. Consumption of refrigerant 4. Percentage of deviations* from cargo handling 5. Percentage of damaged products received	1. Assesses fresh green asparagus products according to the categorization of NTP 011.109:2008 2. Monitors the refrigeration chambers to ensure that they remain within the set limits of microbiological contamination 3. Self-explanatory 4. Monitors the handling of cargos at FrioAereo's facilities 5. Monitors the % of products arrived in unsuitable conditions
Post-service	i. All activities ii. Processing iii. Quality assurance iv. HSE (health, safety and environment)	• Quality of production processes • Standardization	• NTP 011.109:2008 • NTP-ISO 2859-1.1999 • BASC • DGAC	1. Percentage of cargo with temperature monitoring in platform or ramp 2. Percentage of complaints addressed	1. % of cargo with plotted (temperature) – when the cargo has left FrioAéreo's warehouse, until it is uploaded onto the aircraft 2. Assesses customer satisfaction.

Note : (*) Anything that harms the customer's property caused by improper handling of the product in the storehouse.

Source : FríoAéreo, FAO, O'Brien & Diaz, ISO Methodology.

Table 4 FríoAéreo's operational indicators

9.8 Calculation of the economic benefits of standards

The quantitative analysis was performed only for DanPer Trujillo. Considering the focus of this study, the analysis was **restricted** to the **asparagus business**. FríoAéreo is an important service provider but a rather small company and the available data did not allow us to quantify the impact of standards on its operational indicators. In this case, it is also important to note that the standards adopted and promoted by the company have a significant impact **at the overall industry level** – but this analysis was beyond the scope of the study.

Seven DanPer business functions were analyzed, and the quantitative assessment was performed on those for which the impact of standards is most significant : field operations, production/operations, marketing and sales and research and development. **Table 5** presents the main results for the four business functions analyzed.

Selected business functions (BF)	Operational indicators	Financial impact for the operational indicator
Field operations	1. Field productivity	1. USD 321,9 thousand (*)
Production/operations	1. The actual production costs over the planned production cost 2. Asparagus production efficiency	1. USD 71,4 thousand (**) 2. USD 16,6 thousand (*)
Marketing and sales	1. Average growth in profits	1. USD 536,8 thousand
Research and development	1. Number of new products accepted by customers over the number of products offered by DanPer	1. USD 39,9 thousand (**)

Note : (*) To avoid double counting, this contribution is considered embedded in the average profit growth considered for the marketing and sales function. (**) These have been considered as specific " correcting factors " to the average growth in profits and summed-up.

Source : DanPer Trujillo

Table 5 Economic benefits of standards for DanPer, based on average annual gross profits 2007-2010

To support the quantitative analysis, and in particular the translation of the operational indicators in financial metrics, the following assumptions were made :

1. Sales and gross profit figures are always related to the total business of the company[14]. As a consequence, when the analysis focuses on indicators referring to specific product categories (e.g. fresh or preserved asparagus), the estimated economic values presented in **Table 5,** calculated as the % of the total business derived from the selected categories, should be considered as a close approximation of the actual economic benefits of standards.
2. The annual average gross profit for the period 2007-2010, 23,6 %, was estimated on the basis of the average gross profits of competitors comparable in size to DanPer[15] (such as Agroindustrias AIB[16] and Camposol[17]). It was also assumed that the total gross profits was an average constant over the three years, corresponding to USD 2 147,3 thousand per year.

The details of the assessment for the four selected business functions are given below.

Field operations

Four key operational indicators (KOI) are considered for this business function, but only one, *field productivity*, could be assessed (information on other KOI's was unavailable or not relevant).

14 The total turnover includes figures of sales data of asparagus, artichokes, peppers, and the other products detailed by DanPer.

15 DanPer could not provide its average gross profits over the period in the time required.

16 The information was gathered from the financial accounts published on Conasev (Business and Securities National Supervisory Commission of Peru). http://www.conasev.gob.pe/eeff/eeff_x_empresa.asp

17 Camposol Holding Plc (2011) Fourth Quarter and Preliminary Full Year 2010 Results. http://hugin.info/138464/R/1492669/428469.pdf

To avoid double counting, the contribution of increased *field productivity* is considered embedded in the average growth of profits calculated for the marketing and sales function. However, it is useful to present the logical steps taken to perform the quantitative assessment of *field productivity*:

1. The volume of asparagus harvested and ranked as top quality (this is the only crop used for fresh products) increased from 1,2 MT in 2007 to 4,4 MT in 2010. A difference of 3,2 MT.
2. Taking into account that the utilization rate of raw material in fresh products is about 70 %, the volume of products exported amounted to 816,4 thousand kilograms in 2007 and 3 099,3 thousand kilograms in 2010.
3. The sale price and product cost for fresh asparagus (exported) was approximately USD 2,36 and USD 1,25 per kilogram in 2007 and USD 2,72 and USD 1,25 per kilogram in 2010.
4. Therefore, the income generated by the exports of those quantities in 2007 and 2010 were USD 1 929 thousand (USD 2,36 X 816,4 thousand kg.) and USD 8 420 thousand (USD 2,72 X 3 099,3 thousand kg.), respectively. At the same time, the costs were USD 1 458 thousand (USD 1,25 X 1,2 MT) in 2007 and USD 5 534 thousand in 2010 (USD 1,25 X 4,4 MT).
5. This represents a gross profit increase of USD 2 415 thousand for the 2007-2010 period or, assuming, for simplicity, a linear growth over the three years, an annual gross profit of USD 805 thousand.
6. According to DanPer managers, the use of standards in field operations (notably NTP 209.402, NTP 011.109, HACCP, OHSAS 18001, SA 8000, and others) has been an important catalyst in the improvement of the selected products harvested from company fields. Throughout the assessment process, it was estimated that the use of standards contributed about 40 % to the results

indicated under step 5 : i.e. an average contribution of USD 321,9 thousand to the company's annual gross profits.

Production/operations

Six KOIs were considered for this business function, but the quantitative assessment was limited to two : *the actual production costs over the planned production cost* and *asparagus production efficiency* (data re : other KOI's were unavailable or not relevant).

The quantitative assessment of *actual production costs versus planned production cost* was conducted as follows :

1. The assessment covers the labour cost incurred in producing white preserved asparagus for export. Planned and actual labour cost for 2007 and 2010 are compared and reductions in the difference between planned vs. actual are accounted as cost savings.
2. In 2007, the *planned* labour cost per worker was USD 0,32 per kilogram with a resulting *actual* cost of USD 0,40 per kilogram. In 2010, the planned and actual labour costs were USD 0,46 and USD 0,53 per kilogram respectively.
3. The quantity of preserved asparagus exported in the analysis period (2007 and 2010) was 21,5 MT and 17,1 MT.
4. Therefore, the actual labour cost exceeded the planned cost by 1 720 thousand USD in 2007 and by 1 197 thousand USD in 2010 (respectively, 25 % and 15,2 % of the planned costs). This represents improved cost planning, with a decrease of the labour cost delta of 523 thousand USD (2010 vs. 2007), or 174,3 thousand USD per year. This figure is assumed as labour cost savings.
5. The use of standards (in particular ISO 9001 supporting a thorough implementation of the continual improvement philosophy) has significantly contributed to improve process efficiency. DanPer's management estimated that the implementation of standards

contributed 40 % to the results indicated under item 4 – that is, an average annual cost saving of USD 71,4 thousand (40 % of 178,4 thousand USD).

The assessment of the KOI *asparagus production efficiency* is considered embedded in the average growth of profits calculated for the marketing and sales function. More details on this assessment can be found in the full report.

Marketing and sales

DanPer exports nearly all of its products (75 % of total production is exported to the USA and Europe). These target markets, and the buyers serving them, are very demanding in terms of safety, traceability and quality requirements.

Many customers (notably large department store chains) demand certifications against several standards – in these cases, certification is almost "mandatory" in winning contracts. However, even for those customers who do not directly request certification, commitment to standards and certification strongly support the image of, and confidence in, the company, making it easier to reach contractual agreements.

Five KOIs are considered for this business function, but the quantitative assessment was limited to one: *average growth in profits* (data re other KOIs were unavailable or not relevant). The assessment for this KOI was conducted as follows:

1. The total company sales increased from USD 62 340 thousand in 2007 to USD 89 610 thousand in 2010. This represents a USD 27 270 thousand difference.
2. Assuming a linear growth over the three years, this represents an average annual sales increase of USD 9 090 thousand. Considering the average gross profits for the period (23,6 %), this gives an

annual gross profit average of USD 2 147,3 thousand per year. Asparagus exports account for approximately 50 % of that amount, i.e. USD 1 073,7 thousand.

As noted above, *compliance with regulations* (relevant to export markets), and *certifications and extensive use of standards* (e.g. ISO 9001, OHSAS 18001, HACCP, Global GAP, Regulation (EC) No 2377/1999, Ethical Trading Initiative – ETI, etc.) are considered a critical factor in DanPer's sales growth. DanPer's management estimated that certifications and implementation of standards contributed to increased sales in about 50 % of cases. This translates to a contribution to average annual gross profit of USD 536,8 thousand (50 % of USD 1 073,7 thousand).

Research and development

The use of standards by this business function has had a seminal impact, supporting the conception of new ways to improve production processes or to create new product lines. In addition, using standards has made it easier to design new products according to international requirements and/or to adapt products to customer requirements in a shorter time.

Of the five KOIs identified for this business function, only one could be assessed, *number of new products accepted by customers over the number of products offered by DanPer*. The assessment was conducted as indicated below:

1. The overall sales value of new products in 2007 was only USD 17 035, but reached USD 1 031,5 thousand in 2010. An increase of USD 1 014,5 thousand or, assuming a linear growth, an annual increase of USD 338,2 thousand.
2. Based on the average gross profit margin (23,6 %) this represents an annual contribution of USD 79,9 thousand to the total company gross-profit.

3. The asparagus business represent 50 % of the total, therefore the annual contribution to gross profits derived from asparagus can be estimated at USD 39,9 thousand.

Table 6 summarizes the financial impact of the use of standards for the selected business functions. The total economic impact of standards was estimated as contributing 648 158 USD to the company's annual gross profit. This represents about 30 % of the gross profit or about 1,7 % of the total company turnover derived from asparagus in 2010.

Selected business functions (BF)	Financial impact of standards on total BFs
Field operations	USD 321,9 thousand(*)
Production/operations	USD 71,4 thousand (**)
Marketing and sales	USD 536,8 thousand
Research and development	USD 39,9 thousand
Total impact of standards	**USD 648,2 thousand**

Source : DanPer Trujillo

Note : (*) To avoid double counting, this contribution is considered embedded in the average growth in profits calculated for the marketing and sales function. (**) This amount does not take into account the estimated value for the KOI : asparagus production efficiency (USD 16,6 thousand), in order to avoid double counting.

Table 6 The economic benefits of standards for DanPer, based on average annual gross profits 2007-2010

9.9 Qualitative and semi-quantitative considerations

As previously noted, the quantitative assessment was completed for four business functions from the seven identified. **Human resources**, however, deserves further investigation in order to complement the analysis conducted so far.

DanPer's awareness of, and commitment to, social responsibility is an important factor contributing to its success. This highlights its influence on employee performance, and an attitude that is considered very positively by buyers (in support of their own supply chain accountability, and as further proof of the company's seriousness and qualification). Considering DanPer's attitude on standards, and its use of standards in the social responsibility area (e.g. OHSAS 18001), an attempt was also made to assess the impact of standards on human resource activities.

Five KOIs were identified (see **Table 3)**, however the lack of specific data did not allow us to perform the assessment. For example, in the case of "personnel enquiries" (concerning the working environment), DanPer has recently implemented an employee survey, but there is no reference to historical data to evaluate changes. In the case of "personnel improvement" (training), the use of standards may have a direct impact as a means of facilitating transfer of information and knowledge, but no relevant data were found. No direct correlation between the application of standards and KOIs such as "salary increase" or "retention of employees[18]" was identified.

However, the company management is well aware of the importance of fair personnel practices and social matters. This attitude seems to have contributed significantly to the involvement and motivation of employees in supporting the effective and rapid implementation of standards, the benefits of which are reflected in the company's rapid growth.

18 The strong agricultural growth in the north of Peru is leading to a demand for more workers. As a result, the hiring process has become complicated for companies in a job market with inadequate qualified labour, especially during the high season.

Procurement and logistics is another business function critical to the production process. Although this function does not base its activities directly on standards, it does so indirectly through the specifications provided by other departments that extensively apply standards in their processes. A more extensive application of standards by this business function could improve, for example, its purchase programme to achieve further cost savings and strengthen its partnership with suppliers.

Within the field operation business function, the KOI *quality of the harvested crops* was not assessed, because we were not able to find a way to quantify the extra value derived from top quality products, and avoid double counting with other KOIs in the marketing and sales function. However, DanPer's management indicated that the implementation of standards has also contributed to a significant increase in the percentage of asparagus ranked as "top quality product", from 31,5 % of the total in 2007 to 45,4 % in 2010.

Finally, it is important to emphasise that DanPer has been able to grow faster than the sector. Its share of Peru's asparagus exports increased from 8.5 % in 2007 to 9.5 % in 2010. The company's management believes that standards, and its attitude to standards, have contributed significantly to its success. As a result, it seems reasonable to conclude that the value of standards to DanPer exceeds the figures given in **Table 6.**

However, while the implementation of standards has contributed to DanPer's performance and impressive growth, it is also important to consider that this *has primarily been led by the expansion of global demand and the existence of Free Trade Agreements* – factors that cannot be isolated from the pure impact of the use of standards.

9.10 Conclusions

DanPer has been active in the market for nearly 17 years, and has implemented key standards such as NTP 011.109, NTP 011.116, NTP 209.401, ISO 9001, GlobalGAP, USGAP, OHSAS 18001, and HACCP since 2004. Not all its business functions apply standards, but the company intends to further expand their application in future.

The economic value of standards shown in **Table 6** provides an estimate of the company's asparagus business. Extending the analysis to the full range of DanPer's agricultural products (including artichokes, pepper, beans and fruits) would certainly increase the figures in the table. It is also likely that standards have an impact on some of the operational indicators that could not be quantified during the assessment.

According to DanPer's managers, standards play an essential role. They continue to facilitate access to markets and new customers. As analyzed in this study, this contribution generates substantial economic value. In addition, standards have been valuable tools in helping DanPer to improve its production processes and activities in several areas.

Although the methodology was fully applied to only one (leading) company, and in qualitative terms to another key player of the sector, the results enable us to consider the reality that standards create value.

In future it would be worthwhile considering application of the methodology to the whole asparagus sector or even to the total Peruvian agro-export industry.

Many small to medium enterprises operate in these industries and follow the steps undertaken by larger companies. In a broad sense, the implementation of standards is contributing to a change in the landscape of the sector, and this is reflected in improved competi-

tiveness, technology transfer, high employment, process improvements, access to markets and the growing interest of new investors and customers.

Lobatse Clay Works (PTY) Ltd, Botswana

Country : Botswana
ISO member body : Botswana Bureau of Standards (BOBS)
Project team:
Project leader : Ms. Kopano Bogopa (BOBS)
Member : Mr. Michael Mogamisi
(University of Botswana, Master Student, Business Management)
Member : Ms. Lindiwe Mbulawa (BOBS)
ISO Central Secretariat advisor : Reinhard Weissinger
Duration of the study : November 2010 – June 2011

10.1 Objectives and organization of the pilot project

The objective of the project was to identify the impacts of standards, if any, in the operations of the company Lobatse Clay Works (LCW), in terms of cost savings and improvement in product quality, and, in particular, to assess the economic benefits of such endeavours.

10.2 Introduction to the selected company

Lobatse Clay Works (LCW) is located in Lobatse, a small town 70 km from Gaborone, the capital of Botswana. The company began operating in 1992 as a joint collaboration between the Botswana Development Corporation (BDC) and an American company, Inter-Kiln. In 2004, Inter-Kiln diversified and BDC gained total ownership of LCW.

The company produces mainly face bricks, but also window sills and pavers categorized as special bricks. Its face bricks are of one type, but differ in colour and texture depending on customer specifications. Production is continuous from raw material to finished product in a process that operates 24 hours per day in three eight hour shifts plus an additional relief shift.

Presently the company produces in excess of 30 million units per year. It employs 175 people including six temporary workers and interns. Company revenues in the financial year 2009/2010 were 64 million Botswana Pula (BWP), equivalent to about USD 9.73 million (at end-2010 exchange rate). Its financial year runs from July to June of the following year.

A survey conducted during 2009/2010 found that the company had an approximate 48 % share of the local market. Its main competitor is Corobrick, a South African company producing similar products. Corobrick

has been in existence for more than 100 years, is larger, produces many products at a cheaper price, and therefore has an advantage over LCW which buys some of its raw materials from South Africa. Other competitors include Makoro Bricks, Panda and Kwaedza. Makoro produces face bricks while Panda and Kwaedza specialize in semi face and cement bricks.

The Government of Botswana is LCW's main customer, accounting for 95 % of sales. The company exports in small quantities to the SADC countries, predominantly Namibia, and is yet to break through in South Africa and Zambia. Exports account for only one percent of sales, the remaining percentage being accounted for by the private sector and individual customers.

LCW is aware of its legal requirements and operates within the framework of the following Botswana legislation :

1. Lobatse Town Council Bye-laws Chapter 40:02
2. Companies Act Chapter 42:01
3. Mines and Minerals (Prospecting and Leasing Charges) Regulations Chapter 66:01
4. Mines, Quarries, Works and Machinery Act Chapter 44:02
5. Waste Management Act Chapter 65:06
6. Atmospheric Pollution (Prevention) Act Chapter 65:03

10.3 Attitude of the company towards standardization

The company started operating two decades ago and was performing well until it encountered some difficult trading conditions, resulting in lower profit margins. It was declared bankrupt in 2006. BDC then injected funds into the business to aid recovery. LCW has since attributed part of its subsequent success to the use of standards implemented when it began trading again.

