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The Impact of Standardization (Public and Industry) on Product Innovation, Market Access and Foreign Trade: with specific reference to South Africa

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This paper is submitted in partial fulfilment of the requirement for the degree Masters of Commerce in Economics.

DECLARATION

I, the undersigned, hereby declare that the work contained in this assignment is my original work and that I have not previously in its entirety or in part submitted it at any other university for a degree.

Signature_____

Date_____

ACKNOWLEDGEMENTS

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ABBREVIATIONS

APCER: Portuguese Association of Certification

CIE: Centre for International Economics

ESI: Electricity Supply Industry

ESLC: Electricity Suppliers Liaison Committee

HACCP: Hazard Analysis Critical Control Point

IAP: Interested and Affected Parties

IG: Interest Group(s)

ISO: International Standards Organisation

NRS: National Rationalized Specifications

SABS: South African Bureau of Standards

SDB: Standards development bodies

SPS: Sanitary and Phytosanitary Standards

SR: Standardization Revenue

STANSA: Standards South Africa

TBT: Technical Barriers to Trade

TSD: Technology Standardization Department

UG: User Group(s)

WG: Working Group(s)

CHAPTER ONE: INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

The debate on the impact of standards on product innovation, market access and the trade performance of countries is at present very topical in South Africa.[1] Another aspect of the debate concerns the question of who should be responsible to impose product standards, government or private standards setting institutions?

Some researchers argue that formal standards can impede innovation. These researchers argue that standards reduce product varieties that are important for new innovations. On the other hand, other researchers found that standards are in general public goods and a form of technical infrastructure that can enable innovation. Also from a macroeconomic view point standards help to reduce transaction costs between different actors and reduce information asymmetries. The reduction in information asymmetries for the consumers increases their willingness to pay more for the product that in turn increases the success of the innovation, thereby enabling innovation. Standards were found to reduce transaction costs. This is reflected in reduced production and distribution costs for suppliers. For consumers it is reflected in reduced search and testing costs as well as reduced time and effort costs when it comes to evaluating quality. Furthermore the draft papers of standards contain information that can assist researchers to generate new ideas.

Empirical studies in developed countries found a positive effect of standards on technological change. Our understanding of the mechanism through which standards assist in the success and diffusion of innovations is insufficient in developing countries and specifically in South Africa.

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[1] In 2005 the Department of Economics at the University of the Western Cape was contracted by the SABS to investigate the economic impact of standardisation in South Africa. In October 2006 a conference on standardisation was held at Sandton Convention Centre were they discussed the Economic impact of standardisation; standards and transport industry (taxi recapitalization programme); SMME assistance; Food and Health issues

As a result of globalisation traditional trade protection measures such as tariffs and quotas became unpopular. However, to a certain extent, they are being replaced by non-technical barriers to trade, such as standards. There is a growing concern amongst developing countries in particular, that standards are being used unfairly to restrict market access which negatively impacts on their chances to gain market access and thus affects their trade performance.[2]

Economic theory and empirical studies on the impact of standards on market access indicate that the net result is not necessarily positive. For instance, some economists argue that standards are used as an instrument of protection which negatively impacts on market access and export performance. Furthermore, because developing countries may not have the necessary technical or administrative capacities, relatively high compliance cost may cause a comparative disadvantage. Contrary to the mainstream perspective, other economists claim that standards result in higher quality products and can thus be a source of competitive advantage which may contribute to successful market penetration and export performance.

Another issue of debate is who should be responsible for standardisation? Some experts argue in favour of public standard setting institutions, whilst others advocate for market driven standardisation because public standard setting institutions are claimed to be too slow to meet the needs of the producers. On the other hand, firms responsible for market driven standards tend to monopolise markets and create barriers to entry. Furthermore, according to IISD (2003) the standardisation market is becoming increasingly fragmented, which results in higher compliance costs and higher prices (for those trying to meet these standards), which will reduce market access and thus negatively impacts on export performance.

For South Africa as a developing country the successful penetration of export products into foreign markets, which will reduce the trade deficit and also improve economic growth is of vital importance. Therefore with the above in mind this

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[2] According to the International Institute for Sustainable Development (IISD) project (2003, unfair restriction to markets include lack of information on the relevant standard, lack of relevance of the standard to exporter, standard applied without adequate warning or timeframe, different standards applied by different export markets , capacity constraints in meeting standards. [available online] http://www.iisd.org/standards/project_outputs.asp

research paper will identify the factors that are contributing to the possible negative impact of standards on market access and may make a contribution to the present debate and assist policy makers in South Africa.

