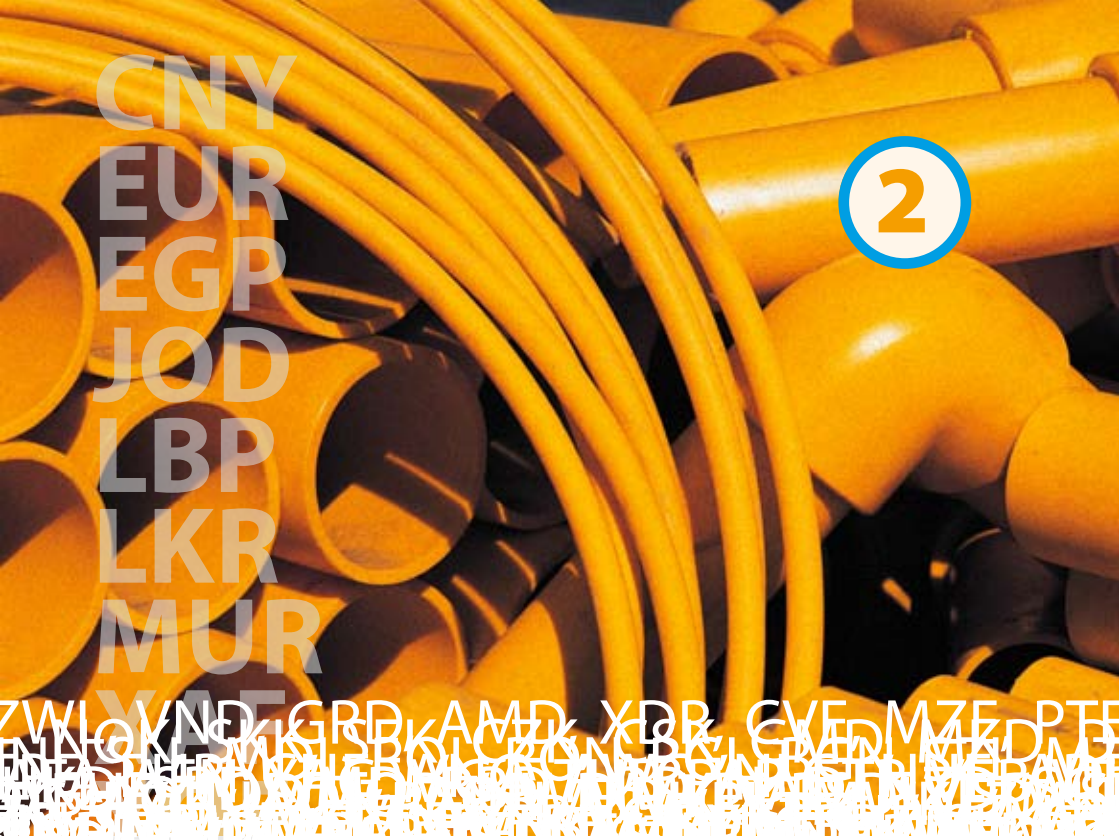


Plastic Pipes and Products Piping Systems Ltd., Mauritius

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

2.1 Objectives and organization of the pilot project

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

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

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

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

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

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

2.2 Introduction to the Company

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

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

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

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

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

2.3 Attitude of the company towards standardization

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

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

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

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

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

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

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

2.4 Application of the ISO methodology

2.4.1 Analysis of the value chain

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

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

2.4.2 The value chain of the plastic and plastic pipe industry

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

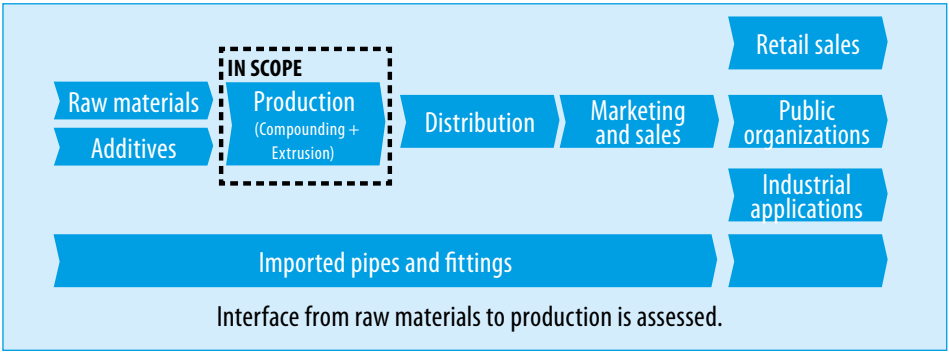


Figure 1 – Plastics industry value chain and scope

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

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

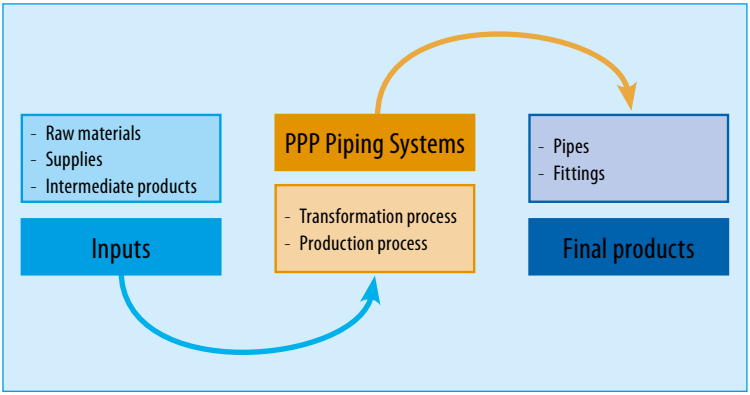


Figure 2 – PPP PSL in the plastic pipe industry value chain

PPP PSL's key target is the local market in Mauritius for sewerage, waste and drain discharge, including industrial applications and water

supply. In addition to the local market it also exports a portion of its products to Reunion, Madagascar, Comoros and the Seychelles.

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

2.4.3 Company value chain

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

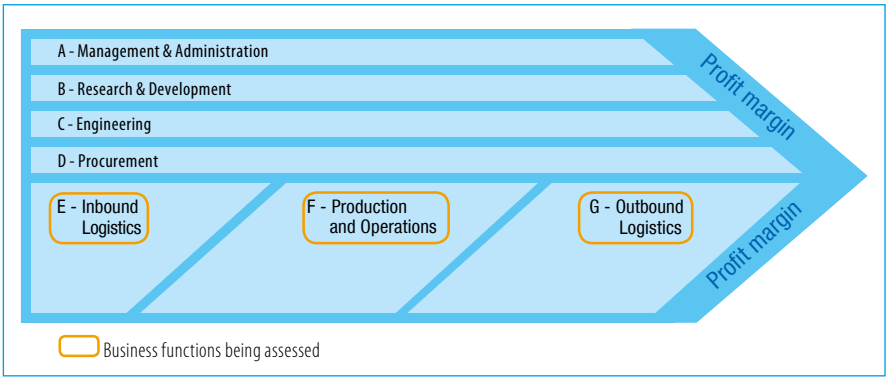


Figure 3 – Value chain of PPP PSL

The operations of the company are subdivided into a number of key business functions, each of which is associated with a set of specific value chain activities. The procurement function is responsible for purchasing raw materials and supplies for the company, and to evaluate suppliers. The activities concerned with the inbound and

outbound logistics functions comprise, among other things, testing of raw materials and final products to verify conformity with applicable standards or other requirements of the company. The research and development (R&D) function is inherent throughout production to improve the production processes and increase productivity. The production function is the core activity of the company where the raw materials are compounded and transformed into pipes, the final product of PPP PSL. The activities include preparation of the dry mix, and monitoring of the production process and product quality. The functions of marketing and sales and customer services are outsourced to a partner company, STR Marketing Ltd.

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

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

Table 1 – Business functions and related activities

2.4.4 Key value drivers

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