A key standard to which the company was first certified in 2006, and recertified in 2009 is BOS 28, Burnt Clay Masonry Units, based on the South African National Standard SANS 227. This standard covers burnt clay masonry units for use in masonry walling (engineering, facing and non-facing) and lays down a classification system. It includes requirements for shape, appearance, texture, colour, dimensions, warpage, compressive strength, efflorescence and soundness. It also specifies test methods for water absorption, water-soluble salts and moisture expansion, and gives information on compressive strength of engineering units, the usage rate of units per square metre of walling and explanatory notes on efflorescence.

The product classes certified are Face Bricks Extra (FBX), Face Bricks Aesthetic (FBA) and Face Bricks Standard (FBS). LCW was re-certified in 2009.

Other standards, including company-internal specifications, are used to test a number of parameters required for conformity to BOS 28, including :

1. Verification of blending of dry raw materials according to the blending ratio
2. Moisture content of ground material
3. Moisture content of mixing pile
4. Sieve analysis
5. Vacuum tests
6. Wet and core hole dimensions
7. Squareness of green
8. Warpage of green
9. Inspection of green
10. Extrusion moisture
11. Drying shrinkage
12. Moisture after dryer

13. Dry to fired shrinkage
14. Fired dimensions
15. Unloading (sorting)
16. FBA analysis
17. Water absorption
18. Warpage of fired bricks
19. Compressive strength.

The company is preparing for BOS ISO 9001 quality management system (QMS) certification.

After operating a QMS for about five years, LCW plans to implement the BOS OHSAS 18001 occupational health and safety management system, and eventually certify to this standard.

The company participates in standards development activities in the country, and in the work of the following technical committees within the Botswana Bureau of Standards:

- Building and Construction Division (BCD1), Cement, Lime and Masonry Units
- Chemical Division (CD4), Occupational Health and Safety

From the above it can be concluded that the company has a positive attitude towards standardization and the use of standards. It appreciates the importance of conforming to standards, and realizes the benefits associated with their use.

LCW participates in standards development committees to keep abreast of new developments in product quality, and by so doing contributes to the nation of Botswana.

The company not only focuses on product quality but also looks at implementation of management system standards as a means of continually improving its processes to meet and exceed customer expectations, and ensure the health and safety of employees.

10.4 Analysis of the value chain

The value chain is a chain of activities linked in a prescribed order through which products move, gaining value at each stage.

10.4.1 Industry value chain

LCW imports some raw materials from South Africa, mines clay on-site and sources another type of clay from Mmamabula. The company produces and distributes all its products from a single site.

The project is focused on the building construction industry and on processing raw material into a final product. This is the reason that we do not include raw material providers in the assessment.

The figure below illustrates the construction industry value chain:

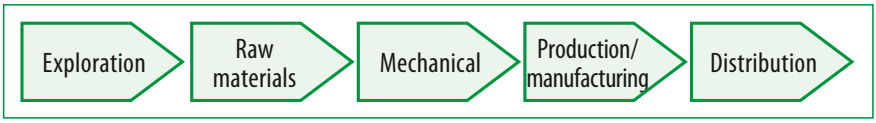


Figure 1 Construction industry value chain

10.4.2 Company value chain

10.4.2.1 Raw materials used

Clay soil is the main raw material used by LCW and the following clay soils are used by LCW to manufacture different types of clay bricks:

- Lobatse clay, 100 % mined on site
- Mmamabula clay mined from the Mmamabula coal mine
- Other types of clay from South Africa.

These raw materials, plus solid and liquid fuel, are combined together in different quantities depending on the final product.

The company produces three types of product :

- Clay bricks used for building i.e. Face Bricks Extra (FBX), Face Bricks Aesthetic (FBA) and Face Bricks Standard (FBS)
- Window seals
- Paving bricks (Paver Terracotta, Pavers Dark Brown).

These products can be manufactured in any of the following colours :

- Kalahari Satin, Kalahari Travertine ; Borolong Brown Satin ; Borolong Brown Travertine ; Terracotta Travertine ; Terracotta Travertine Blue ; Terracotta Satin.

The final finish of the bricks can either be rough or smooth, hence the designation " travertine " and " satin " which refer to the roughness or smoothness of the brick.

10.4.2.2 Production process

The production process consists of the following steps :

Step 1 : Excavation of clay

The clays are mined from quarries and stockpiled to allow the clay to mature. Quality tests are carried out to guide the mining process and verify the quality of the clay.

Step 2 : Grinding/refining of clay

The stockpiled clay is ground using clay preparation equipment prior to storage.

Step 3 : Storage in silos

The prepared clay is stored in silos prior to extrusion.

Step 4 : Moulding

The dry clay from silos is then carried by a conveyor belt to an extrusion machine that produces columns which are then cut into bricks.

Standards are used to check column length and size, and dimensions of the final brick. Tests for vacuum control, wet and corehole dimensions, squareness of green, warpage of green and dry, inspection of green and extrusion moisture are then carried out.

Step 5 : Drying

The bricks are set on a kiln car and the drying process starts through the dryer.

Step 6 : Firing and cooling

Bricks are exposed to different degrees of heat in the kiln, from zone zero to zone nine. Temperatures are regulated as per specification to achieve high quality bricks that are resistant to breakage and other malfunctions. During this stage the brick colour may be varied. Dimensions are checked after firing.

Quality control measures are also taken to determine strength of bricks and the rate of water absorption.

Step 7 : Sorting and packing

Bricks are sorted according to size, shape and colour. The products are then classified into one of three categories :

a) FBX – Face Brick Extra – a durable face brick possessing the highest degree of size, shape and colour uniformity

b) FBS – Face Brick Standard – these are clay face bricks that are durable, uniform in size and shape

c) FBA – Face Brick Aesthetic – these are durable clay face bricks with distinctive aesthetics derived from deliberate non-uniformity of shape and colour.

Defects and scrap discovered during sorting are treated as 'grog' and reused as raw materials.

Producing consistent brick quality is a challenge to LCW. Another challenge facing the company is the efflorescence of bricks. Efflorescence is the crystallization of soluble salts on the surface of the brickwork arising from salt-bearing water evaporating from bricks and mortar joints. This is usually a temporary and harmless phenomenon associated with newly laid brickwork that is drying out. However, certain types (crypto-efflorescence) and severe degrees of efflorescence may prove harmful.

BOS 28 defines five degrees of efflorescence which can be treated :

1. Nil – no perceptible deposit of salts
2. Slight – a very thin and just perceptible deposit of salts, or a small amount of salts occurring only on the edges of a masonry unit
3. Moderate – a heavier deposit than 'slight,' but that has not caused powdering or flaking of the surface
4. Heavy – a thick deposit of salts covering a large area of the unit, but that has not caused powdering or flaking of the surface
5. Serious – a deposit of salts that has caused powdering or flaking of the surface.

Step 8 : Ready for sale

Once product quality has been assured, the bricks go through the wrapping machine and are stacked into piles of five hundred per pallet. The bricks are then ready for sale.

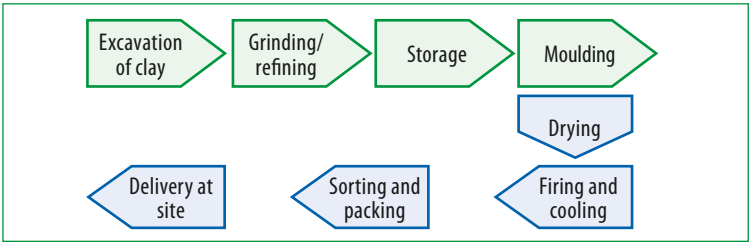


Figure 2 Lobatse Clay Works manufacturing process

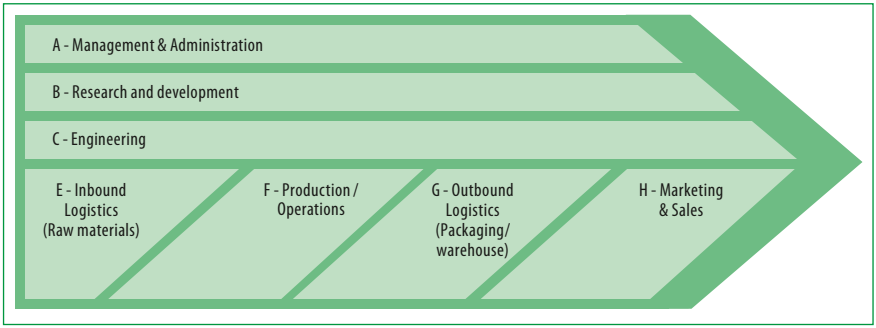


Figure 3 Lobatse Clay Works value chain

10.4.3 Key value drivers

The key value drivers for LCW are those strengths that work to the company's advantage, making it a preferred supplier of goods versus competition.

LCW has carved a niche in the national and international market due to several distinct attributes:

- The company is 100 % citizen owned
- The main raw material used in brick production is mined locally
- All workers are insured and pensionable
- The company has more than 20 years experience
- It produces high quality products
- Stringent quality tests are made before dispatching products to customers
- It offers reasonable prices
- It delivers on time.

10.5 Scope of the pilot project assessment

The scope of the assessment is limited to the production function, which we view as the backbone of the company because, as the product realization process, it converts raw material into finished product. The product then becomes the revenue earner for the company.

10.6 Use of standards in the company value chain

LCW uses many company standards in the production function to test raw materials pre-production, and to assess product quality during production.

The following tests are carried out during the production process:

- Measurement of dimensions
- Compressive strength
- Degree of efflorescence
- Soundness
- Water absorption
- Marking (batching)
- Screen analysis
- Stiffness test on green bricks
- Clay test during mining.

The impacts of standards are identified using a tool of the ISO Methodology, the "standards impact map". This is a list of potential impacts assisting in the identification of the most relevant impacts. The outcome of this step is a list of impacts to be assessed in the next step.

By consulting the standards impact map, the following possible impacts can be compiled:

Impacts	Description
Better internal information transfer	Using standardized documents and specifications makes communication of internal information on products and services more efficient.
Better training of personnel	Production/operations staff can be trained better because relevant specifications for products and services are standardized.
More efficient processing	Due to the reduced number of non-standardized products, production/operations can become more efficient.
More efficient assembly	Assembly processes are more efficient due to modular product architecture.
Better quality of equipment and supplies	Higher quality of equipment and supplies based on standards reduces failure rates and related correction costs.
Better quality management	Quality management based on standards can be implemented more effectively.
Better health/safety/environmental compliance	HSE management based on standards can be implemented more effectively.

Table 1 Possible impacts of standards on the production/operations function

10.7 Selection of operational indicators to measure the impact of standards

As stated in Section 10.5, the scope of the assessment of the impact of standards is limited to the production function. However, before taking this decision the functional heads of every department selected were interviewed using a questionnaire, and were asked whether they saw an improvement or not for each possible impact. Since the core function of LCW is production, it was decided to limit the scope of the assessment to this single business function. To prepare for the quantification of the impacts, the following areas were identified as important, and the operational indicators defined in 10.7.1 were chosen to measure the impacts and the economic benefits of standards:

10.7.1 Definition of operational indicators

Selected business function : **Production/operations**

Activity	Impacts	Explanation/impact description	Operational indicator
Processing	Better quality of equipment and supplies	Equipment is calibrated and maintained to keep it in good working order and reduce breakdowns. Testing of raw materials (Lobatse, Hammanskraan and Mmamabula clays) is carried out in accordance with standards to validate quality and ensure conformity with specifications.	**Indicator 1:** Equipment and supplies failure rate
Processing	More efficient and reliable organization of the production process	Production is an automated (high technology) single line process, therefore one type of clay brick is produced at a given time. Focusing on one type of product saves time and minimizes product failure throughout the stages of brick production.	**Indicator 2:** Production volume/ output
Processing	Higher and more consistent product quality	Reduction in non-conforming products, improved product and service quality, and taking preventive and corrective action.	**Indicator 3:** Product failure rate
HSE	Better health, safety, environmental compliance	Costs due to accidents have been reduced due to raised health and safety awareness among staff.	**Indicator 4:** Accident rate

Table 2 Operational indicators for LCW

10.7.2 Estimations of the impacts of standards

The table below gives estimates of the impacts of standards applied to the LCW production process. Savings or improvements are expressed in percentages before and after the use of standards for each process stage outlined in Section 10.4.2.2. It should be noted, however, that the estimates for the individual process stages are based on an overall estimation for the whole company since it was not possible to obtain data for the impacts on each individual stage of the production process.

Business function : Production				
Stages in the production process	**Standards used in this stage of the production process**	**Operational indicators [Number of indicator is given in brackets]**	**Before introduction of standards (per year)**	**After introduction of standards (per year)**
Excavation	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %
	BOS OHSAS 18001	Accident rate [Ind. 4]	5.1 %	0.1 %
Grinding/ refining	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %
	BOS OHSAS 18001	Accident rate [Ind. 4]	5.1 %	0.1 %
	BOS 28	Equipment and supplies failure rate [Ind. 1]	25 %	20 %
Storage	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %
Moulding	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %
	BOS 28 BOS ISO 9001	Equipment and supplies failure rate [Ind. 1]	25 %	20 %
	BOS 28 BOS ISO 9001	Product assembly rate [Ind. 2]	44 %	32 %
Drying	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %
	BOS 28 BOS ISO 9001	Equipment and supplies failure rate [Ind. 1]	25 %	20 %
Firing and cooling	BOS 28 BOS ISO 9001	Equipment and supplies failure rate [Ind. 1]	25 %	20 %
	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %
	BOS 28 BOS ISO 9001	Product assembly rate [Ind. 2]	44 %	32 %
Sorting and packing	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %

Business function : Production				
Stages in the production process	**Standards used in this stage of the production process**	**Operational indicators [Number of indicator is given in brackets]**	**Before introduction of standards (per year)**	**After introduction of standards (per year)**
Storage prior to sales	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18 %	6 %

Table 3 Impacts of standards

10.7.3 Calculation of the economic benefits of standards

On the basis of the percentage impacts given in section 10.7.2, the impacts are expressed in financial terms and impact on the company EBIT as shown in the table below :

Business function	Operational indicators	Financial impact for the operational indicators (in Botswana Pula)
Production	**Indicator 1 :** Equipment and supplies failure rate	BWP 315 789.47
	Indicator 2 : Production volume/output	BWP 1 152 000.00
	Indicator 3 : Product failure rate	BWP 216 000.00
	Indicator 4 : Accident rate	BWP 1 500.00
TOTAL (in BWP):		**BWP 1 685 289.47**
TOTAL (in USD):		**USD 256 213.00**

Table 4 Financial impacts of standards

10.7.3.1 Percentage impact of standards on the company EBIT

The revenues of the company in 2010 were BWP 64 million, approximately USD 9 729 860. The EBIT was BWP 34 million, which amounts to about USD 4 560 870.

The percentage impact of standards on the company EBIT is calculated as:

(Total impacts / (Total revenues – Total costs)) x 100, that is:

EBIT = (1 685 289.47/(64 000 000 – 30 000 000)) x 100

= (1 685 289.47/34 000 000) x 100

= **4.96 %**

10.7.3.2 Percentage impact of standards on total company sales/turnover

The percentage impact of standards on company revenue is calculated as:

(Total impacts / Total revenues) x 100, that is:

= (1 685 289.47/64 000 000) x 100 = **2.63 %**

It should be noted that the scope of the assessment of the impacts is limited to one business function (production) and does not cover the whole company. Had other business functions been included, then the impact could have been somewhat higher.

10.8 Qualitative and semi-quantitative impacts of standards

The following are other impacts of standards on the company which have been identified but which could not be quantified:

- Reduction in variety of products manufactured by the company. LCW has cut down the number of products from 13 to 8. This variety reduction has resulted in savings for the company, but it was not easy to quantify the amount of savings
- There was some reduction in time used for communicating information about products within the production function due to the use of standards, however this reduction is quite small and not easy to quantify

- Production staff can be trained better because relevant product specifications are standardized, however it was not easy to quantify the savings during staff training. The company felt that the savings were relatively small.

10.9 Recommendations to improve company operations

1. Fuel is expensive and the kiln must run continually for 24 hours, thus exacerbating fuel consumption. When recycled fuel is used, the rate of FBX products (the product type with the highest quality) decreases, whereas that of FBS and FBA increases. As a result, more production resources are directed towards standard products which generate less revenue for the company.

It is recommended that fuel quality be ascertained before use. There should be an acceptable standard for fuel to enable the company to meet the desired quality of product in optimum quantities.

2. Car decks use expensive blocks which are susceptible to breakage. It is recommended that LCW should investigate if there are more durable blocks available to save the cost of replacing damaged blocks.

3. Wooden pallets used to store bricks rot under long-term exposure to weather. The plastic used to wrap bricks also deteriorates. More durable material could be used instead of plastic wrapping.

4. It is recommended that the company consider re-testing clay when it reaches the site to ensure that it is the same quality as that tested before leaving the supplier, and to avoid the use of clay that has been contaminated with top soil.

10.10 Conclusions

Lobatse Clay Works is a customer focused company that endeavours to manufacture products that meet quality specifications. It has started implementing management systems standards with the aim of continually improving its processes, to meet and exceed customer expectations and ensure the health and safety of employees.

For this pilot project, the focus was on the company's production process because that is the function where standards are most applied. This process can be the make or break of an organization because it is here that inputs are converted into outputs, and the quality of the outputs is dependent on effective and efficient running of all production processes.

The impact of standards on the production process was calculated as 4.96 % of the company EBIT, and as 2.63 % of total sales/turnover.

For a company such as LCW, operating in a competitive environment, these are significant figures that demonstrate that standards contribute considerably to the economic and financial performance of the company.

Pretoria Portland Cement Company Limited (PPC Cement), South Africa

Country : South Africa
ISO member body : South African Bureau of Standards (SABS)
Project team :
Project leader : Mr. Terrence Moodley
(Senior Manager of Standards Sales and Promotions, SABS)
Member : Ms. Praneshri Pillay (Researcher for SABS)
External advisor : Mr. Ian Jandrell, professor and head of the School of Electrical and Information Engineering at the University of the Witwatersrand, South Africa
ISO Central Secretariat advisor : Reinhard Weissinger
Duration of the study : October 2010 – March 2011

Executive summary

This report presents the results from the assessment of the economic impacts of consensus-based standards in the construction industry. The assessment was carried out on the Pretoria Portland Cement Company Limited (PPC Cement), comprising eight manufacturing plants and three milling depots. Together these facilities are capable of producing almost eight million tons of cement per year. Related products include aggregates, metallurgical-grade lime, burnt dolomite and limestone.

