ISO Pilot Project on Economic Benefits of Standardization

Lobatse Clay Works (Pty) Ltd

BOTSWANA

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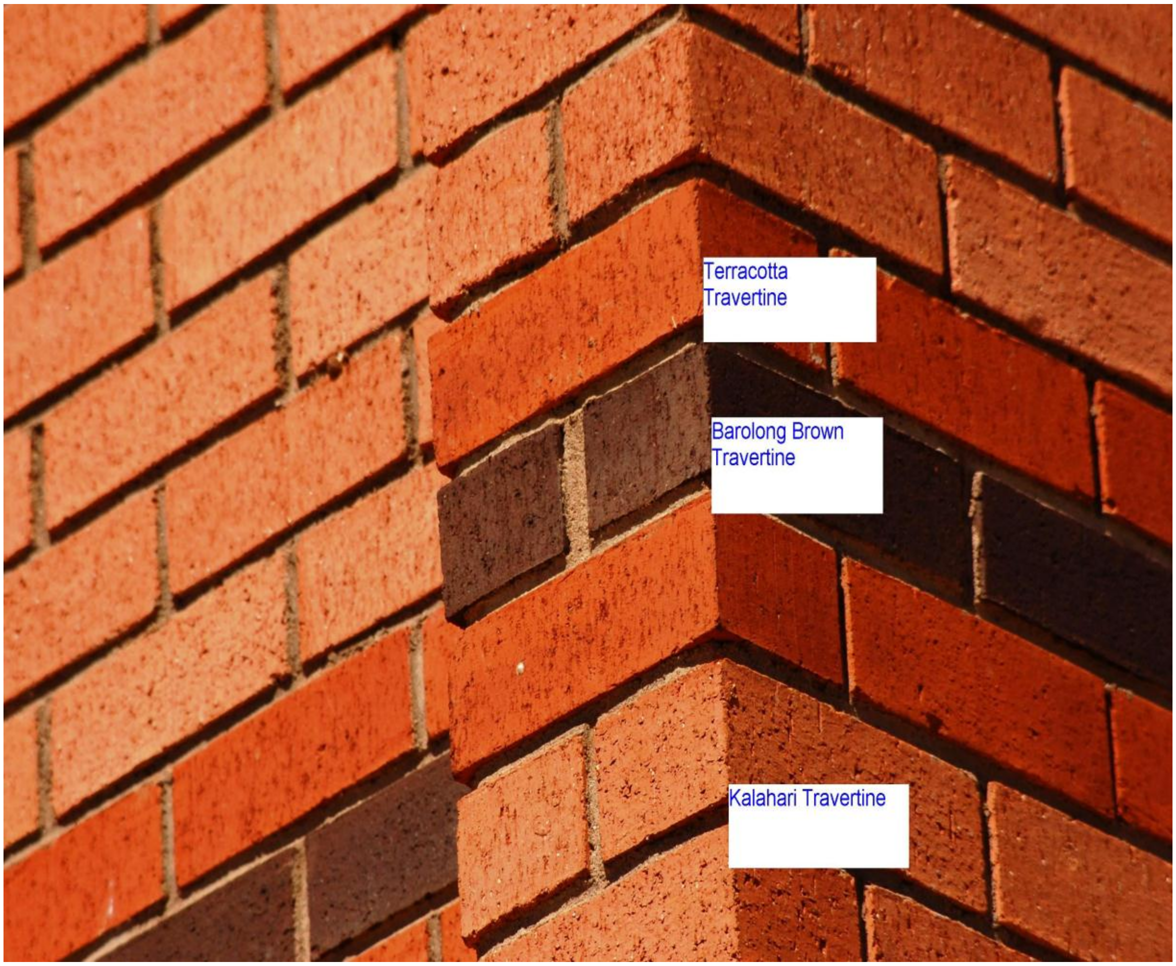

LOBATSE CLAY WORKS (PTY) LTD - BOTSWANA

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.

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

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:

a) Building and Construction Division (BCD1), Cement, Lime and Masonry Units
b) 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.

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.

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:

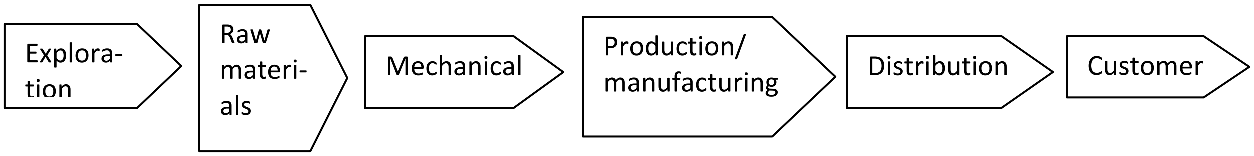

Figure 1 Process flow for clay brick manufacturing

4.2 Company value chain

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.

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 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:

i). Nil - no perceptible deposit of salts
ii). 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
iii). Moderate - a heavier deposit than 'slight,' but that has not caused powdering or flaking of the surface
iv). Heavy - a thick deposit of salts covering a large area of the unit, but that has not caused powdering or flaking of the surface
v). 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.