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

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

Table 2 – Value drivers for PPP PSL

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

Pipes manufactured by PPP PSL have obtained the product certification mark based on the relevant international standards issued by MSB. This mark gives consumers confidence in the products, and enables

the company to broaden its potential markets. The company acquired several sewage pipeline and drinking water supply contracts from public organizations, including those for export markets in the region. PPP PSL was also able to access the market in Reunion, a French outer island, after its products were certified by AFNOR.

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

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

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

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

2.5 Scope of the pilot project assessment

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

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

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

2.6 Standards used in the company value chain

The company uses standards essentially in the following business functions :

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The pipes and fittings produced by the company carry product certification marks based on the above standards. These marks are value drivers for the company and have helped it win an important

tender for the supply of pipes for the national sewerage project, as well as several other public contracts.

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

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

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

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

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

Table 4 – Impacts of standards

2.7 Selection of operational indicators to measure the impacts of standards

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

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

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

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

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

2.8 Calculation of the economic benefits of standards

The impact of standards can be assessed quantitatively through a change in the selected indicators and then expressed in monetary

terms as a reduction in costs, an increase in sales revenues etc., as shown in **Table 6.**

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

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

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

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

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

1) 1 MUR – 0.03301 USD.

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

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

This is an example of the value of standards applied as the basis for developing and/or producing new products that can generate revenues over and above contributing to efficiency gains. Such standards can help a manufacturer gain a leading position in a market, resulting in higher than normal revenues. This is in line with the characterization of PPP PSL in section 2.3 where its attitude to standardization has been described as strategic and the company can therefore be considered as a strategic standards adopter. Such a unique position, however, will be challenged by competitors over time, and the revenues from the production of this new product will eventually decrease.