ISO developed a methodology to help assess and quantify the economic value that standards contribute towards a company. This study is based on the principle of capturing data at the operational level where standards have a more direct impact. Interviews with key PPC Cement personnel have assisted us in quantifying the impacts that standards have at a functional level, as well as on the company as a whole.

The company confirmed the importance of standards and the direct impact standards have on sales and costs. At each selected business function, standards made a contribution towards cost savings and sales increases. Apart from the quantitative aspects, there are also the qualitative aspects of standards. Qualifications of suppliers have been raised due to the systematic use of standards by PPC Cement. Implementation of ISO 14001 has resulted in lower energy consumption and a better environmental record. The use of OHSAS 18001 has created a safer working environment for employees and, indirectly, has enhanced the safety of the public. Taken together, the measures above have helped improve the reputation of PCC Cement in the eyes of its customers.

11.1 Objectives and organization of the pilot project

Standards developers claim that standards, once implemented, bring about huge benefits for users and the economy. However, only a handful of studies have proven that standards really do have an impact on the economy of a country. Substantiating and quantifying the true value of consensus-based standards is no small challenge. Though it is difficult to quantify the benefits of standards, it is important to monitor and prioritize standardization activities to raise awareness and improve communication, thereby promoting the use of standards and encouraging stakeholder participation.

The objectives of the study are to :

- Assess the impact of standards that are documentary voluntary and consensus-based, regardless of the nature of the standards-developing organization and
- Provide decision-makers with clear and manageable criteria to assess the value of using standards.

The overall approach is based on value chain analysis. A value chain is a chain of activities within an organization operating in a specific industry. The output of the work of an organization (products and services) passes through all the activities of the chain in a given order, gaining value at each step. The value chain analysis aims to investigate the structure of the value chain and of the activities performed at each step of the chain, with a view to understanding and quantifying the contributions of standards to value creation.

11.2 Introduction of the selected company

South Africa's construction sector has experienced a decade of considerable growth, particularly as a result of the buoyant property market and the government's spending on infrastructure in the mid- to late-2000s. The global recession has since put a dampener on that growth. As we slowly emerge from recession, construction investment is expected to average 9.6 % of GDP (Gross Domestic Product) during the next three years [see : Industry Insight (2010) www.industryinsight.co.za, 2009].

PPC Cement operates within this highly dynamic industry. Because of its well established brand and extensive application of national and international standards, PPC Cement was selected as our assessment company for the study.

Established in Pretoria in 1892, the company has grown to include operations across South Africa, and in Botswana and Zimbabwe. With excess capacity available and a strategy to increase its presence in sub-Saharan Africa, PPC continues to focus on exports to other African countries, especially Mozambique and Angola.

Now, nearly 120 years after its inception, PPC Cement has eight manufacturing plants and three milling depots. Together these facilities are capable of producing almost eight million tons of cement products per year. Related products include aggregates from the company's Gauteng and Botswana quarries.

Furthermore, PPC Lime is southern Africa's foremost supplier of metallurgical-grade lime, burnt dolomite, limestone and related products. PPC Cement has played a vital role in the history and development of southern Africa.

It is a reliable supplier of cement and materials to the civil, commercial and residential sectors throughout South Africa. Its target

market is mainly retail ; the company has a distribution network that is responsible for supplying cement to the building and construction industry, concrete manufacturers, hardware stores and DIY centres.

PPC Cement has had to contend with three consecutive years of declining cement demand in its principal markets as cement sales in South Africa dropped more than 20 % below 2007 levels. The company's main competitors in the market (for the producers of cementitious material) are Afrisam, Lafarge (South Africa) and NPC-Cimpor.

11.3 Attitude of the company towards standardization

PPC Cement is well established in terms of its industry experience. Product and system standards are implemented within the organization because of their strategic value.

The company manufactures products that must meet regulatory requirements, and standards help PPC Cement to achieve this objective. They allow PPC Cement to apply standardized test methods, which make it easier to demonstrate compliance with regulations, while regulators reference the very same standards in laws that regulate the industry in which PPC Cement operates. The company also applies voluntary standards throughout its organization to achieve consistent quality, a sustainable business and a safe and secure working environment.

PPC also participates in various national and international standards development committees. The company believes that by helping develop national and international standards it will broaden its competitiveness at a national and international level. PPC Cement perceives itself as an influencer in the development of national and

international standards for its industry. This leverage enables the company to introduce or promote changes to standards, and align its processes and technology with the requirements of the new and revised standards.

The company is certified in accordance with the following system standards: SANS 9001, SANS 14001, OHSAS 18001 and SANS 17025 and the following product standards: SANS 50197-1, SANS 50197-2 and SANS 1841. All are international standards that have been adopted as South African National Standards (SANS).

Management's views on the benefits of standards

PPC Cement management across all functions acknowledges that the company derives economic benefits from the application of standards. However, because PPC Cement and its competitors are expected to apply the same standards, it gains no distinct competitive advantage. Management believes that five years ago businesses were not as committed to applying standards as they are today, so any competitive advantage no longer exists.

Management also feels that participating in standards-setting committees provides benefits by enabling the company to influence the content of standards through its understanding of the industry and its requirements. Managers also have earlier access to technical information, which gives them an advantage in preparing their business to meet the new requirements of the standards.

Relationship building with other participants in the industry is another important benefit. By networking with other participants, management can determine how a standard benefits other companies, discuss obstacles in applying standards, and learn how to overcome them when implementing the standards in its own company.

11.4 Analysis of the value chain

11.4.1 Industry value chain

The raw materials used to produce cement are primarily limestone, clay, shale, and silica sand. These are quarried, crushed, and transported to a nearby cement plant. The plant proportions the raw materials to the correct chemical composition and grinds them to a fine consistency. The finely ground "raw meal" is then fed into large rotary kilns, cylindrical furnaces 10 to 25 feet in diameter and 200 to 1 000 feet in length.

The raw meal is heated to about 1 450°C (2 700°F), causing the composition to react and form complex mineral compounds. These compounds exit the kiln as a hard nodular material called "clinker". Many newer cement plants use the hot exiting kiln gases to preheat the raw meal. Clinker is cooled and ground with approximately 5 % gypsum (which controls concrete setting time) and other minor additives to produce cement.

Concrete is produced by blending cement with fine aggregate (sand), coarse aggregate (gravel or crushed stone), and frequently with small amounts of chemicals called "admixtures." Admixtures are used to accelerate or retard setting time, control early plasticity properties, increase strength, improve resistance to acid and sulphates, control shrinkage, and improve freeze/thaw cracking. When water is added to the concrete mix at the job site, it forms slurry that coats the surfaces of the aggregate and fills the voids to form rock-solid concrete. The process of hardening or setting is the result of the water hydration chemical reaction of the cement. The properties of concrete are determined by the exact chemical composition of cement used, the additives, and the overall proportions of cement, aggregate, and water.

Concrete is the material of choice for driveways, sidewalks, patios, steps, and for garages, basements, and industrial floors. The walls of ordinary houses, as well as the more massive walls of engineering structures, are now frequently built in concrete, either in continuous mass or in blocks. It is relatively inexpensive to install and provides an attractive, durable surface that is easy to maintain. Proper attention to the standard practices and procedures for constructing exterior or interior concrete can yield a concrete surface that will provide long-lasting, superior performance.

PPC Cement operates in the raw material extraction and cement production segments of the value chain. Its leading competition in the market includes Afrisam, Lafarge (South Africa) and NPC – Cimpor. The residential market and large infrastructure projects tendered by the government constitute the major demand for PPC Cement products.

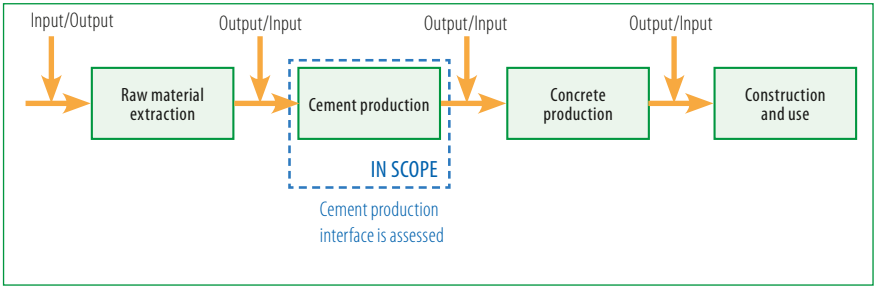


Figure 1 Value chain of cement-based building materials

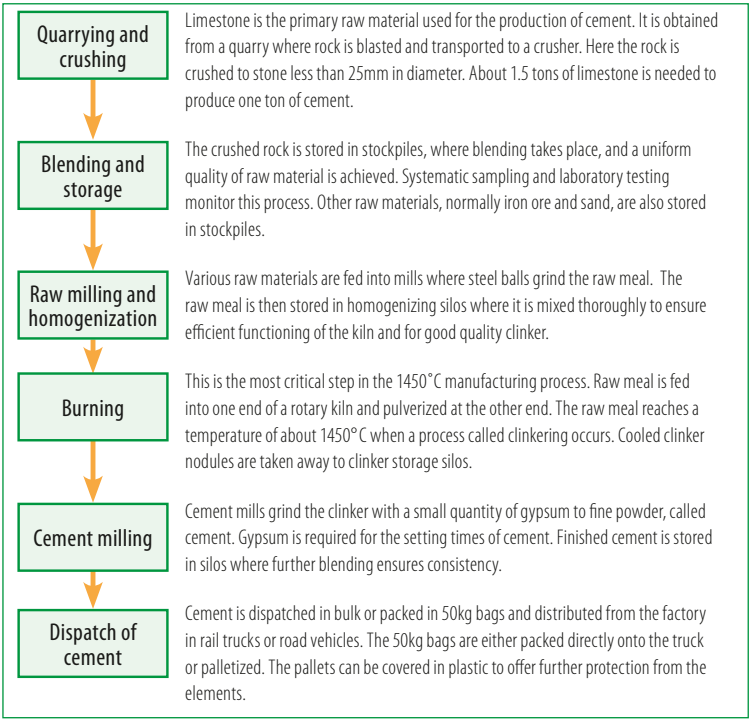


Figure 2 The key process stages in cement production

11.4.2 Company value chain

The model developed by Michael Porter of Harvard Business School is used to analyse the company value chain. This divides the value chain into primary and supporting functions and categorizes company activities into nine different business functions. Using this model, the company value chain for PPC Cement can be described as follows:

Supporting functions in the company value chain:

A. Management and administration

B. Finances

C. Human resources

D. Research and development

Activities include: research and product development – fusion and clinker activation techniques must comply with standards; Cement extender types (fly-ash, slag, silica fume) must be tested for durability of concrete.

E. Engineering

F. Procurement

Activities include: screening and selection of suppliers; negotiating and contracting – major contracts and day-to-day procurement processes follow governmental legislation and guidelines.

Primary functions in the company value chain:

G. Inbound logistics

H. Production/operations

Activities include: training personnel; cement-making processes (mining to production to dispatch of final product); quality control – ensure compliance with internal process control parameters which will ensure compliant product; quality assurance – ensures compliance with SANS 50197.

I. Outbound logistics

J. Marketing and sales

Activities include: marketing; contracting; sales. Has various supporting functions which include:

- Credit
- Maintenance
- Laboratory
- Dispatch

11.4.3 Key value drivers

Key value drivers are capabilities that give companies advantages over their competitors.

Using existing literature together with the data derived from the interview process, we identified the following as the key value drivers for PPC Cement:

- Sales effectiveness
- Relationship building (with suppliers)
- Quality products
- Efficiency of production
- Quality of production processes
- R&D effectiveness
- Maintenance cost reduction.

11.5 Scope of the pilot project assessment

The scope of the assessment was determined after our first round of interviews with company management. The following business functions of PPC Cement were selected to determine the economic benefits of standards:

- Research and development
- Procurement
- Production/operations
- Sales and marketing

The reason for this selection follows the sequence of our interviews at PPC Cement: our initial interview with the quality assurance manager indicated which standards were important to the company, and how they were implemented.

Research and development was chosen because the department uses standards to improve production processes and to keep up to date with technology. Standards clearly have an impact on this function.

The main value driver for the **R&D function** is R&D effectiveness, which is an indication of the cost-effectiveness of these activities. This is a relevant value driver because of the need for continuous product development and improvement. The company must comply with SANS 50197, i.e. the manufacturing of cement has to conform to requirements, and the responsibility of the R&D department is to ensure that the manufacturing process is efficient and cost-effective. Other value drivers include competency of staff and R&D costs.

Procurement needs to source supplies from suppliers who are using standards. All standards applied to raw materials will eventually contribute to end-product quality and cost, and therefore standards impact this function as well.

Within the **procurement function**, major and day-to-day contracts follow a preferential procurement framework using legislation and guidelines from governance reports. According to management, the main value driver for procurement is relationship building (with suppliers). Relationship building is entrenched in the quality that suppliers can provide. PPC Cement might forego cost for better quality, better response, etc., since cement manufacturing takes place 24 hours per day, 365 days per year. If a supplier cannot provide raw materials on a weekend, then PPC Cement will use another supplier who can do so.

Production/operations apply stringent standards to contribute to the quality of the end product and regulate the quantity of the volumes produced on the basis of orders received.

The main value driver for the **production/operations function** is the quality of the final product – this influences customer buying

patterns since customers always compare product benefits and value to cost. This is a relevant value driver due to high customer expectations and product options. Other value drivers include the efficiency of production with regard to internal operations as an indication of the cost-effectiveness of production.

Standards also have an impact on **sales and marketing** because the products gain consumer confidence by carrying the SABS trademark. This will affect the sales of the product, which in turn will impact on production/operations.

The main value driver for the **sales and marketing function** is sales effectiveness, that is, to generate more revenue. This is a relevant value driver since all cement manufacturers produce cement to the same minimum standard specifications to meet regulatory requirements.

11.6 Use of standards by the company : Standards used in the company value chain

The company has implemented the following standards :

SANS 9001, which specifies the requirements of a quality management system. The standard motivates the staff of any organization by defining their key roles and responsibilities. It also provides the company with the following benefits :

- Cost savings achieved as a result of increased workforce competence
- Improvements following identification of product and service deficiencies, resulting in less waste, reduced defects and fewer complaints
- Customers benefit from consistent on-time deliveries to the correct specification ; this in turn leads to increased market opportunities.

SANS 14001, an environmental management system that offers an organization a set of environmental goals to achieve continual

improvement and prevention of pollution. Cement-making raw materials sometimes contain trace amounts of toxic elements such as mercury, thallium, iodine, cadmium and other heavy metals. The cement-making process can also lead to trace emissions of POPs (Persistent Organic Pollutants). SANS 14001 implementation allows the company to reduce:

- Quantities of waste sent to landfill
- Energy use (electricity, coal, fuel oil, gas)
- Discharge of effluent contaminants
- Emissions of gases and particulates to the atmosphere, for example, an electrostatic precipitator (ESP) is used to control dust emissions; applying SANS 14001 requirements can reduce or eliminate the impact of dust emissions on the environment
- Levels of raw material used
- Amounts of packaging for purchased goods and product shipments
- Increase the amount of recycled waste – paper, plastic etc.

OHSAS 18001, an international standard for managing health and safety. Workers involved in the production of cement are often at risk of injury, for example, coming into contact with hot clinker or cement, or with machinery. All PPC Cement factories are OHSAS 18001-certified. The company benefits from OHSAS implementation as follows:

- Customer satisfaction – through delivery of products that consistently meet customer requirements whilst safeguarding their health and property
- Reduced operating costs – by decreasing downtime through incidents and ill health, and reducing legal fees and compensation costs
- Improved stakeholder relationships – by safeguarding the health and property of staff, customers and suppliers

- Legal compliance – by understanding how statutory and regulatory requirements impact the organization and its customers
- Improved risk management – through clear identification of potential incidents and implementation of controls and measures
- Proven business credentials – through independent verification of conformity to recognized standards
- Ability to win more business – particularly where procurement specifications require certification as a condition of supplying raw materials.

Many of PPC Cement's factories and depots have been rated by Dekra as five-shield sites. Dekra is an independent European certification body that ensures compliance with internationally recognized standards (OHSAS 18001). Five-shield status is awarded for an audit score of >95 % and a lost-time injury frequency rate of <1.

SANS 17025, specifying the general requirements for the competence of testing and calibration, including sampling. It covers testing and calibration performed using standard, non-standard, and laboratory-developed methods. It is essential for PPC Cement laboratories to be SANS 17025 accredited. This is a prerequisite when trading internationally, in product development and manufacturing, and in the protection of consumers.

PPC Cement applies the following established national standards to its products: SANS 50197-1:2000, SANS 50197-2:2000 and SANS 1841:2008.

SANS 50197-1, a compulsory specification of properties and performance criteria for common cements. Composition and strength are required to be displayed by the manufacturer on the packaging of each cement bag produced. SANS 50197-1 lists the physical and chemical requirements to which cements must comply.

SANS 50197-2, specifying strengths determined in accordance with SANS 50196 – Methods of testing cement (consisting of seven parts) to be carried out by a certification body. SABS is the certification body carrying out audit and certification of PPC Cement.

Cement testing standards used by PPC Cement include:

- **SANS 50196-1**
- **SANS 50196-2**
- **SANS 50196-3**
- **SANS 50196-6**
- **EN 451-1**

PPC Cement also operates its own system of auto-control testing for produced cement to demonstrate conformity to requirements using some of the testing methods mentioned above.

SANS 1841, specifying the requirements for controlling the quantity of contents of products prepacked in accordance with the recommendations of legal metrology legislation (part of the Trade Metrology Act and Regulations). It is intended for use by packers who voluntarily participate in the quantity mark scheme provided for in such legislation. An e-mark scheme has been introduced to support the use of this standard, guaranteeing that a product has been packed in accordance with SANS 1841.

