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

Festo Brasil, Brazil

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 has been implemented as showed in **Table 1**.

Table 1 – Project timeframe

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
Refine/complete company data	21 Feb 2011	17 Mar 2011
Consolidate results and develop draft report	17 Mar 2011	18 Mar 2011

Exchange draft results in the regional project team and discuss	21 Mar 2011	25 Mar 2011
Develop the final version of the case study	25 Mar 2011	31 Mar 2011

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 BRl503.9 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 few next 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 of the hydraulics and pneumatics technological infrastructure in the country. The 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 following criteria:

- A positive attitude towards standardization
- Intensive use of standards;
- Proactive participation in international and national standardization development processes
- 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
- Innovation excellence.

Festo Brasil is headquartered in São Paulo and has a modern industrial park over 43 000m² - 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 BRL239 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.

Table 2 Festo Brasil: 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	BRL239 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.

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 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 (**Annex 1** lists the persons interviewed). Many commented that the questions raised during the interviews helped them to rethink specific issues and standardization topics.

4. Analysis of the value chain

4.1 Industry value chain

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

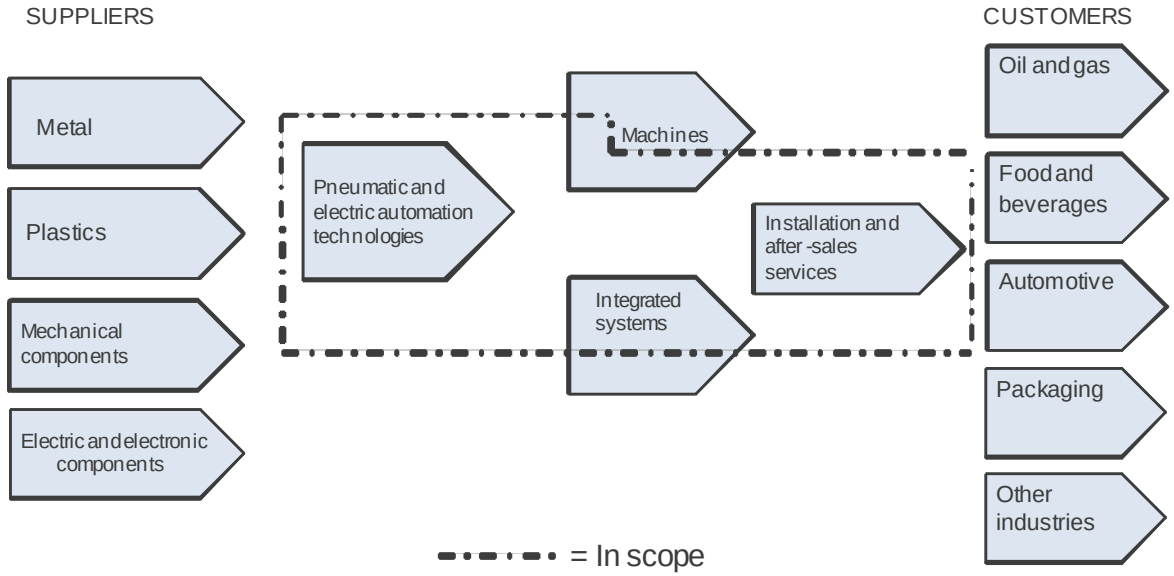

Figure 1 Automation industry value chain and scope

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 product ranges 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.

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.

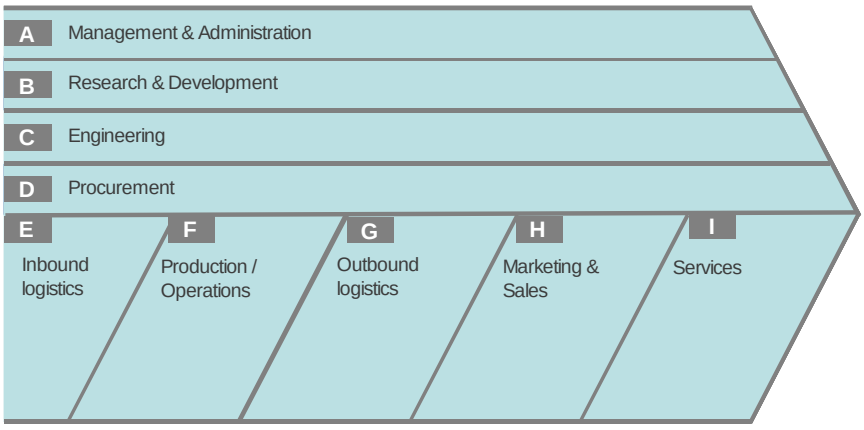

Figure 2 Festo Brasil's value chain

The operations are subdivided into nine key business functions A to I. Each is associated with a set of specific value chains activities. For example, those concerning product development; automation systems development; product tests; master data administration for Festo 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.