With the above in mind the objectives of this research paper are:

- To examine the economic theory regarding the impact of product standards on product innovation, market access and export performance;
- To explain the mechanism through which standards affect and assist in the efficient diffusion of product innovation;
- To examine the findings from empirical studies on the net impact of standards on product innovation, market access and export performance;
- To explain the findings from empirical studies in South Africa;
- To examine which institutions (public or private) should be responsible for setting standards.

1.2 RESEARCH METHODOLOGY AND CHAPTER OUTLAY

The paper presents an overview of the relevant literature and a typology case study analysis to determine the effect of multiple standards and compliance costs on trade (market access and exports) within the automobile, fishery and fruit sectors of South Africa.[3] In addition, case studies of the impact of trade on the environment are presented within the coal, steel and citrus sectors of South Africa. This paper is largely quantitative as it aims to describe the relevant phenomena as they are and to obtain information on the nature of specific problems or issues.

The paper is structured as follows: Chapter two presents a brief overview of the economic theory of standards on product innovation, market access and trade performance. It firstly presents the different definitional matters concerning standards. It then highlights the different mechanisms through which standards affects innovation, thereafter it presents three theoretical perspectives of the impact of

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[3] These sectors were chosen because automobile sector is the biggest contributor to the manufacturing industry in addition information on these sectors was readily available.

standards on trade (comparative advantage, comparative disadvantage and intra-industry trade). Furthermore it provides theoretical perspectives on the links between trade and environmental standards.

Chapter Three presents an assessment of the impact of standards on market access and trade performance in the automobile, fishery and fruit sectors of South Africa. Furthermore the chapter provides a further assessment of the impact of environmental standards on trade in the coal, steel and citrus sectors of South Africa. In Chapter Four the report provides an overview of international empirical studies on the impact of standards on product innovation, market access and export performance. In addition the chapter presents a comparative analysis. Chapter Five provides the general conclusion.

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CHAPTER TWO: THEORETICAL FRAMEWORK

2.1 INTRODUCTION

As explained in the introduction, this chapter provides a descriptive overview of the relevant economic theory on the impact of standards on product innovation, market access and trade performance. It begins by identifying and classifying standards according to their economic effects. Thereafter the focus will be on the impact of standards on product innovation, market access and trade performance. As standards can be produced by both market institutions and public institutions, the important question of who should be responsible for standardisation is addressed. This theoretical framework was compiled by investigating international experiences.

Section 2.2 presents the different definitional matters concerning standards. Section 2.3 identifies the different mechanisms through which standards affects innovation, while Section 2.4 highlights the three theoretical perspectives on the impact of standards on, market access and foreign trade. Section 2.5 deals with the important question of who should be responsible for standardisation. Finally, Section 2.6 provides summaries and conclusions.

2.2 DEFINITION AND TYPES OF STANDARDS

Standards can be defined as "…documented agreements containing technical guidelines to ensure that materials, products, processes, representations, and services are fit for their purpose" (Allen and Sriram, R. 2000). Standards are commonly categorized in terms of their economic effects. Other economists chose to categorize them as being formal or de facto[4] standards (Blind, 2004:14). The economists that decided to classify standards according to the economic problems that they solve mainly considered four dimensions of standards. These dimensions are compatibility, quality and safety, variety-reducing and information standards.

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[4] This is a term that is ascribed to standard setting organizations that are not recognized either directly or indirectly by any government (Krechmer, 2006:44)

2.2.1 Compatibility Standards

According to Tassey (2001) compatibility standards "…specify properties that a particular product must have in order to work physically or functionally with complementary products within a product or service system." According to Farrel and Saloner (1985), the importance of standards for compatibility grew significantly with the developments of network industries. Compatibility standards mainly assist in increasing market opportunities due to the fact that they foster network effects (or externalities). Examples of this type of standard are mainly used in telephones, personal computer software, bank automatic teller machine (ATM) networks. These are standardized so that they are compatible among different banks. (Blind, 2004:15).

2.2.2 Minimum Quality and Safety Standards

Minimum quality "…standards are developed to specify acceptable product or service performance along one or more dimensions such as functional levels, performance variation, service lifetime, efficiency, safety…" (Tassey, 2001). According to Blind (2004:18), consumers are usually not fully informed about the characteristics of a good. They suffer from what economists call information asymmetries. This leads to two results namely a moral hazard and adverse selection. Leland (1979), shows that standards that define a minimum amount of quality can assist in reducing the problem of adverse selection. These are known as minimum quality standards and assist consumers to distinguish between high quality and low quality before purchase (Hudson and Jones 2001).