Standards other than listed above, such as those developed by ASTM (American Society for Testing & Materials) are not actively used by the company. R&D uses them for background information and cross-referencing, and should an overseas company wish to import PPC Cement products, the company might be required to test in conformity to ASTM requirements.

In **Procurement**, standards are used to facilitate best practices in structuring supplier contracts, which makes it easier to assess and

engage potential suppliers. When suppliers comply with the relevant standards PPC Cement is confident that the goods and services procured are of a consistent quality (e.g. sand and its chemical compositions must comply with standard specifications). This ultimately contributes to the quality of the end product.

Suppliers must also have SANS Management Systems in place and be environmentally certified. It is no problem if suppliers are not certified at an international level since PPC Cement applies products to the South African environment. If the company has a relationship history with such suppliers, they will be used.

Safety standards are also important. If suppliers work in an unsafe environment, PPC Cement will try to avoid associating with them.

The use of standards within **research and development** contributes towards the department's effectiveness by improving staff competency and minimizing R&D costs.

Standards are used to ensure that manufacturing processes are compatible with, and upgraded regularly to, new technology, thus providing a more efficient manufacturing process.

Research and development is not a profitable function ; money is used to develop new projects which will in turn determine future profit. Standards can have a positive impact on R&D costs if PPC Cement is investigating a potential product.

Within **production/operations** standards help to standardize and streamline manufacturing processes and lower production costs.

Standards are used to manage the quality system, which is essential in ensuring that the final product is of a consistent quality.

Training of production personnel is efficient and easier to manage because standards are a good benchmarking tool.

The use of standards within **sales and marketing** ensures higher sales due to customer confidence in standardized products.

The use of standards also leads to more efficient contractual agreements because defining product specifications and customer requirements make it easier to conclude contractual agreements.

New sales and marketing staff can be trained better because relevant specifications for products and services are standardized.

In its ability to implement standards PPC Cement demonstrates initiative not only in using them to show compliance, but also to improve its business.

11.7 Selection of operational indicators to measure the impact of standards

Selected business functions (BF)	Related activities	Value drivers (if applicable for the BF)	Standards used	Operational indicators	Definition of the indicators
Research and development (R&D)	Research Product development	R&D effectiveness	SANS 50197 ISO 17025 ISO 9001 SANS 1841 ISO 18001 ISO 14001	Personnel costs (direct assessment by manager)	**Indicator 1 – Clearer product specifications :** Standardized specifications of the suppliers' products make it easier to collect relevant information. **Indicator 2 – Better internal information transfer :** Using standardized documents and specifications improves dissemination of product and service information within R&D.

Selected business functions (BF)	Related activities	Value drivers (if applicable for the BF)	Standards used	Operational indicators	Definition of the indicators
Procurement	Screening and selection of suppliers Negotiating and contracting	Relationship building	ISO 9001 ISO 14001 ISO 18001	Personnel costs (direct assessment by manager)	**Indicator 3 – Better internal information transfer :** Internal information about products and services is passed on more efficiently by using standardized documentation and specifications.
Productions/ operations	Processing Quality assurance Quality control	Quality of products	ISO 9001 SANS 50197 ISO 18001 ISO 14001 SANS 50196-1 SANS 50196-2 SANS 50196-3 SANS 50196-6 EN 451-1	Personnel costs (direct assessment by manager)	**Indicator 4 – Better training :** Production/Operations staff can be trained better because relevant product and service specifications are standardized.
Sales and marketing	Marketing activities Contracting Sales	Sales effectiveness	ISO 9001 SANS 1841 ISO 14001 ISO 18001	Sales and marketing costs (direct assessment by manager) Personnel costs	**Indicator 5 – Higher sales :** Sales are higher due to customer confidence in standardized products **Indicator 6 – More efficient contractual agreements :** Defined specifications of the company's products and customer requirements make concluding contractual agreements easier.

Table 1 Operational indicators for PPC Cement

11.8 Calculation of the economic benefits of standards

Selected business functions (BF)	Operational indicators (to measure the impact of standards)	Savings/Impacts
Research and development	Personnel costs	Indicator 1 : the reduction in time used to collect relevant information on suppliers' products was 6.8 %. Indicator 2 : the time used to transfer internal information was reduced by 7.5 %.
Procurement	Personnel costs	Indicator 3 : the time used to transfer internal information about products and services was reduced by 0.2 %.
Production/ operations	Personnel costs	Indicator 4 : time used to train staff is reduced by 1.32 %.
Sales and marketing	Sales revenue Personnel costs	Indicator 5 : the sales of products will be 2.1 % lower if no standards would be used. Indicator 6 : the time used to negotiate contractual agreements has reduced by 12 %.

Table 2 Economic benefits of standards

Selected business functions (BF)	Financial impact of standards on all BFs in 2009 (%)
Research and development	14.3 %
Procurement	0.2 %
Productions/operations	1.3 %
Sales and marketing	14.1 %
Total financial impact :	**2.5 %**

Table 3 Financial impacts of standards

The total financial impact of standards is 2.5 % of the company's total revenue (ZAR 5.9 billion) and is based on the impact from standards in the year 2009, on the selected business functions.

11.9 Qualitative and semi-quantitative considerations

There are other intangible aspects to standards that cannot be quantified, but could still be considered in demonstrating the benefits of standards. The production of cement is conducted in a regulated environment; standards enable a company to meet regulatory requirements and ensure a quality product. Making cement is also an energy and resource intensive process with both local and global environmental, health and safety impacts. The use of standards helps regulate these impacts.

Quality

Due to the reliability and quality of PPC Cement's products, there is an increased recognition of the company by its customers. Customers have confidence in the consistency of the product and this makes it easier to market and test the quality of PPC Cement products. Peer recognition from other competitors in the industry is another benefit because the company is also seen as a strong competitor.

The qualifications of suppliers are also raised because of PPC Cement's insistence on the use of standards. Thus, suppliers know exactly what the company requires, and this ensures positive relationships with suppliers in the future.

Environment

The application of environmental standards helps reduce energy use and waste associated with the manufacturing of cement, thus contributing towards a sustainable environment.

By conforming to environmental standards PPC Cement also ensures that it is able to manage and sustain the production of cement in the future, and demonstrates to customers that it cares about the environment.

Health and safety

The application of health and safety standards ensures a safe and secure working environment for employees working within the industry; in turn employees have more confidence working in a safe environment.

Apart from the safety of employees, the use of standards within any company or industry should ultimately ensure the safety of the public. For example, in bridge building it is imperative that only the best cement is used so that it does not collapse.

11.10 Evaluation of results

The overall result showed a total financial impact of 2.5 % of the total company revenue in 2009, which is relatively high. The total impact of standards is calculated on the organizational level by aggregating/consolidating the functional impacts. This percentage (2.5 %) is based on results from selected business functions where we thought standards had greatest impact. The strongest impacts can be seen in research and development, and sales and marketing.

However, this is the result from only one company in the construction industry sector. We would need to sample more companies to obtain a conclusive result across the industry.

Procurement shows a total cost saving representing 0.2 % of total procurement costs. The use of standards primarily saves time in distributing internal information about products and services through standardized documentation and specifications. This leads to more efficient processes which in turn contributes to the quality of the end product.

Productions/operations achieved a total cost saving representing 1.3 % of total production/operations costs. The use of standards pri-

marily saves time in staff training through standardization of product and service specifications. Employees are trained more efficiently when working to an internal quality management system based on standards. Implementing standards within the production process reduces stoppages, wastage of raw materials and inconsistent products, thus ensuring a more efficient production process and a better quality end product.

Research and development achieved total cost savings of 14.3 % of total R&D costs. The use of standards primarily saves time in collecting relevant information because suppliers product specifications and customer requirements are standardized. Using standardized documents and specifications also improves the distribution of product and service information within R&D. As technology changes so do the demands of customers ; there is thus a need to continuously improve products and services. One way R&D can accomplish this is to review international best practices to determine how best to incorporate them. R&D can also try to influence the development of international standards to benefit PPC Cement.

Sales and marketing achieved a personnel cost saving representing 12 % of total sales and marketing costs. The use of standards primarily saves time on contractual agreements due to defined specifications of the company's products and customer requirements. Revenue is also affected because sales of standardized products would be 2.2 % lower without the implementation of voluntary standards.

The only way that cement can be sold in South Africa is through conformity to the SANS 50197 standard. PPC and other cement manufacturers operate in a regulated environment ; they must all comply with minimum standard specifications in order to sell their product. Because this is considered the " norm " for all cement manufacturers, regulated standards do not present a competitive advantage.

In addition to SANS 50197, non-mandatory standards are also implemented by the company, e.g. those for environmental, health and safety, and quality management. These standards provide a key element in the company's marketing strategy. They inspire customer confidence, and consumers know that PPC Cement strives to reach a level of quality or excellence by using these standards.

However, implementing such standards does not give a discernable competitive advantage, especially if the company is seeking compliance rather than improving its business. If a company is able to use standards in a way that extracts the maximum benefit, then implementing them can indeed present a competitive advantage to the industry. If standards are used as a means to achieve customer confidence, cost-efficiency and an increase in sales revenue, then PPC Cement can definitely promote the further support and monitoring of standards.

Our findings show positive impacts on costs for each selected business function, and on sales and marketing revenue. It would be of value to PPC Cement to systematically examine how standards operate and how the company could further exploit the benefits that arise from their use. This can be achieved by extending the list of operational indicators used in this study to measure the contribution of standards to other business functions in the company value chain. In that way PPC Cement could systematically monitor the impact of standards on its operations.

The company could further improve the impact of standards by incorporating international best practices and by influencing the development of international standards to the benefit of the company. This would in turn serve PPC Cement better because it would raise its visibility in the international arena. In addition, this would enable PPC to compete at an international level and export cement

to Europe, America and other overseas countries, thereby increasing the production and sales of cement.

11.11 Conclusions

PPC Cement is a well-established company driven by the goal of becoming the leading cement manufacturer in the country. It applies national and international standards throughout its organization because of their strategic value. The company also has the required systems in place to support the implementation of these standards.

Even though PPC Cement is certified in conformity to both product and system standards, its management is of the opinion that the implemented standards do not bring about a competitive advantage because its competitors also apply the same standards. They do, however, acknowledge that there are economic benefits to be derived from implementing standards.

The study has enabled us to estimate the economic impact of standards on the company. PPC Cement's standards-based management systems make a relatively strong financial impact on the sales and marketing function. This is due to the benefits of implementing non-mandatory standards, which provide a key element in the company's marketing strategy.

Standards contribute to cost savings in all four of the selected functions, and have the greatest impact on personnel costs. The use of quality management standards, e.g. SANS 9001, and health and safety management standards, e.g. OHSAS 18001, contribute to cost savings by helping PPC enhance work force competency and staff training, and by minimizing health and safety risks, thereby reducing personnel costs.

Apart from using standards to ensure cost-efficiency, standards instil customer confidence because they are used at every stage of the cement production process, ensuring a consistent and quality end product. Since standards are used as a means of achieving customer confidence and cost-efficiency, PPC Cement has an incentive to implement and monitor standards still further.

Standards are important to cement manufacture. Indeed, since cement cannot be sold without meeting minimum regulatory standard requirements, all major cement manufacturers must comply. This leaves little leverage for PPC Cement to gain a competitive edge over its competitors. Cement manufacturers differentiate themselves by focusing on aspects such as customer service, pricing and turnaround times, etc., in order to gain market share. The application of standards throughout the value chain makes it possible to build relationships with reputable suppliers of raw materials, saves time in the communication of information of new products and services, and contributes to the quality of the end product.

Siemens AG, Germany

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Duration of the study : October 2010 – March 2011

12.1 Introduction

This study is an evaluation of the economic benefits of the use of standards by industry carried out following the ISO methodology, in collaboration with the switch technology and standardization divisions of Siemens AG, Germany. The main focus was on the DIN EN 62271 standards series, which are essential for the switch technology sector.

Standardization in the industrial environment is often regarded as a concrete financial burden of uncertain benefit, an attitude based on a cost accounting point of view. While there is a concrete cost centre for "standardization", there are no profit centres with the same designation on the opposite side of the balance sheet. Indeed, in contrast to the evident costs of standardization, it is often difficult to identify the resulting profit.

This could, among other things, be because standards are often used to prevent costs from occurring in the first place, for example, by creating contractual and legal security. In addition, the advantage of using standards only becomes apparent through their application in a particular business function. Thus, the resulting advantage is often regarded as an achievement of the organization's departments which implement the standards. Here the ISO methodology comes into play, as it tries to crystallize and aggregate the advantages gained in individual business functions through standardization, with the result that an accumulated virtual balance sheet entry "benefits of standardization" can be created once the methodology is applied.

This study not only focuses on the application of the ISO methodology, but also on any difficulties which might occur, and on any changes and adjustments which need to be made to the implementation and evaluation of the methodology. This will especially help in improving

it further, making it more user-friendly and less complicated for use in the industrial environment.

Since the economic benefits of standards do not only depend on their content but also on their applicability, an empirical study of the perception of the usefulness of extensive industrial standards was suggested by Siemens as well.

12.2 Standardization policy at Siemens

Siemens has long and extensive experience of standardization. The company regards standardization as very important for its success and has an entire department dedicated to this subject. At Siemens various standards are used in production, for price optimization and for compliance. Beyond that, great value is attached to participation in standards committees, which is seen as an important tool for ensuring a competitive, future-oriented product portfolio.

Within the remit of this analysis, it was evident that the standardization concept is actually very widespread and, as a rule, it is rare for the benefits of standardization to be questioned.

12.3 Introducing the ISO methodology

The ISO methodology is a methodological approach used to systematically analyze – taking Porter's value chain as a starting point – the individual value creation stages within a company or even an entire industrial sector with respect to the economic impacts of standards. This method is intended for investigations into the impact of standards on value creation within a business. The idea of such an investigation is not new. For example, as early as 1990 DIN published a technical

report on "Ways of calculating the success of standards projects"[1]. Admittedly, the separate consideration of each value creation stage is a considerable improvement on the earlier approach because it makes the identification of the impacts of standards more structured and more comprehensible.

The method is based predominantly on surveys of technical experts and standardization experts inside the company. On the basis of these interviews, an attempt is made, using a detailed, step-by-step plan, to localize and substantiate each potential source of the benefits to be gained from standards.

The individual steps of the methodology are[2]

- Analysis of the value creation chain
- Identifying value drivers
- Identifying the impacts of standards
- Data evaluation and aggregation.

12.4 Application of the ISO methodology

12.4.1 Analysis of the value chain

12.4.1.1 Value chain of the industry

First, the position of the switch technology sector considered in this study is determined within the overall industrial context (**Figure 1)**. As inferred by the name "energy" given to this Siemens sector, switch technology is part of the larger energy technology sector, and within the electricity supply value chain, which involves essential components for the transport and distribution of electrical energy for uses

1 DIN (1990)
2 ISO, Roland Berger (2010)

ranging from high-voltage circuit breakers in transformer stations to low-voltage switchgear in a building.

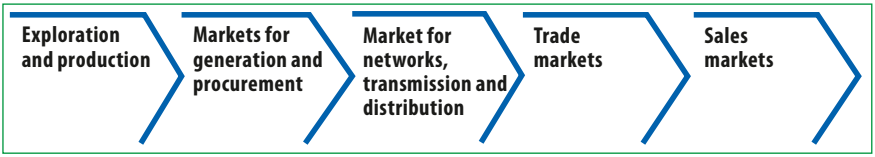

Figure 1 Value chain for electricity [3]

12.4.1.2 Value chain at Siemens

In Siemens' switch technology sector there is a conventional value chain, presented in the form introduced by Porter (see **Figure 2**).[4]

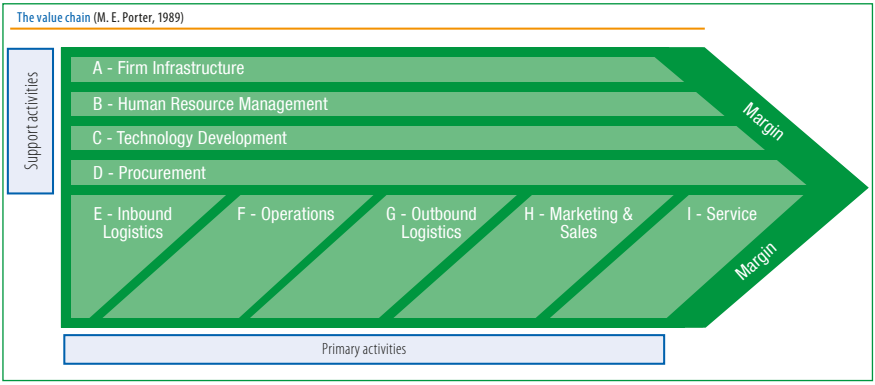

Figure 2 Value chain according to Porter[5]

3 Winje D. (2009)
4 Michael E. Porter (1989)
5 Michael E. Porter (1989)

12.4.1.3 Areas of value creation

It is important to bear in mind that switch devices and installations may be complex, but they represent a mature technology that brings little in the way of new logistic or operational demands. Thus the changes made over the past few years predominantly relate to the optimization of functions and improving the efficiency of the switches. This and the observation that Siemens has managed to retain its market position not by competing on price but by maintaining a high technical standard has resulted in the analysis being focused on the development and market preparation of the switch products (**Figure 3)**.