Table 3 Business functions of Festo Brasil's 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 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.

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).

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.

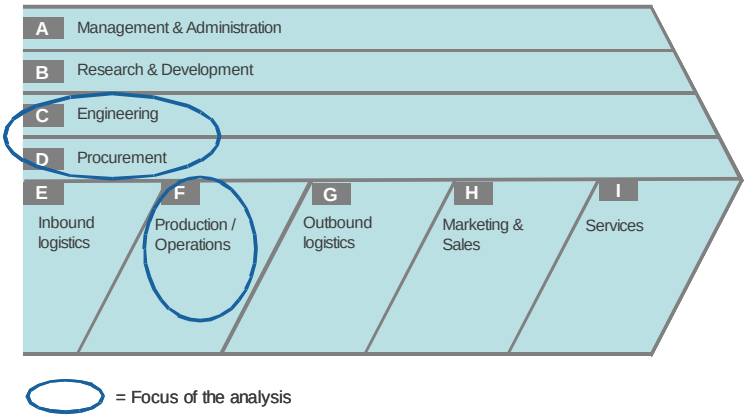

Figure 3 Scope of the assessment

6. Use of standards in the company value chain

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

Table 4 Standards used in the company value chain

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.
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 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, IN 1798, DIN 3405, DIN 433, DIN 439, DIN 470, DIN 471, DIN 472, DIN 5401, DIN 546, DIN 625, DIN 670, DIN 6799, IN 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, and SAE 1035.

Table 4 – Standards used in the company value chain (Cont.)

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, and 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; and ISO 5599.
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.

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.

Table 5 Operational indicators to measure the impact of standards on 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, and DIN 844.	Production efficiency gain	Production costs reduction (BRL/year)
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 (%)

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 the operational indicators, such those described 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 standards use by Festo Brasil in its procurement, production/operations, and engineering functions.

8.1 Procurement

The total cost of procurement, including materials and components, is BRL143 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 it 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 BRL13 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 BRL5.22 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 BRL143 million, or about R$ 3 219 750 per year, or 2.25% of procurement costs.

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. 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 impact 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 BRL7.16 million, i.e. BRL3.58 million per year

- Savings due to the use of standards for geometrical and positional tolerances can therefore be estimated as 10% of 33% of BRL3.58 million or BRL118 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 BRL127
- Total cost of personnel was BRL338 670 per month, or BRL4.07 million per year
- Savings from using standards for geometrical and positional tolerances can therefore be estimated as 5% of 4.07 million = about BRL203 202 per year.

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 BRL1.59 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 BRL524 700.

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.

Table 6 Financial impact of standards by operational indicator

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 7 shows the financial impact of standards on the whole business function, and indicates that total EBIT impact of standards is estimated at BRL4 378 622 per year. This corresponds to 1.90% of company turnover (BRL239 million per year).

Table 7 Financial impact of standards on business function

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**

9. Qualitative and semi-quantitative considerations

In addition to the measurable results showed in **Tables 6** and **7**, there are many examples of benefits from the use of standards 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 reduced time-to-market
- Higher quality of supplier's materials
- Less component variation in stock
- Lean manufacturing
- Faster customer service through standardized components.

10. Evaluation of results

Festo Brasil uses product, process and management system standards intensively. In **Section 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, more environmental compliance, 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.

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 BRL312 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 BRL3 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 BRL118 058 per year, or 1.6% of engineering function costs.

In addition, savings in engineering project time due to such standards were estimated at BRL203 202 per year.

Production/operations function: it was assumed that standards helped production efficiency gains as showed in **Section 8**. The mix of measures introduced through the standards-driven continual improvement process has enabled the company to achieve BRL1.59 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 BRL524 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 three business functions in Festo Brasil was some BRL4 378 622 per year. This corresponds to 1.90% of the company annual turnover of BRL239 million.