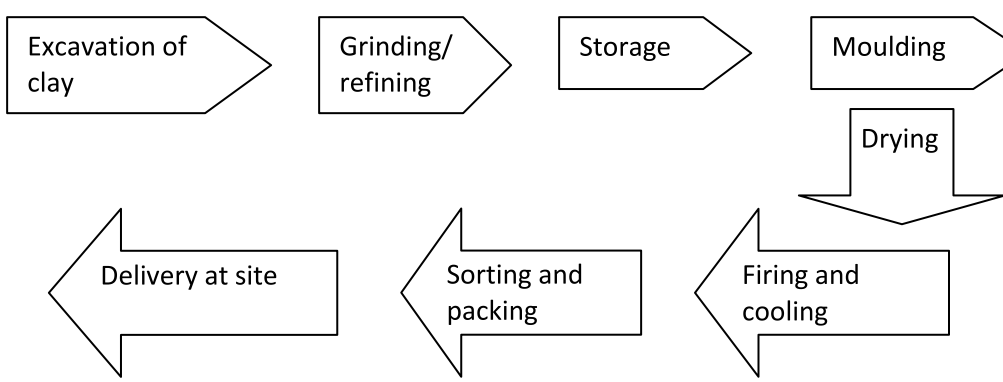

Figure 2 Lobatse Clay Works manufacturing process

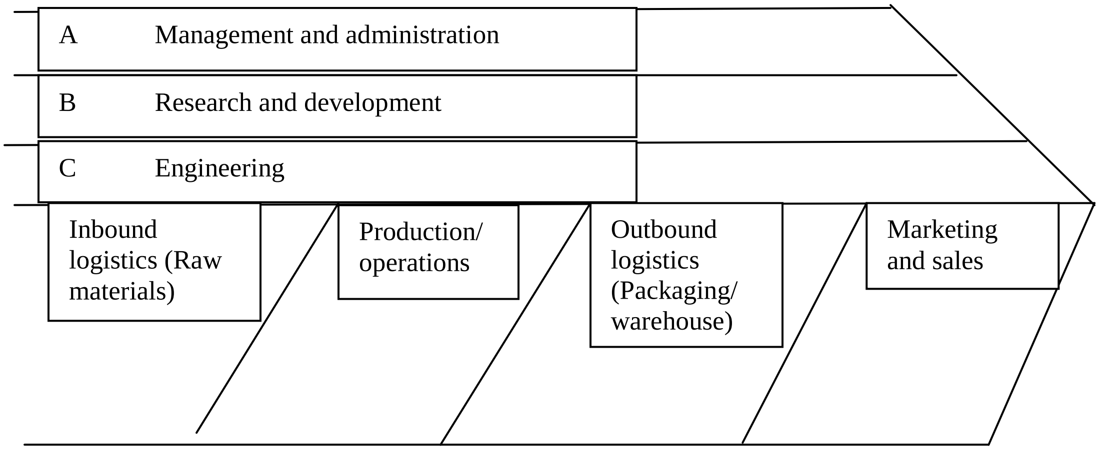

Figure 3 Lobatse Clay Works value chain

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.

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.

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:

Possible impacts of standards on the production/operations function

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.

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

As stated in Section 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 7.1 were chosen to measure the impacts and the economic benefits of standards:

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

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 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%
Storage prior to sales	BOS 28 BOS ISO 9001	Product failure rate [Ind. 3]	18%	6%

7.3 Calculation of the economic benefits of standards

On the basis of the percentage impacts given in section 7.2, the impacts are expressed in financial terms and impact on the company EBIT.

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**

7.4 Calculation of the overall impacts of standards on the company

7.4.1 Percentage of the 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%**

7.4.2 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.

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:

a. 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
b. 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
c. 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.

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. 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 a company.

ANNEX: Explanation of the calculation method of the standards impacts

The following general assumption was made when doing the calculations: Whenever the response for the impact of standards given from different company staff was within a range of e.g. 20-40 %, the uppermost number was used in the calculations, i.e. in this case: 40 %. For the definition of the four indicators, please see section 7.1.

The calculations were done in the following way:

1. It was established that the overall production costs related to the failure of equipment and supplies is 20% and the failure rate in equipment and supplies due to standards introduced or modified in the past five years was reduced by 5%.

INDICATOR 1: SAVINGS in production costs due to reduced failure rate in equipment and supplies	
Production costs total (2009):	BWP 30,000,000.00
Failures of equipment & supplies (20% of total production costs):	BWP 6,000,000.00
If no standards were used (the costs would be):	BWP 6,315,789.47
Difference (cost savings due to the use of stds in this activity):	**BWP 315,789.47**

2. It was established that the overall production costs related to product assembly is 32% and that the reduction in assembly cost due to standards introduced or modified in the past five years is 12%.

INDICATOR 2: SAVINGS in production costs due to reduced failures in product assembly	
Production costs total (2009):	BWP 30,000,000.00
Product assembly cost (32% of total production costs):	BWP 9,600,000.00
If no stds were used (the costs would be):	BWP 10,752,000.00
Difference (cost savings due to the use of stds in this activity):	**BWP 1,152,000.00**

3. It was established that the overall production/operation cost related to failure of products/services is 6%. The product/service failure rate due to standards is 12%.

INDICATOR 3: SAVINGS in production costs due to reduced product failure rate	
Production costs total (2009):	BWP 30,000,000.00
Production/operation cost (6% of total production costs):	BWP 1,800,000.00
If no stds were used (the costs would be):	BWP 2,016,000.00
Difference (cost savings due to the use of stds in this activity):	**BWP 216,000.00**

4. It was established that the overall production/operation costs related to accident is 0.1%. The accident rate was reduced by 5% due to the introduction of standards in the past 5 years.

INDICATOR 4: SAVINGS in costs due to reduced accident rate	
Production costs total (2009):	BWP 30,000,000.00
Cost due to accidents (0.1%):	BWP 30,000.00
If no stds were used (the costs would be):	BWP 31,500.00
Difference (cost savings due to the use of stds in this activity):	**BWP 1,500.00**