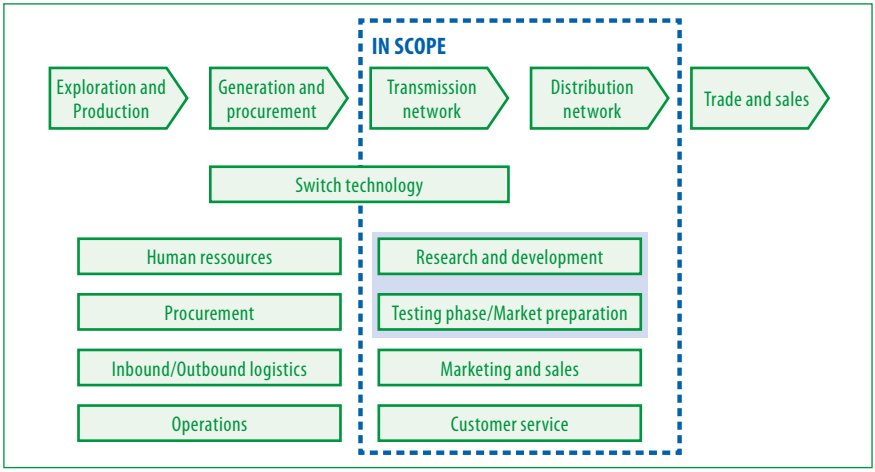

Figure 3 Value creation areas (author's representation)

12.4.2 Identification of value drivers

The search for value drivers was based on numerous conversations with employees, on the joint analysis of the market, and on the positioning of Siemens AG in this market. It became clear that many other

intangible values also play a major role, for example, maintaining a good reputation over many years and the image of a manufacturer demanding the highest quality. The value drivers identified are listed below:

- Improving product efficiency
- Cost-effective further development of the product portfolio
- Products which cover a wide spectrum of customer needs, with emphasis on extremely demanding systems
- Future-oriented technology
- Above-average quality and reliability of switches and switchgear
- Tests and inspections which go beyond the requirements of the standard to substantiate an above-average quality
- Capitalizing on long experience and maintaining a good reputation.

12.4.3 Identification of the impacts of standards

After the first few interviews with switch technology employees it became clear that it would not be possible to apply the methodology without modifications. This is mainly because switches and switchgear are products that cannot be sold if they do not meet the relevant standards. Furthermore, these standards have generally existed for decades so it was not possible to establish the benefits by comparing the situation before the standards were introduced or make comparisons with competitors who do not use them. One approach is to consider the regular revision of the relevant standards and to see whether added value has been created for Siemens through these revisions, and whether this added value benefits all companies in the sector to the same extent.

12.4.3.1 Standards relevant to switch technology

The essential standard series for switch technology is DIN EN 62271, *High-voltage switchgear and controlgear*. The following standards are of particular relevance to the sector:

- DIN EN 62271-1, *Common specifications*
- DIN EN 62271-100, *Alternating current circuit-breakers*
- DIN EN 62271-200, *AC metal-enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52kV*
- DIN EN 62271-203, *Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*.

The modifications to these standards over the past few years were investigated as regards their potential monetary impacts.

12.4.3.2 Indicators for identifying the impact of standards

Indicators help to clarify the often complicated relationship between the changes made to the standards and the company's success, particularly on the basis of the value drivers identified. To make this connection clear, it must be possible for the indicators to be influenced by a standard and they must have a direct impact on the company. A list of indicators which meet these criteria is given below:

- Changes to the procedures for developing and approving switches
- Changes to the technical requirements for switches and switchgear
- Changes to quality and service requirements
- Changes to recommended and mandatory values
- Care should be taken to determine if the following indicators apply:
  - The change to the standard affects a criterion relevant to tendering
  - Changes to the standard do not equally affect all market participants

- The cost to Siemens or other market participants for implementing the changes
- The extent of the actions needed as a result of the changes (e.g. on the basis of costs incurred/savings made, or matters which have a bearing on employees affected by the changes).

12.4.3.3 Potential impact of changes to standards on company success

Siemens switch technology experts with special knowledge of each standard listed in 12.4.3.1 were consulted. Correlations between the value drivers and indicators given above were investigated. Potential changes to DIN EN 62271-100 and DIN EN 62271-203 that would benefit Siemens became especially evident, although only a few changes seemed likely to have a direct positive impact on the success of the business. With many of the changes, an influence on the market as a whole could be expected, and could affect the performance of the company in complex ways.

Changes to the standards are stated below, assigned to one of three categories according to its impact. In each case there is a short explanation of the changes in the standard, and their connection with Siemens and the market is described in the full version of this study.

- **Direct positive impacts:**
  (Savings or profits are the direct result of applying the changed standard)
  1. DIN EN 62271-100, Chapter 6.111 – Capacitive current switching tests, combination of tests
  2. DIN EN 62271-203 – Harmonization of the standard with US standard IEEE 37.122 (on-going)

3. DIN EN 62271-203, Chapter 8.1 – Recommended voltage levels.

- **Indirect positive impacts:**
  (Savings or profits result from competitors having problems implementing the changed standard)
  4. DIN EN 62271-100, Chapter 4.101 – Examination of different DC time constants
  5. DIN EN 62271-100, Chapter 6.2.11 – Voltage test as a condition check
  6. DIN EN 62271-100, Chapter 6.101.1.1 – Characteristic performance curves of drive units
  7. DIN EN 62271-100, Chapter 6.111 – Capacitive current switches, reclassification
  8. DIN EN 62271-203, Annex F – Service Continuity
  9. DIN EN 62271-203, Chapter 12 – Environmental aspects

- **Impacts which cannot be attributed to a particular change:**
  1. Anticipation and consideration of potential future changes to standards in the development and design of switching products
  2. Participation in standards committees.

12.4.4 Evaluation and aggregation

The impacts stated in 12.4.3.3. were evaluated quantitatively. First, each impact was considered separately and the financial impacts gained from it were quantified with the help of the relevant experts. Where figures were not available, qualified estimates were made and bundled together with any impacts having similar value drivers/ indicator-combinations in order to obtain a broader basis of indices for a reliable estimate.

With many impacts or impact groups, the data available are not sufficient to attribute a specific value to the established outcomes. Therefore, where there is no certainty about the values, calculations of maximum and minimum outcome are given. Thus one can be confident of finding the true value in the interval between the two.

As confidential internal company figures were used to quantify the financial benefits of individual impacts, the calculation is not dealt with in detail here. The cumulated benefit from all impacts on the EBIT adds up to between 1.1 % and 2.8 % and is discussed in the following section.

12.5 Evaluation of the results of the ISO methodology

12.5.1 General evaluation of results

During the study it was often not easy to identify the necessary values, with the result that most are based on expert estimations. This was also the reason why the result is given in terms of intervals. However, at no time was the work conducted with unfounded or vague data, so that it is justifiable to claim that the data used for the methodology is reliable. Nevertheless, the result cannot be expressed in the form of a direct numerical value as a tangible benefit. Rather, it is a matter of observing if there is an impact at all and estimating whether this impact will lead to a constant value.

In carrying out the ISO methodology, an impact of the use of standards on the EBIT of the Siemens sectors under consideration was found to be roughly between 1.1 % to 2.8 %.

To further evaluate these results, the following specific boundary conditions of the study should be considered :

- We are not dealing with the benefits of applying new standards, but only with the benefits of minor changes to an established standard. The benefits gained from a new standard can be considerably greater, especially in areas that have not been standardized
- To make a plausible evaluation of the benefits from the observed impacts of the changes to the standards, the lowest values were always estimated in cases of doubt
- Three chronologically and thematically independent new editions of existing standards from the switch technology sector were considered
- Since the objective of the study was to demonstrate the benefits of applying standards in the switch technology sector of Siemens AG, attention was directed towards the positive impacts of standards in this explicit case. The impacts used, especially the indirect ones, could also have negative implications for other companies
- There was no detailed investigation as to whether the changes to the standards might also have caused negative impacts. Because of Siemens AG's active participation in the standardization process, it can be assumed that such negative consequences were kept to a minimum and did not affect the benefit gained by the new editions of the standards.

After considering the boundary conditions it is possible to conclude that the observed positive impact is well-founded. The conservative estimate of 1.1 % highlights a feature of this positive impact that cannot be explained only in terms of disturbing influences and random variations in the market.

Due to the unique boundary conditions, this impact cannot be automatically applied to other companies. Only if further studies carried

out using the ISO methodology bring similar results could a general characterization prove to be true.

Yet even this single result is an important indication that companies should consider in their dealings with standardization, and in investigating the potential economic advantages of standards and standardization. The existence of potentials alone is not sufficient to realize economic benefits, as seen in our consideration of Siemens switch technology.

12.5.2 Evaluation of the results of the study from the Siemens AG perspective

Siemens AG already has a distinct standards culture and standardization as a whole is taken very seriously. The company is very active in the use of standards and in participation in standards projects, and this clearly pays. In all sectors considered, products were well prepared for changes currently taking place so that no unexpected tasks or costs arose when the standards were finally updated. Often it was even possible to profit from the revision of the standard.

However, there were also areas in which a potentially available benefit could not be made use of economically. Specifically, there were potentials resulting from stricter test requirements based also on the fact that competitors could not easily fulfil the new requirements (indirect positive impacts 2 to 4 in 12.4.3.3). It is therefore important that a further analysis be carried out to investigate how information about quality can be communicated to the market so that the potential described above can, at least in part, be realized.

Furthermore, it is important to communicate the conclusions of the study to ensure that the proactive involvement in standardization, which has led to positive results, will continue in future as well.

12.6 Experience of using the ISO methodology and suggestions for modifications

The following addresses the experiences gained from applying the ISO methodology and the associated tools. In particular, we take a close look at difficulties that occurred and the resulting adaptations. Where possible, suggestions are made about potential measures for modifying the methodology to make it even more comprehensible and easy to use in future.

12.6.1 Getting to know the ISO methodology

The methodology is described in detail in many different documents and is illustrated with good, but sometimes too simplified, examples of its use in practice. The many almost identical documents hamper the process of familiarization with the methodology and can result in misunderstandings. Nevertheless, one quickly gains an understanding of the consistent and systematic procedures.

12.6.2 Application of the ISO methodology

It is apparent that the methodology is best suited to an established traditional manufacturing company which replenishes or updates its standards portfolio at regular intervals. If, however, the company being investigated departs from these assumptions, difficulties are encountered relatively quickly when carrying out the prescribed steps of the process.

Section 12.6.4 discusses measures to help make the ISO methodology more flexible, efficient and user-friendly.

12.6.3 The tools of the ISO methodology

In the methodology toolbox are many documents that, in theory, provide graphics, schemata and questionnaires for every phase of the analysis. It also provides advice on identifying and quantifying the potential impacts of standardization, and evaluation tables.

The tools are strictly oriented towards an ideal course of procedure. As soon as the procedure deviates from the prescribed methodology (for example, for the reasons stated under 12.6.2), many of the tools could no longer be used in the given form, and it was often easier to devise a special tool for the problem at hand than to modify the existing tool. The tools often gave the impression that the investigation should be conducted as broadly as possible (across an entire company or industry sector) which would be at the expense of a more precise, in-depth study of the benefits of standardization in specific areas.

12.6.4 Suggestions for modifications of the ISO methodology

- The ISO methodology and tools should be available in the local language of the company in question, especially for small and medium-sized companies.
- Various versions of the original methodology and tools should be available, which should depend on elementary criteria of the companies under consideration. Possible criteria would be:
  - Whether a company, a company department, or a sector is being considered
  - Whether the relevant standards are applied voluntarily or are mandatory
  - Whether the subject is a private, state-run, or partly-privatized company

- What constitutes the company's or department's principal means of creating value: manufacturing, services or idea engineering?
- It should be possible to sub-divide the identified impacts of standardization into theoretical impacts and realizable impacts, if needed.
- Depending on the figures obtained, the evaluation should aim at obtaining either a specific value or a specific interval as its result.
- Where a company is not prepared to provide information about costs, profits, etc., it would be useful to have an alternative (for example, an algorithm) to enable the study to work in the absence of absolute numerical values without distorting the results. Such an option is important, because in the earlier DIN study of the economic benefits of standardization, only 9 % of companies involved were prepared to give cost information [6].

12.7 Conclusions

It is largely recognized that standards and standardization are an important economic factor. However, in the past this recognition was based on many isolated observations, theoretical principles and individual experiences. Using the ISO methodology, this study has demonstrated the clear positive economic benefit to be gained from the application of standards. Admittedly, the figure quantifying the minimum benefit from standards, approximately 1.1 % of the EBIT, is not a value with universal validity that can be applied to all other companies, but it is nevertheless an outcome that supports the benefits of standards.

6 DIN (2000)

While implementing the methodology, a few difficulties occurred due to the fact that the methodology is formulated in relatively strict and inflexible terms. However it was always possible to circumvent these difficulties by reflecting on the basic idea of the methodology and using a little creative effort. Modifications were suggested in order to make it simpler, more flexible and easier to understand in future.

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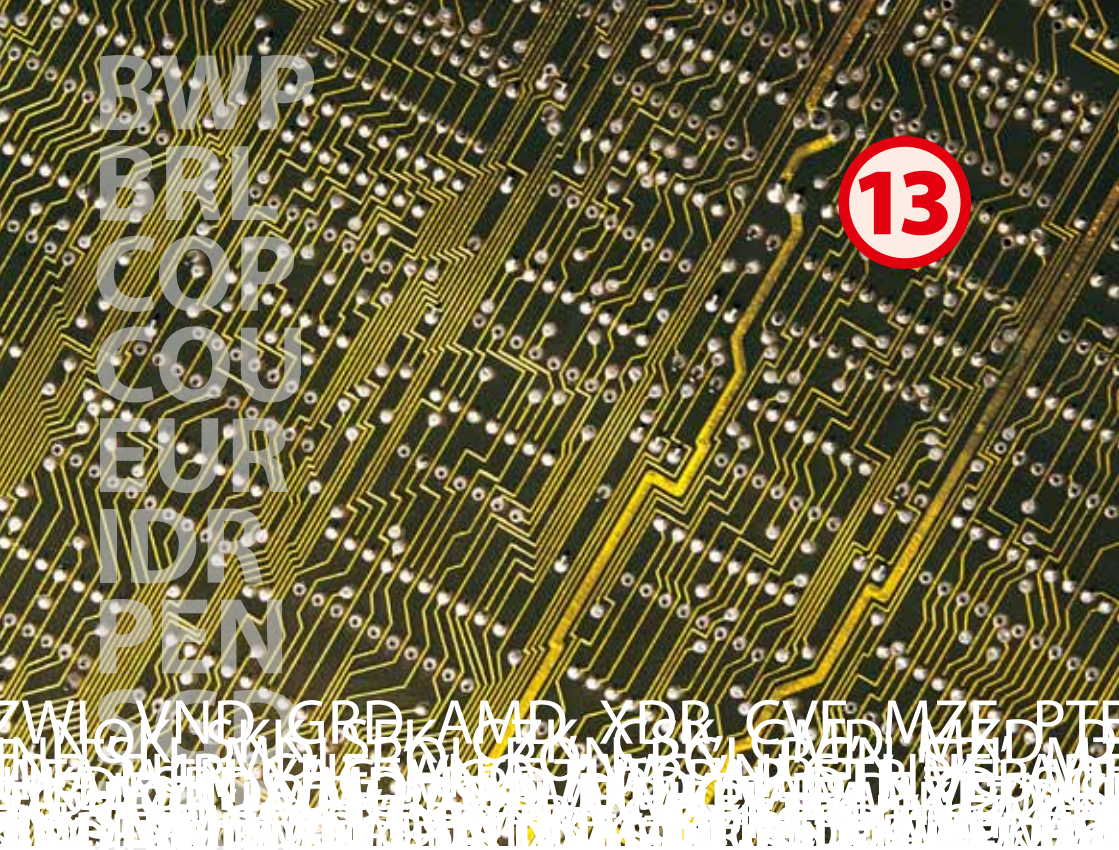

13

Nanotron Technologies GmbH, Germany

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Duration of the study : October 2010 – June 2011

13.1 Objectives and organization of the pilot project

In this study, we have applied the ISO methodology for the assessment of the economic benefits of standards to the German company Nanotron Technologies GmbH. To do so, we have analyzed the value chains of the industry branch and the company under study and, based on the data, have identified the quantitative and non-quantifiable benefits of standards for Nanotron.

13.2 The ISO methodology

The ISO methodology describes company processes, definitions and explanations and provides a toolbox to determine the benefits of standards for a company or an industry sector.

13.2.1 Objectives of the ISO methodology

The key objective of the ISO methodology is to provide a basis for studying the benefits of standards and ensuring that the results of such studies are comparable. The advantage is that it can be adapted to the analysis of individual enterprises, different industry sectors and other types of organizations.

The intention is to quantify the benefits and to relate them, for comparative purposes, to the total sales revenues of the company being studied. Non-quantifiable benefits should also be identified and their impacts described. The key assessment questions are :

1. What impacts do standards have on the value creation of the company ?
2. Are there any factors specific to the industry sector or the company that have a particular impact on value creation ?
3. How can companies maximize the benefits of standards in value creation ?

13.2.2 Approach

The following table summarizes the key steps of the ISO Methodology as applied in this study and is based on the documents *ISO Methodology Guide, ISO Methodology Essentials* and *ISO Methodology Implementation Guide*.

No	Step	Importance to the approach
1	Describe the industry sector value chain	Helps in planning the case study and in relating the company to an industry sector
2	Locating the position of the company in its industry sector	Preparation for describing the company value chain. Assists in identifying value drivers for step 4
3	Description of the company value chain	From step 2 and the organization chart of the company it is possible to establish the company value chain. The chain facilitates in mapping standards to their areas of application. To do this, it is useful to classify standards into their main applications
4	Identify value drivers	Helps to focus the later stages of the study and to determine the most important impacts of standards
5	Identification of standards	Identification of standards used in the last five years in order to determine the benefits derived from their use
6	Identify the impacts of standards	Identify the impacts of each standard
7	Decide on the scope of the study	Focus the study on the most important segments of the company
8	Identify operational indicators to quantify impacts	Serves in quantifying the benefits with the help of indicators
9	Calculation of quantifiable benefits	Determine the benefits of standards
10	Add up the benefits to those company functions within the scope of the assessment	Analysis on the basis of those business functions to which standards are applied
11	Relate the impacts on the company EBIT to total sales revenues	This enables a comparison between companies and industry sectors on the basis of sales revenues
12	Describe the non-quantifiable impacts	Reveals additional areas which benefit from standards

Table 1 Assessment approach in accordance with the ISO Methodology

13.3 Introduction to the selected company

13.3.1 Nanotron Technologies GmbH

Nanotron is a medium-sized engineering company founded in Berlin, Germany, in 1991 and participates in the global information and communication technology (ICT) sector. With the support of venture capital Nanotron started up its own technology development in 2001. The company currently has 25 employees and develops products on the basis of patented Chirp technology. Its first product, nanometer, was introduced in 2004 to enable the implementation of wireless networks.