Finally, the application of ISO Methodology in Festo Brasil's organizational context is helping people involved in this pilot project 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).

Bibliography

ABIMAQ. **Annual report 2010**. Available at: <http://www.abimaq.org.br/anuario/anuario.html>. Access: March 2011.

ABIMAQ. **Sectorial chambers.** Available at: <http://www.abimaq.org.br/site.aspx/Servicos-Camaras-Setoriais>. Access: March 2011.

FESTO BRASIL. **Company performance 2010**. Internal document. São Paulo: Festo, 2010.

FESTO BRASIL. **Festo Brasil's institutional press release**. São Paulo: Festo, 2010.

FESTO. **Company Profile**. Available at: <http://www.festo.com/cms/pt-br_br/index.htm>. Access: March 2011.

FESTO. **Festo Brasil.** Company Profile. Available at: <http://www.festo.com/cms/pt-br_br/4956.htm>. Access: March 2011.

FESTO. **Festo Brasil.** Company Profile. Available at: <http://www.festo.com/cms/pt-br_br/4957.htm>. Access: March 2011.

GERUNDINO, D.; HILB, M. The ISO Methodology: assessing the economic benefits of standards. **ISO Focus**. June, 2010.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION; ROLAND BERGER STRATEGY CONSULTANTS. **Economic benefits of standards:** methodology handbook. Version 01. February, 2010.

PORTER, M. E. **Competitive advantage:** creating and sustaining superior performance. New York: The Free Press, 1985.

PORTER, M. E. **Competitive strategy: techniques for analyzing industries and competitors.** New York: Free Press, 1980.

ROLAND BERGER STRATEGY CONSULTANTS. **Automation:** global view on the automation industry. Think: act study 05/2010. Vienna, 2010.

Annex 1 Schedule of interviews at Festo Brasil

<table>
<tr><th rowspan="2">Time</th><th>24 Nov 2010</th><th>25 Nov 2010</th><th>26 Nov 2010</th></tr>
<tr><th>Contact centre room (2nd Floor)</th><th>Sales engineering room (2nd Floor)</th><th>Contact centre room (2nd Floor)</th></tr>
<tr><td>08:00</td><td rowspan="8"></td><td></td><td rowspan="2">Services
Anderson Franco – Post-sales Services Coordinator</td></tr>
<tr><td>08:30</td><td></td></tr>
<tr><td>09:00</td><td rowspan="2">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</td><td rowspan="2"></td></tr>
<tr><td>10:00</td><td>Maintenance
Rogério Tavares - Maintenance Coordinator
Robinson Santos – Administrative Assistant
Adilson Soares - Maintenance supervisor</td></tr>
<tr><td>10:30</td><td rowspan="3">Sales
Homero Paulino - product application consultant
Viviane Maschio - product application consultant</td><td rowspan="3">Guided visit to Festo Brasil’s divisions.</td></tr>
<tr><td>11:00</td></tr>
<tr><td>11:30</td></tr>
<tr><td>12:00</td><td colspan="2">Lunch time</td></tr>
<tr><td>12:30</td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>13:00</td><td rowspan="3">Marketing intelligence
Osvaldo Sato – Business Manager (Pneumatic Technologies Segment)
Latin America marketing
Weeney Bolfaine – Marketing Manager</td></tr>
<tr><td>13:30</td><td rowspan="2">Quality assurance
André Galhumi - Quality Assurance Manager</td></tr>
<tr><td>14:00</td><td rowspan="3">Company overview
Paulo Roberto do Santos - Engineering Director
Fernando Mascarenhas – Master Data Administration and Project Detail Coordinator</td><td rowspan="4">Occupational safety
Cláudio Lara – Occupational Safety Coordinator</td></tr>
<tr><td>14:30</td><td rowspan="3">Production/operations
Carlos Valentim - Production Process Coordinator</td></tr>
<tr><td>15:00</td></tr>
<tr><td>15:30</td></tr>
<tr><td>16:00</td><td rowspan="3">Procurement, inbound and outbound logistics
Alessandro Coppo - Logistic and Supply Chain Manager</td><td rowspan="3"></td></tr>
<tr><td>16:30</td></tr>
<tr><td>17:00</td></tr>
</table>