2.9 Qualitative and semi-quantitative considerations

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

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

2.10 Evaluation of results

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

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

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

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

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

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

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

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

2.11 Conclusion

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

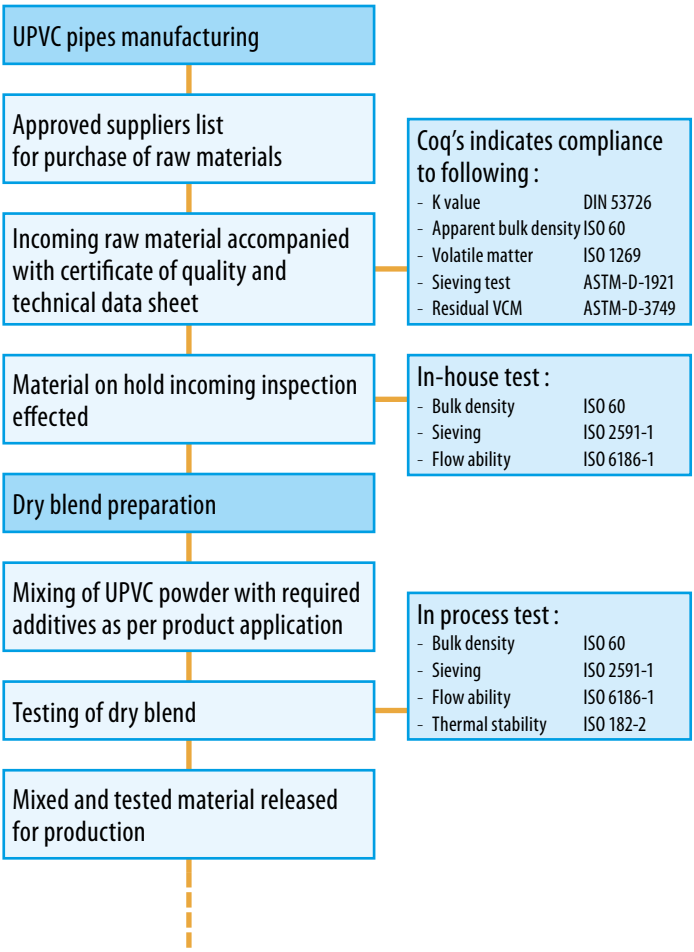
A longer study may reveal whether PPP PSL's competitive advantage can be maintained or improved by the use of standards.

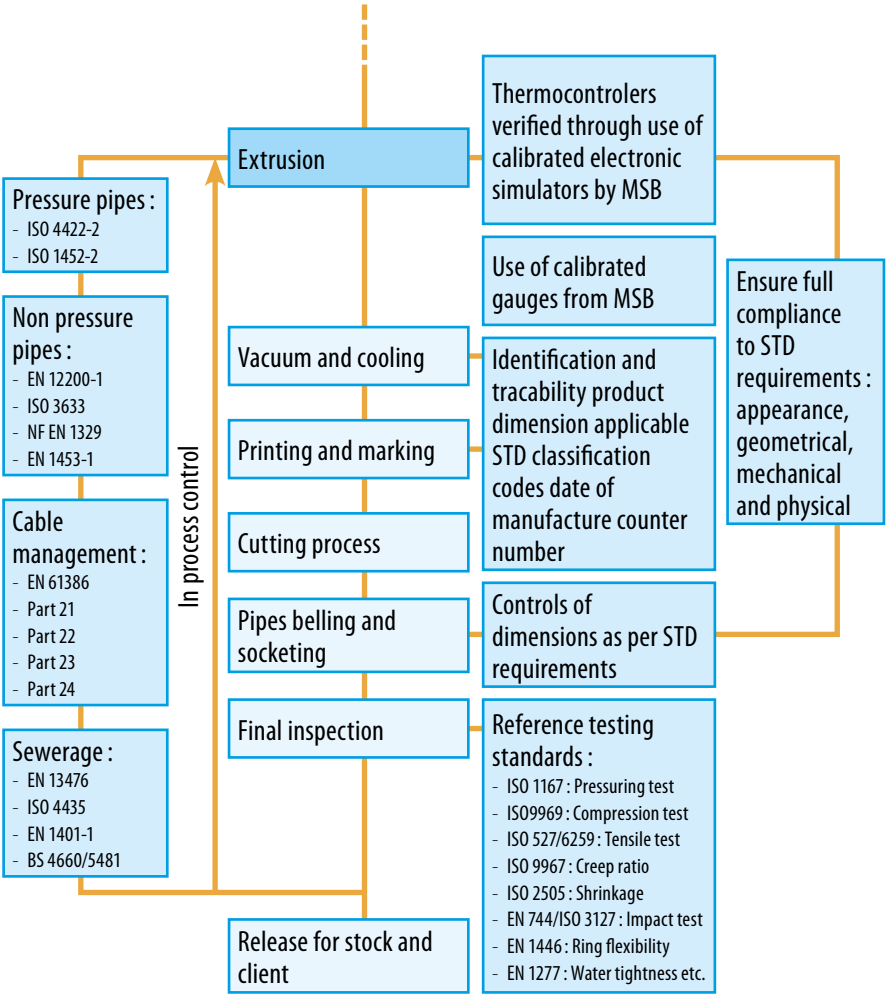
The methodology is applicable by comparing the results achieved before and after the implementation of the standards. Such a comparison, however, is often not available under real conditions, particularly for companies that have a certain history and operate in well established markets.

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

Annex : Production process flowchart – Standards map

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




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