Nanotron's current product portfolio is focused on physical position localization, the identification of persons and objects, and the installation of intelligent sensor networks. The company uses Chirp technology, radio frequency (RF) modules, development kits and subsystems, as reference for final products. The product strategy is to sell products in four development stages, as illustrated in **Figure 1,** indicating the relationship between the products.

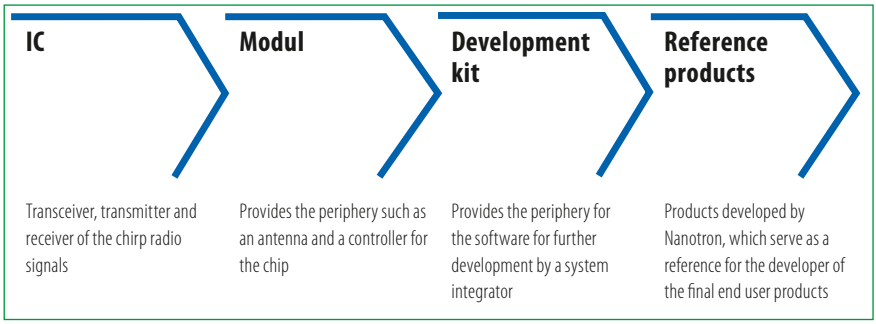

Figure 1 Interrelationship between Nanotron products

Reference products developed by Nanotron include a child loss protection system (CLOPS), a pet fencing system, and real-time locating system (RTLS) tags and anchors. CLOPS supports parents and teachers in monitoring children to ensure they stay within a "safe environment". The pet fencing system makes it possible to encircle gardens with virtual fences to contain domestic animals safely. RTLS anchors are used to set up networks to localize RTLS tags. Production of Nanotron products is outsourced.

Chips and modules to measure distances, location and data transmission are needed in many markets. To date, applications have been developed for the consumer, industrial, health care, energy and logistics sectors.

About 36 % of Nanotraon sales come from the consumer sector, the remaining sales are derived from different industry sectors, including health and senior care. **Figure 2** shows Nanotron's sales per region.

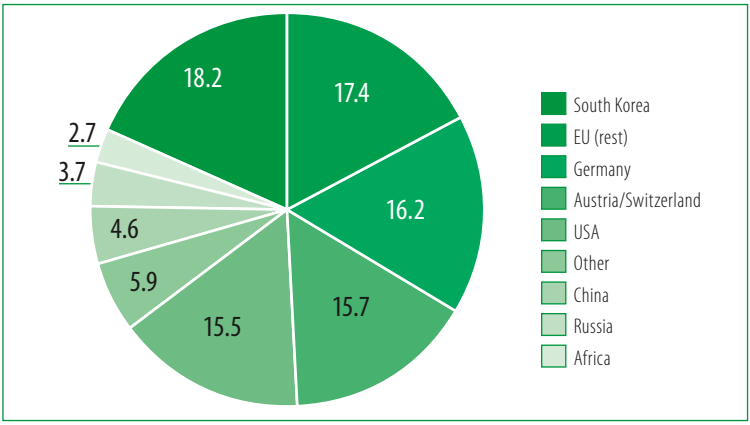

Figure 2 Nanotron sales revenues per region

13.3.2 Attitude of the company towards standardization

Soon after the company's transition to a technology provider, the management decided to implement standards to gain from the advantages of doing so and participate actively in the development of new standards.

The company's internal processes and responsibilities have been oriented towards DIN EN ISO 9001. Standards are mainly used as a strategic marketing tool and to enhance sales. It is most likely that without the use of standards Nanotron could only exist in niche markets. Standardized products and technologies assist in winning high volume chip and module contracts with major companies. Customers are developing products based on new chirp spread spectrum (CSS) technology after having built confidence in this new technology. If this technology is standardized, then such confidence can be much more easily built.

Nanotron has played an influential role in the development of the standard ISO/IEC 24730-5:2010, *Information technology – Real-time locating systems (RTLS)* – Part 5 : *Chirp spread spectrum (CSS) at 2,4 GHz air interface* published in 2010. This standard defines the air interface protocols for real time location systems RLTS using CSS within the 2.4- GHz ISM-frequency band. In 2007, Nanotron participated in the development of the IEEE standard 802.15.4a, which supplements IEEE 802.15.4 by adding the physical layers of an ultra wideband and a CSS-signal. The company plans to engage in future standardization projects in parallel with the development of future products.

13.4 Application of the ISO methodology

13.4.1 Analysis of the value chain

In a value chain all activities which result in the production of a product are implemented in a particular sequence. The product gains in value by passing through each of the stages of the chain. It is possible to develop value chains for whole industries, individual companies as well as for divisions of companies.

13.4.2 Value chain of the ICT industry sector

The ICT sector is involved with a wide range of data communication technologies. **Figure 3** illustrates the value chain of the ICT industry sector.

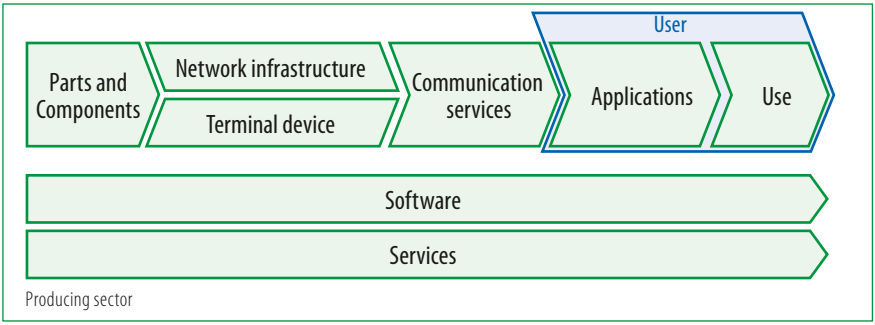

Figure 3 Value chain of the ICT industry

Parts and components include chips, modules and interfaces. The network infrastructure comprises connecting and transmission networks and office networks. Terminal devices can be telephones, computers and localization hardware such as tags and anchors. Communication services transmit the signals. Telecommunication companies are part of communication services, and applications include e-commerce, e-government and localization. The main

communication applications consists of transactions, information collection and the area localization of tags. Software is required at each stage of the value chain to control and handle the hardware. Service providers offer services in the form of consulting, training and other forms of support.

13.4.3 Company value chain

Nanotron produces parts and components in the form of chips, RF modules and the tags and anchors which are also part of the development kits. CLOPS, the pet fencing system, RTLS anchors and tags are offered as reference products for terminal devices. Nanotron also develops the driver and application software for the hardware. The company's production and technology is focused on the areas marked in orange in the industry value chain shown in **Figure 4.**

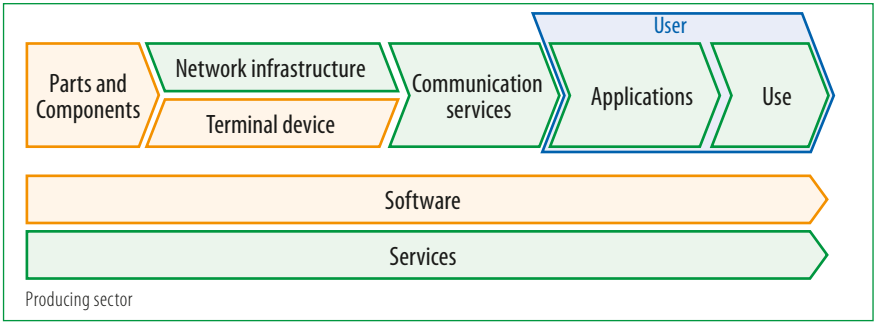

Figure 4 Stages of the ICT value chain covered by Nanotron

Research and development (R&D) is organized in the technology, systems architecture, hardware and software business units (BU). Procurement is undertaken by the operations BU. Production is outsourced to a supplier company. Marketing is carried out by the production management BU, and marketing and sales is supported by customer services. Product management has a guiding function

for R&D in particular. The value chain process is the responsibility of senior management, while administration is in charge for administrative and operational tasks. This results in the following value chain as shown in **Figure 5**:

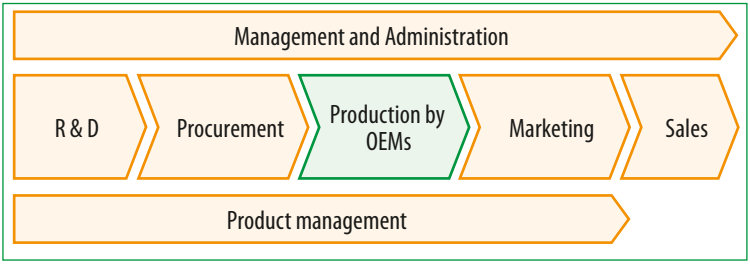

Figure 5 Value chain of Nanotron Technologies

The production value chain stage marked in green is outsourced to original equipment manufacturers (OEMs), that produce products based on design documents developed by another company.

About 45 % of the employees are involved in R&D activities at Nanotron, and about 30 % in marketing and sales managed as one organizational unit. Marketing can be subdivided into the processes of product management and marketing management, and sales into sales processing and customer support.

13.4.4 Key value drivers

The ISO methodology defines a value driver as a capability which creates a competitive advantage for a company. Impacts of value drivers can be observed as increases in sales revenues and cost reductions. Value drivers can be based on standards, since standards also contribute to increases in sales revenues and cost reductions.

A comparison between the industry sector and the company specific value chain can provide some evidence of the units in which company

value drivers can be found. The cost structure at Nanotron may also provide relevant information. Value drivers were identified in company units following interviews with senior management. The importance of a value driver is expressed in the form of its impact on sales and costs. As expected, the impact of value drivers in terms of cost saving potential is greater in company units with a high level of costs.

The comparison between the industry sector and the company specific value chain demonstrates that Nanotron combines the value chain stages of parts and components, terminal devices and software in the R&D unit. Most of the costs accrue in R&D, followed by marketing and sales, and management and administration.

Company costs	In % (estimated)
Customer support	5 %
Research and Development	55 %
Marketing and Sales	25 %
Management and Administration	15 %

Figure 6 Cost structure for different company units

From the list of expenditures per unit and the comparison with the ICT industry value chain, it can be assumed that value drivers can be found in R&D, marketing and sales and management and administration. This assumption was confirmed in the interviews with senior managers for all units. The following value drivers were identified, as shown in **Figure 7**:

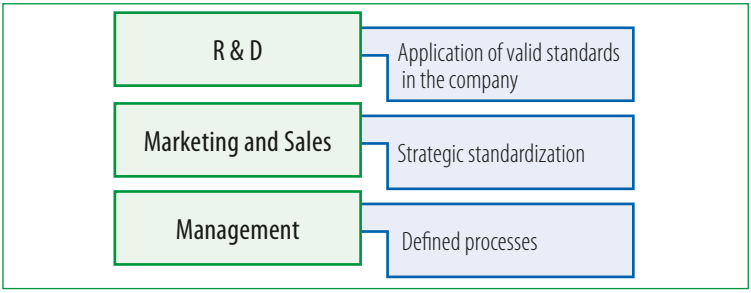

Figure 7 Nanotron's value drivers

The use of standards in R&D not only results in cost savings due to fast access to consensus-based knowledge, but also guarantees that the technical state-of-the-art is met.

In marketing Nanotron uses standards as a strategic tool. Due to its autonomous development of the patented Chirp-chips, Nanotron is not only well known in its industry, but it has also created an international market for its products with the result that standards are of direct benefit to sales. Product development at Nanotron is aware of the content of standards even before their official publication, and is therefore at an advantage in being able to offer innovative products earlier than its competitors. An additional strategic reason to use standards is that customers have confidence in standardized technology and assume that such technologies will remain relevant to the market for longer.

Senior management attaches a high importance to defined process structures since they result in time and resources savings, and contribute to cost reduction in all company units.

13.5 Standards used by Nanotron and their impacts

First, we will subdivide the use of standards into three categories, then analyze in which parts of Nanotron these categories of standards are used, and which individual standards are applied. By mapping the standards to company units, we can describe the impact of the standards as shown in **Figure 8**:

Standard type	Standard reference	Standard description
Product standards	ISO/IEC 24730-5	RTLS – Air interface applying CSS at 2,4 GHz
	IEEE 802.15.4a	Wireless MAC- and PHY-specifications for low rate Wireless Personal Area Networks (LR-WPANs) : Correction 1 : Addition of an alternative PHY-Layer
Process standards	DIN EN ISO 9001	Quality management system standard : Defines minimal requirements for the processes in companies
Conformity standards	ETSI : R&TTE Directive 1999/5/EC	Radio admission for 2,4 GHz CCS Low Power RF transceiver (ETSI)
	FCC : regulations Part 15C	Radio admission for RF transceiver in the range of 2,5 GHz (FCC)
	Japan's ARIB STD-T66	Radio admission for 2,4 GHz CCS Low power radio equipment (ARIB)

Figure 8 Standards used by Nanotron

In the ISO methodology and this study, "standard" refers to consensus-based standards, which are developed by international, regional or national standardization organizations, as well as consensus-based consortia standards, for which participation in development and access to documents is open. Excluded, however, are regulations and company standards as well as standards which have been used in a company for longer than five years, or have remained unchanged during this period. The conformity standards used by Nanotron are

regulations for radio admission, which is why they are excluded from the analysis. Since ISO/IEC 24730-5 is based on IEEE 802.15.4a, we will also not include this IEEE-standard in our assessment.

Nanotron uses standards at five levels:

- In R&D of new products
- In senior management of the organization for process definition
- In sales as an incentive to sell products
- In the process from marketing to product definition
- In the creation of markets for Nanotron's CSS technologies.

This makes it possible to categorize the benefits derived from standards in a manner consistent with the categories proposed by the ISO methodology:

1. Operational standards adoption
2. Strategic standards shaping
3. Strategic standards adoption

In category 1, the main benefit of standards results from their use in company operations. Standards provide information about technologies, describe methods or define guidelines. This results in shorter development times, expedites work processes and contributes to a unified basis for communication. The key benefit is the streamlining of work.

In category 2, the main benefit results from the company being engaged in standards development. This gives it an information advantage over its competitors, through its involvement in modifying and adding to existing standards, as well as through the opportunity to submit proposals for the development of new standards.

In category 3, the main benefit is derived by applying the standards in the company. The standards are an advantage that supports the sales or purchase proposition. The customer has confidence in the

quality of a standardized product or in its compatibility with standardized interfaces. Indeed, the product is defined on the basis of its conformity with a standard. This standards-based strategy helps Nanotron to create a market for its products or reduce time to market in order to generate higher profits through early market introduction.

The categories applied to the standards in figure 8 are expressed in **Figure 9**:

Category of use	Company units	Standards
Operational standards adoption	R&D	ISO/IEC 24730 IEEE 802.15.4
	Management and administration	DIN EN ISO 9001
Strategic standards shaping	Marketing	ISO/IEC 24730 IEEE 802.15.4
Strategic standards adoption	Sales	ISO/IEC 24730 IEEE 802.15.4

Figure 9 Use of standards by company units

ISO/IEC 24730 is the basis for software and hardware developments in R&D. Due to the application of this standard, there is no need for new developments of air interfaces (AIs) and application programming interfaces (APIs). The specification for such interfaces is part of the standard.

Senior management places a high level of importance on the implementation of the organizational requirements in DIN EN ISO 9001 to ensure the optimal design of processes.

The marketing unit at Nanotron took a strategic decision to become actively involved in standardization. It was the company's intention to offer other service providers an alternative to already standardized technologies such as the direct sequence spread spectrum (DSSS) by standardizing a CSS air interface for RTLS.

It was also a strategic vision to create a worldwide market for the technology as a consequence of the dissemination of, and penetration by, the standard.

In the sales unit, standards are used strategically. The standardization of products serves as a sales argument, since standards are seen as evidence of quality and compatibility. Customers pay attention to market penetration when they buy products and are also influenced by how long a product is likely to be offered on the market. This applies to new technologies in particular. Both aspects are supported by standardized technologies, so that sales can use "standards" as a strategic argument in advertising. The following impacts of standards can be identified:

Company unit	Standard	Impacts
R&D	ISO/IEC 24730 IEEE 802.15.4	- More precise product specifications
Marketing	ISO/IEC 24730 IEEE 802.15.4	- Creation of a global market - Costs for the development of standards
Sales	ISO/IEC 24730 IEEE 802.15.4	- Reduced time-to-market - More efficient product description - Confidence in the product
Management	DIN EN ISO 9001	- Shorter processes and workflows

Figure 10 Impacts of standards

13.6 Scope of the pilot project assessment

On the basis of the available data, it was possible to focus the assessment on the R&D, marketing, sales and management units.

13.6.1 Operational indicators used to quantify benefits

After having mapped the standards and their impacts and benefits to the company units, it was necessary to define the operational indicators to be quantified, as expressed in **Figure 11** :

Company units	Value driver	Type of benefit	Standard	Impacts	Operational indicator
R&D	Application of valid standards	Operational standards adoption	ISO/IEC 24730 IEEE 802.15.4	Precise product specifications	Time savings (in %)
Marketing	Strategic standardization	Strategic standards shaping	ISO/IEC 24730 IEEE 802.15.4	Creation of a global market ; Reduced time-to-market	Increase in sales (in %)
Sales	Strategic standardization	Strategic standards adoption	ISO/IEC 24730 IEEE 802.15.4	More efficient product description ; Confidence in the product	Increase in sales (in %)
Management	Lean production	Operational standards adoption	DIN EN ISO 9001 IEEE 802.15.4	Shorter time for processes ad workflows	Time savings (in %)

Figure 11 Operational indicators used to calculate economic benefits

Figure 12 summarizes the quantitative benefits from the impacts of standards on the basis of the company units using these standards :

Company unit	Impacts	Operational indicators	Quantitative benefits
R&D	Price product specifications	Time savings (in %)	5 % of sales revenue
Marketing and sales	Reduced time-to-market	Loss in revenue should standards not be applied (in %)	3 % of sales revenue
	More efficient product descriptions	Time savings (in %)	1 % of sales revenue
	Confidence in the product Creation of a global market	Loss in revenue should standards not be applied (in %)	16 % of sales revenue
	Costs due to participation in the development of the standard	Estimate (of the absolute value)	-4 % of sales revenue
Management	Shorter processes and workflows	Time savings (in %)	12 % of sales revenue
		EBIT Impact (total)	**33 %**

Figure 12 Cumulative economic benefits for each company unit

The total of the quantitative benefits for all Nanotron units, representing the impacts of standards on the company EBIT, can be distinguished into the two categories

- cost savings (14 %) and
- increase in sales revenue (19 %).

The percentage of the impacts of standards of the total sales revenue is almost **33 %**.

13.7 Non-quantifiable benefits

The benefits to Nanotron from standards introduced or modified within the last five years have been demonstrated to a large extent through the quantitative analysis. Participation in standards development, however, provides aspects that are not quantifiable. Nevertheless, standardization meetings and events provide opportunities to

exchange information and views with other companies. It is also possible to discuss future trends, establish business contacts and initiate new projects, including those involving joint development.

In the sales unit benefits result from standardized products. As an example, if there is a need for a water-resistant case for a circuit board, sales can refer to relevant standards for the product, in this case DIN EN 60529, to influence the R&D purchase decision.

The cross-unit benefits of the use of standards have not been analyzed as a consequence of focusing the quantitative analysis on individual units of the company. However, it is possible to benefit, in particular, from the use of standardized electronic components in the cooperation between R&D and outsourced production. Such benefits also result from the consistency in meeting defined dimensions during the planning of circuit board layouts. As a result, products developed by Nanotron can be produced without incurring any additional costs from later adaptations or adjustments.

13.8 Discussion of the results

The results of the assessment demonstrate that standardization makes an important contribution to the EBIT of the company. With a contribution of 33 % of the company sales revenues, the impacts are significantly higher than those found in similar studies in other industry segments and companies. These typically evaluated the impact of standards at about 1-4 % of sales revenue.

Consequently, two questions should be considered:

- Why is the percentage contribution so high in the case of Nanotron?
- Is it possible to base a comparison of the benefits of standards between different companies exclusively on the quantitative benefits?

The first question can be answered as follows:

1. Nanotron has clearly recognized the potential that can result from standardization. As shown, standards are used actively in all three possible areas of application. As a result, the quantitative benefits are especially high.
2. Much of the benefit is generated by the global market for Nanotron's products, which – in the case of the CSS technology – has only evolved as a consequence of the company's participation in standardization. This type of standardization benefit only results for new technologies or products. The benefits of standardization are particularly high for Nanotron, because the impacts from standards apply to almost its entire product range.
3. Since the products are based on new technology, it takes some time until customers are able to develop their own products on the basis of the new chips and RF-modules. Only when this point is reached do the sales volumes of Nanotron's chips and modules increase significantly.

The benefits in points 2 and 3 above can also be argued in conjunction with the product life cycle model (see **Figure 13**). However, since we address the whole company, the model does not, in this case, apply to an individual product, but to the sum of all the company's products. If the product portfolio is composed of a set of products that are still in development, another set just recently introduced and a third smaller set that is fully established in the market, then the product portfolio is still in an introductory phase. This is an appropriate description of Nanotron's current portfolio. However, it is assumed that this phase will be concluded by the end of 2011. On the other hand, it can be assumed that the product portfolio of companies already well established in their markets can be described as being in the maturity and saturation phase.

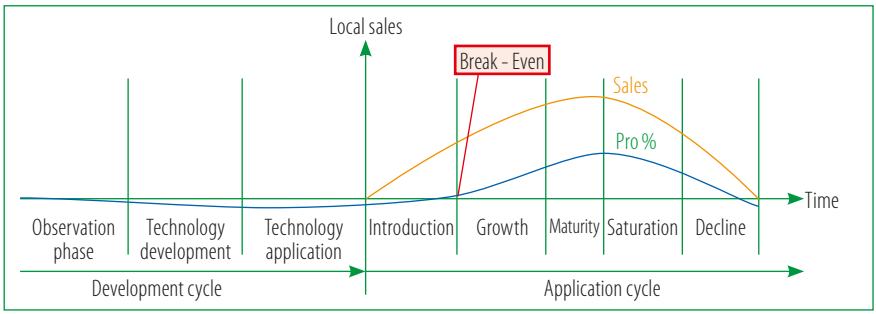

Figure 13 Product life cycle

The comparison between this and other studies demonstrates that companies that have not yet reached their break-even point have an advantage over different companies on the basis of the percentage of the contribution of standards to sales revenues. Sales revenues are still so limited that even a small quantitative benefit results in high percentages. If one attempts to undertake reasonable comparisons it is more appropriate if the product portfolio of the companies is at a similar phase in the life cycle.

13.9 Summary of the study

As the results have shown, standards have a significant impact on Nanotron, amounting to 33 % of current overall annual sales revenues.

It was not possible to identify specifics of the industry sector that have caused this result. However, it could be concluded that, for companies such as Nanotron, with a product portfolio new to the market and partially still under development, the benefits from standardization as a percentage of sales revenues and EBIT are especially high. This phenomenon could be explained with the life cycle theory, which provides an explanation of the sales and cost structure in the introductory phase of products into the market.

Nanotron already exploits all the potential means of using and benefiting from standards as also stated in the ISO methodology. Its implementation of standards, the strategic use of standards, and also its involvement in standardization committees are important elements of Nanotron's business strategy.

List of abbreviations :

AI	Air interface
API	Application programming interface
CEO	Chief executive officer
CFO	Chief financial officer
CLOPS	Child loss protection system
CSS	Chirp spread spectrum
DSSS	Direct sequence spread spectrum
ICT	Information and telecommunication technology
IEC	International Electrotechnical Commission
OEM	Original equipment manufacturer
R&D	Research and development
RFID	Radio frequency identification
RTLS	Real-time location systems
USN	Ubiquitous sensor networks

Article first published in the *ISO Focus*+, June 2010, on the ISO Methodology

The ISO Methodology. Assessing the economic benefits of standards

by Daniele Gerundino and Michael Hilb

Note: Figure 6 has been amended to align it with the document *ISO Methodology Essentials. Reference for the development of case studies* (October 2010).

We standardizers are generally quite certain that our work generates considerable benefits for organizations, markets and society. But substantiating and quantifying the real-world value of consensus-based standards is no small challenge. Few organizations have systematically analyzed the issue. Data is scarce and difficult to capture.

Though difficult, quantifying the benefits of standards is extremely important for monitoring and prioritizing standardization activities, as well as for raising awareness and improving communication, promoting the use of standards and encouraging stakeholder participation.

In the past several years, a number of studies on this issue have been developed or supported either by national standards bodies or external research teams – a compendium of these studies is available online on the ISO/IEC Information Centre (www.iso.org/benefits).

An analysis of these studies shows a great diversity of approaches: from macro-economic assessment to research on the economic impact of specific standards on various types of organizations. No common methodology for economic assessment and quantification of benefits has been used, preventing comparisons between studies, and making it difficult to draw any benchmark or general trend from a combination of studies.

These shortcomings inspired the development of the ISO Methodology to assess and communicate the economic benefits of consensus-based standards. To this end, a project aiming to contribute to the sustained development of ISO and the promotion of the ISO system was approved by the ISO Council in 2007.

14.1 A much needed approach

The ISO Methodology's main objectives are to provide:

- A set of methods to measure the impact of standards on organizational value creation (with an emphasis on businesses)
- Decision-makers with clear and manageable criteria to assess the value associated with using standards
- Guidance on developing studies to assess the benefits of standards within a particular industry sector.

The ISO Methodology has been designed to support analysis of a company, or a specific organizational entity such as a business function or a business unit, as well as industry sectors, at the national or international level. It primarily addresses for-profit companies, but the approach can be extended to cover public sector organizations. It can be used by anyone participating in the development of projects and studies to assess the economic benefits of standards.

The ISO Methodology was developed with the support of Roland Berger Strategy Consultants in a three-phase project:

- *Phase 1:* Analysis and comparison of recently published studies and their related methodologies (October – December 2008)
- *Phase 2:* Development of a generic methodology to assess and quantify the economic benefits of standards (February – May 2009)
- *Phase 3*: Application of the methodology to a pilot industry-sector worldwide (July – September 2009).

A project steering group and a team of reviewers, including national standardization bodies (NSBs) and academic institutions, maintained an overview of the project and provided peer review.

The project has been an exciting and enriching experience – a race against time; a relentless effort to capture original data from a sig-

nificant number of organizations all over the world ; and an attempt to consolidate experts' input in a solid and manageable framework.

14.2 Core concepts

The methodology addresses the following key questions :

- What is the contribution of standards to corporate value creation ?
- How do industry and company specifics impact corporate value creation arising from standards ?
- How can companies maximize the value generated by standards ?

To answer these questions, the ISO Methodology provides a conceptual framework and a set of tools aimed at identifying and quantifying the impact of standards on value-creating activities.

The overall approach is based on the value chain analysis (VCA), a concept of business management introduced by Professor Michael Porter of Harvard Business School during the 1980s.

A value chain is a chain of activities within an organization operating in a specific industry. The output of the work of an organization (products or services) pass through all the activities of the chain in a given order, gaining value in each step.

The VCA aims to investigate the structure of the value chain and of the activities performed at each step of the chain, with a view to understanding and quantifying the contributions of various activities to value creation.

In this approach, the operations of a company are subdivided into a number of key business functions (see **Figure 1)**. 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/operation " business function.

Through analysis of activities within the various business functions in the value chain, the ISO Methodology aims to identify and quantify how standards contribute to value creation.

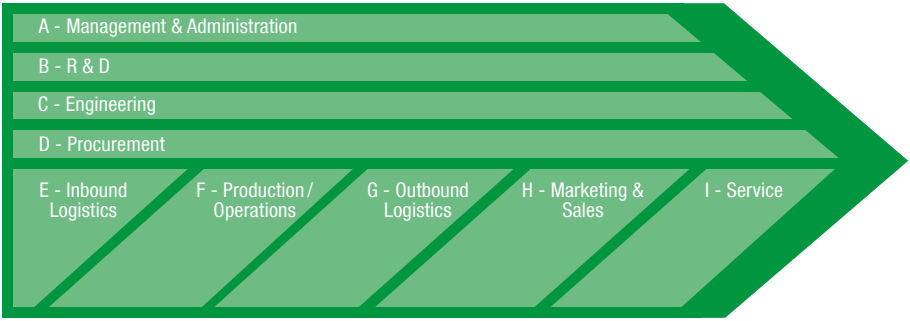

Figure 1 Company value chain

When the value chain approach is applied to an industry sector, the network of suppliers and customers are included. This is referred to as the "industry value chain" (see **Figure 2** for an example taken from the oil and gas engineering sector). Once the industry value chain is determined, the position of individual companies and their functions in the industry can be better understood.

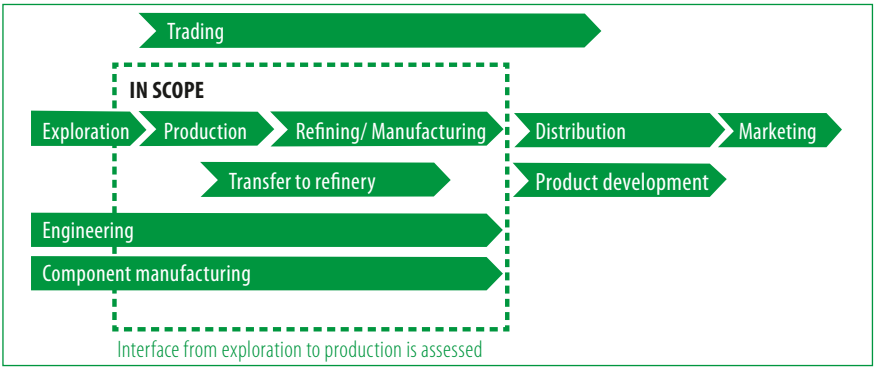

Figure 2 Oil and gas engineering industry value chain and scope

14.3 The process

To assess the benefits of standards for a given organization it is necessary to follow the steps indicated below.

Step 1 : Analyse the value chain

The first step is to determine the value chain of the industry, and to position the organization to be assessed in the context of this value chain.

The analysis makes it possible to identify the segments of the industry value chain covered by the company, and to consider the company's core competences and key activities in relation to the creation of value.

Step 2 : Identify the impact of standards

A comprehensive standards impact map (see **Figure 3)** aims to determine the impact resulting from the implementation of standards on each of the main business functions and associated activities. Examples include a reduction in the time required to perform a given activity (e.g. the design of a product component), lower cost for the procurement of raw materials, and increased sales deriving from access to markets opened by the adoption of standards. The standards impact map provides a detailed list of more than 90 potential effects on the activities of the various business functions indicated in **Figure 4.**

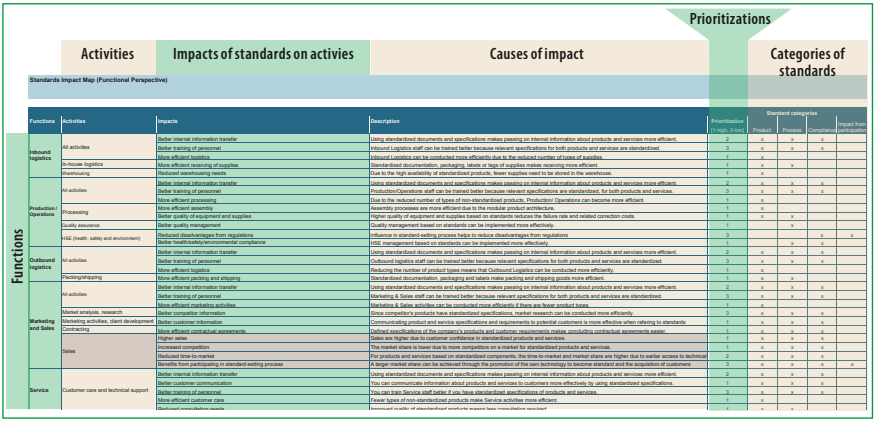

Figure 3 Standards Impact Map : Business functions, associated activities and impacts of standards .

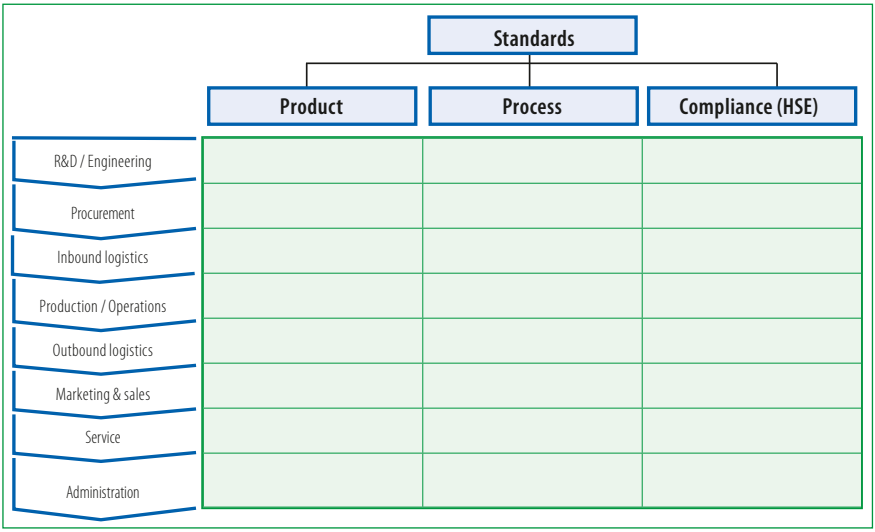

Figure 4 Relating business functions and impacts from standards

Step 3: Determine value drivers and define key operational indicators

Investigators need to determine the value drivers – crucial organizational capabilities that give a company a competitive advantage. The analysis of value drivers helps assess the most relevant desirable impacts in the standards impact map.

To measure the actual impact, it is necessary to identify one or more operational indicators. Examples include: manpower needed to perform a given task, cost of materials and processes, rate of failure in product manufacturing, and customer satisfaction ratios.

Step 4: Collect information and measure impact

At this point, the quantitative impact of standards on the selected operational indicators needs to be determined. This is done by translating the impact into financial metrics. It can be directly measurable (for example, cost savings for the procurement of materials and components), or determined on the basis of existing company data (for example, the reduction of manpower needed to complete the design of products is converted into estimated cost savings on the basis of the average cost of personnel).

The earnings before interest and tax (EBIT) indicator is used as a measure of value created. EBIT accounts for the gross profit for a company (revenue minus costs) at a given point in time (see **Figure 5)**.

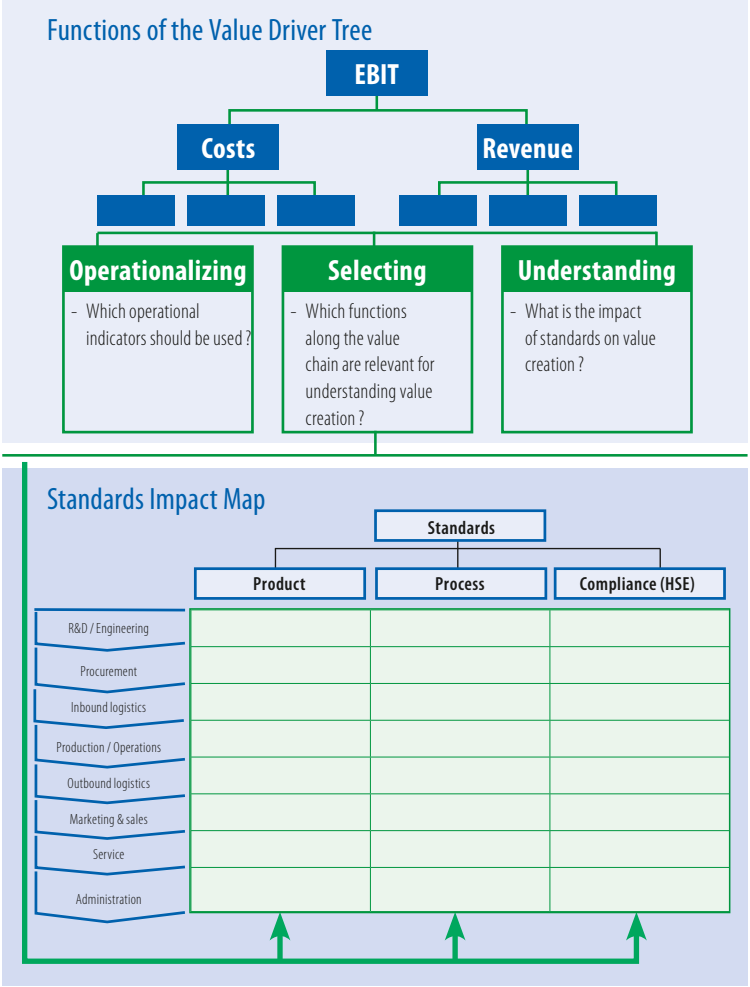

Figure 5 Relating value drivers to the impacts of standards and calculating their impact on company value creation

If the data is insufficient or unreliable, the ISO Methodology describes alternative approximation methods based on data obtained from assessments of similar functions in other organizations.

Finally, all relevant impacts are aggregated. Together they represent the overall EBIT impact from the use of standards for the company, or the business function(s), being assessed.

14.4 Handy toolbox

The ISO Methodology offers a toolbox to support the assessment process, the capturing of information and data, and the calculation of the impact of standards. **Figure 6** provides an overview of the four steps in the ISO Methodology and their corresponding tools.

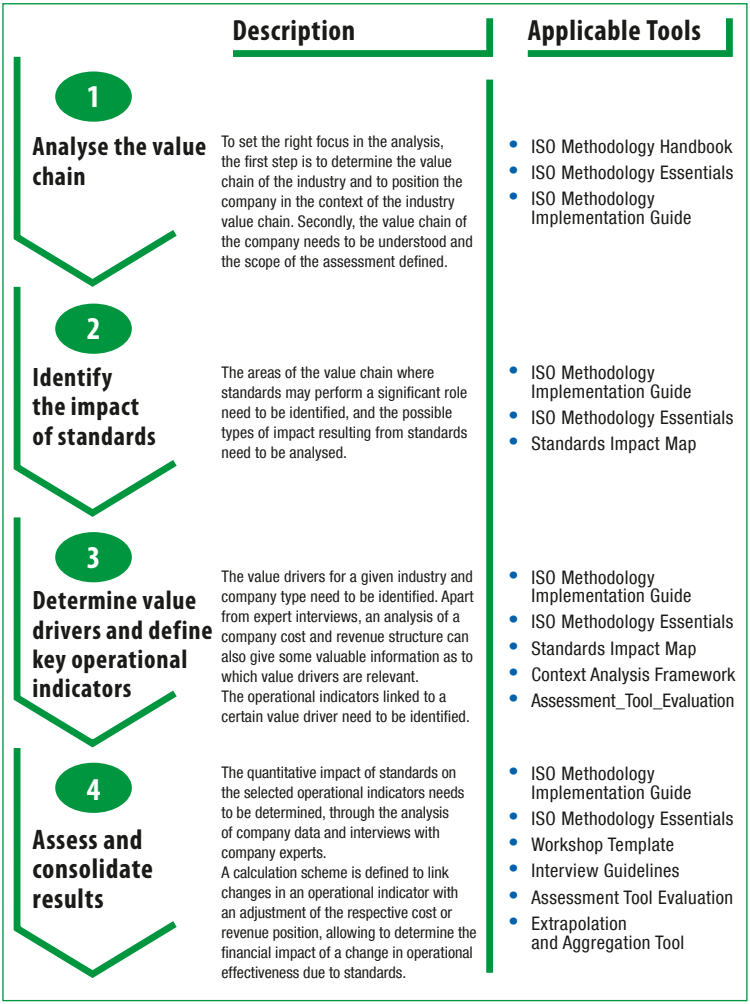

Figure 6 Key steps in impact assessment and supporting tools

The methodology can be used to assess the impact of standards on an industry sector at the national or international level (see **Figure 7**). In this case, it is important to pay close attention to the sector value chain, to the determination of the sector's boundaries, and to the selection of organizations to ensure a heterogeneous sample (in terms

of company type, size and location). For each company belonging to the sample, the assessment is performed following the four steps previously described. Individual data has then to be consolidated at the industry level.

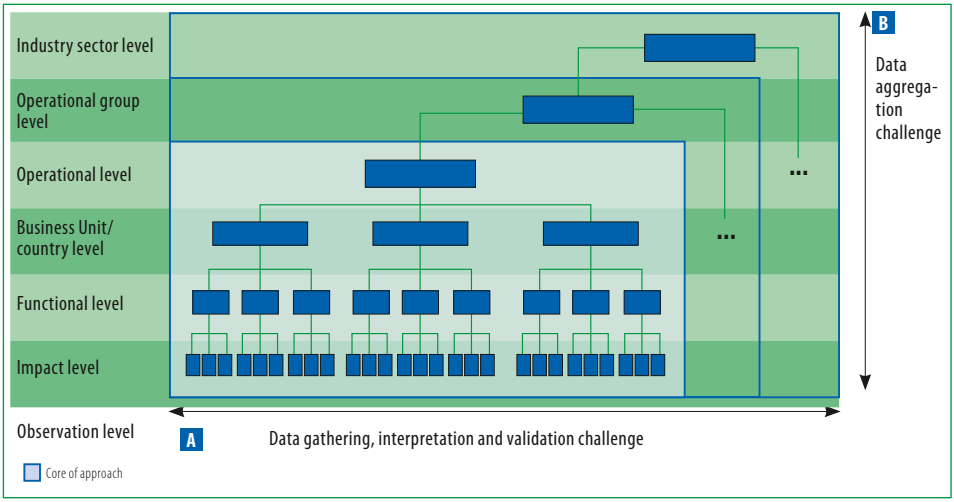

Figure 7 Different levels of the impact assessment approach

A pilot study for the global automotive industry has already been conducted to test the methodology.

Focus on the automotive sector

The main objectives of the study are summarized below:

- Using the methodology's toolbox, assess the impact of standards in the automotive industry
- Evaluate the results to obtain the EBIT impact of standards for specific companies in the industry
- Aggregate the results at company level to estimate the scale of impact at an aggregated sector level.

The field study sample was designed to cover a variety of company types, sizes and geographical locations (see **Figure 8)**.

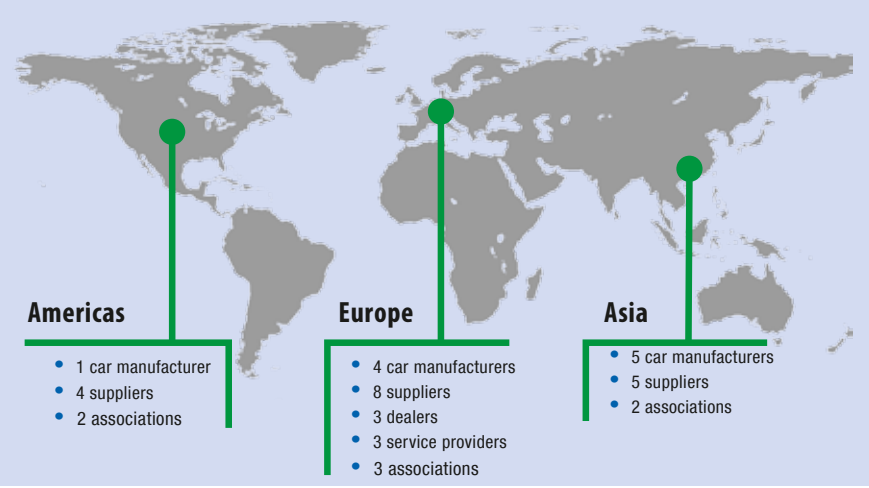

Figure 8 Company types and geographies covered by the field study

Detailed analysis was conducted on the industry value chain, the position of the companies in the various segments of the chain, the respective value drivers, and key industry trends, taking advantage of the comprehensive experience and knowledge of Roland Berger's practice in the automotive sector (see **Figure 9)**.

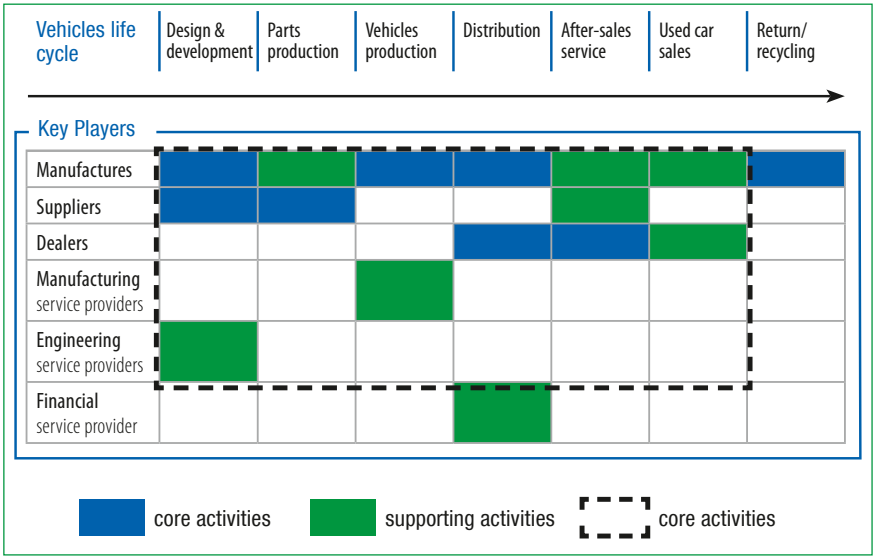

Figure 9 Automotive sector value chain and scope of study

The extent and manner in which organizations are affected by standards vary by company type and function, as illustrated in **Figure 10**.

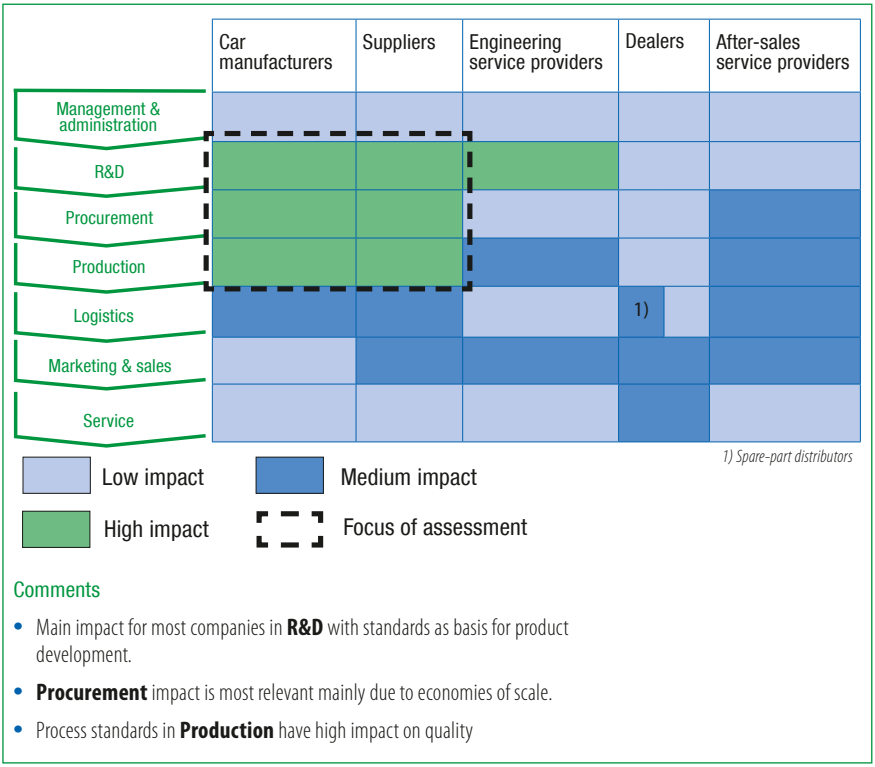

Figure 10 Intensity of impact from standards by company type and function

The analysis focused on those business functions and company types for which standards have the highest impact, including research and development engineering, procurement and production (business functions), and auto manufacturers and suppliers (company types). Around 80 specific impacts from standards were identified and quantified during the interviews.

The study revealed that standards affect procurement functions as follows:

- They help car manufacturers and suppliers reduce the variety of supply categories, with a positive impact on costs (making it possible to purchase in larger quantities)
- They help to make the procurement process more efficient (decreasing the time needed to manage the process), and simplify contractual agreements
- Standardized components, even if they only account for a limited portion of the car, are offered at lower prices.

Their impact on research and development and engineering functions, on the other hand include:

- Lower research costs from defined material and test standards
- The reduction of product development costs varies, depending on the level of adherence to external standards by car manufacturers. The closer company standards are to external standards, the higher the costs savings
- Supply costs are reduced, since specifications are more easily met by potential suppliers
- Process standards positively impact product development costs. For example, when combined with a range of defined testing standards, quality management systems lower costs and achieve comparability on the market for suppliers.

For the production function, the main impact comes from quality management standards, both for car manufacturers and suppliers (as well as for some service providers):

- Measurable improvements result from quality management standards such as ISO/TS 16949, *Particular requirements for the application of ISO 9001:2000 for automotive production and relevant service part organizations*

- Car manufacturers can also better integrate suppliers into their supply chains.

Using data gathered through interviews, various types of data aggregation and estimates have been performed, including:

- Aggregation of impacts from standards on core business functions (R&D/engineering, procurement, production) for a single company
- Aggregation of total impacts from standards for a company
- Estimate of the total impact from standards on one of the core business functions for the entire industry
- Estimate of the total impact from standards for the entire industry.

A variety of company cases were considered in the study. The results show an incidence of the impact from standards ranging from 0.15 % to about 3 % of turnover – depending on the company and the business function analysed.

The estimate of the total impact from standards on the three core business functions for the entire industry has been given in percent of revenues for the two most relevant company types (see **Figure 11** for an example). Since the estimates have been computed from a relatively small sample size, the results are given as a range with the lower bound being 70 % of the estimated values.

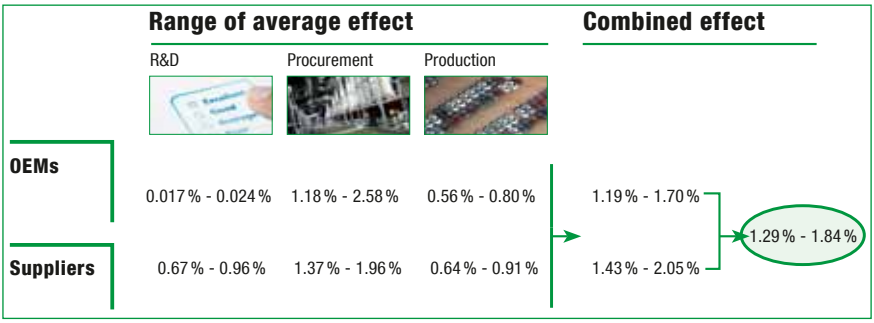

Figure 11 Aggregation of contributing effects (% of sales, annualized impact)

To give a better appreciation of the scale of the standards impact, the above estimate has been projected to the total industry revenues for 2008. As a result, the total contributing impact would be between USD 38 billion and 55 billion.

This estimate is based on a limited sample of companies and to achieve more precise and reliable figures, it should be refined and validated using a larger sample. However, the analysis provides a clear and valid indication of the scale of the standards contribution to the sector.

14.5 The way forward

The main deliverables of the project are :

- *A methodology guide*, providing information on the theory behind the approach, and on how the methodology can be applied to a company (from the private sector), an industry sector, and how it can be adapted for organizations from the public sector
- *A methodology toolbox*, providing a number of relevant methods and tools to manage the analysis
- *An implementation guide*, providing information and suggestions on the application of the methodology, following a step-by-step approach
- The report, *Economic Benefits of Standards in the Global Automotive Industry*, providing an example of how the methodology is implemented for a specific industry sector.

All these documents are available from the ISO Website member's portal, under the entry " Economic benefits of standards " within the " Resources " section (password protected). Interested parties that are not ISO members, such as academic institutes, research centres,

standards developing organizations and companies, can contact ISO for access (weissinger@iso.org).

The dissemination and application of this methodology will help analyse and clarify the contribution of voluntary, consensus-based standards to the performance of individual companies and industry sectors.

ISO members are encouraged to apply and promote the methodology with organizations in their respective countries. Planning is underway for presentation and promotion of the ISO Methodology to academic institutions, with a view to stimulating further development of research and case studies.

Note: The authors would like to thank the steering group and the team of reviewers for their contributions along with the representatives of more than 100 companies, associations and public institutions who were involved in the project, providing essential input, operational data and qualified estimates.

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/iso-focus-plus
  (10 editions annually in English and French)

- **ISO videos**
  www.youtube.com/PlanetISO

- **ISO Café**
  www.iso.org/isocafe

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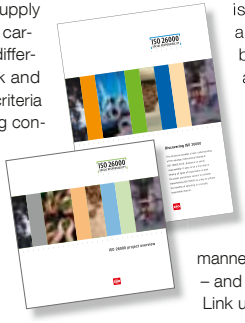
- **Contact the ISO member in your country:**
  www.iso.org/isomembers

- **ISO/IEC inventory of studies on the economic and social benefits of standardization:**
  www.iso.org/benefits

ISO 26000, *Guidance on social responsibility*

The first link in a global supply chain may be a little guy carrying a heavy load. The difference between hard work and exploitation depends on criteria like adequate pay, working conditions, health and safety factors, and social protection. Labour practices comprise one of the seven core subjects of social responsibility defined in ISO 26000, along with 37 underlying issues and seven overarching principles. All are based on consensus among 99 countries and 42 international organizations from both public and private sectors. People worldwide now demand that organizations behave in a socially responsible manner. ISO 26000 shows how – and the benefits of doing so. Link up now!



Available from ISO national member institutes (listed with contact details on the ISO Website at **www.iso.org**) and from the ISO Central Secretariat Webstore at **www.iso.org/isostore** or e-mail to **sales@iso.org**.

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