2.2.3 Variety-Reducing Standards

Blind, (2004:20), points out that standards reduce the number of characteristics such as quality and size, in addition to limiting the product to a certain range. These are known as variety reducing standards. Variety reduction perform mainly two functions. Firstly by reducing the number of variations, it leads to economies of scale that leads to lower costs per unit (Dixit & Stiglitz, 1977). The second is that they can help a market to focus that can assist a market take off.

2.2.4 Information Standards

Standards assist in providing valuable information to the public. These are known as information standards. Information further helps the public to quantify and evaluate product characteristics (Tassey, 2000). Information is provided by means of publications and electronic data bases.

The next section presents the mechanisms through which standards affect innovation and growth.

2.3 STANDARDS AND INNOVATION

New Innovations that is "…the introduction of something new, such as an idea, method, or device" are important in increasing economic prosperity (Allen & Sririam, 2000). According to Pleskovic and Stiglitz (2000), once a product was introduced into the market its method of production can be spread.

Swann (2000) argues that the production of new products is a necessary condition for innovating firms. However, it is not a sufficient condition. A sufficient condition is that these new products need to be diffused into the economy in order for them to cause increased positive economic effects. This can be done by an efficient standards institution. Specific standards such as compatibility standards were found to promote innovation and interface standards were found to be positive for economic growth (Hayvattinen, 2006).

2.3.1 Mechanisms through which standards affect Innovation

The various mechanisms through which standards may affect innovation will now be investigated.

2.3.1.1 Standards and Public Information

Krechmer (2006), indicates that the drafts papers of standards contain information about the technology that is being used. Researchers can therefore use this information to generate new ideas. Furthermore in the case of formal standards this information is publicly available. Since it is publicly available the information can be freely transferred between the standards institution and the users of the standard. The

information also assists in the effective spreading of technology throughout the economy (Tassey, 2000).

2.3.1.2 Standards and Information Asymmetries

Jones & Hudson (1995) point out that another channel through which standards affects innovation is through the reduction of information asymmetries. For the consumers information asymmetries are reduced when products are standardized. The consumer's willingness to pay more for the product increases. This in turn leads to an increase in the probability of a new innovation (Blind, (2004:27).

2.3.1.3 Standards and Network Externalities

Farrel & Saloner (1985) indicate that network externalities exist if the positive external effects appear in consumption. The benefit depends on the total number of people who buy the network good. In the case of physical networks the increase in the number of consumers who use the same network would increase the consumption benefit for everyone on that particular network. Compatibility standards associated with new technology are able to increase the chances of new innovation by reducing the risk of not reaching critical mass (Blind, 2004:31).
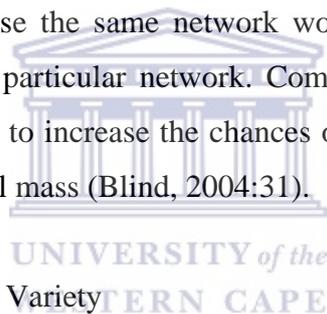
2.3.1.4 Standards and Product Variety

Tassey (2000:591) points out that standards were found to reduce variety. Variety reduction typically assists economies of scale to be achieved and this leads to a reduction in cost. The reduction in cost helps to achieve critical mass that is needed for new innovations (Ronnen, 1991).

2.3.1.5 Negative Impact of Standards on Innovation

Maxwell (1998) pointed out that formal standards can inhibit innovation. Minimum quality standards can reduce the profitability of innovation. In addition the reduction in innovation incentives due to minimum quality standards may also reduce social welfare. Furthermore according to evolutionary theory variety is needed for technical change. Therefore the reduction in variety can affect technical change negatively (Krechmer, 1998-1999; Blind, 2004).

According to Tassey (2001) another constraining effect of standards on innovation relates to timing. It was found that a standard that is introduced too early can shut superior technology out. A standard that is introduced too late increases the cost of using the standard and this ultimately prevents diffusion.

TABLE 1 Overview of influence of standards on technical change

	Positive effects	Negative effects
Compatibility Standards	• More possibility of combining system elements, forming Network bridges	• Impeding transition from old to new technology
Minimum Quality/Safety	• Reducing information asymmetries • Greater probability of market acceptance of new products	• Lock-in of technology status quo
Variety reducing	Cost reduction, which fosters the accomplishment of critical masses of new products	• Reduction of variety
Information Standards	• Information on state of technology; Source for new technological innovation (i.e idea generation)	

Source: Blind, 2004:28

Vernon (1966)as quoted by Chacholiades (1990) generalized the technological gap theory[5] into the product cycle. The product cycle stresses the standardisation of products. The three stages are new product, maturing product and standardisation. A mature product becomes standardized and the comparative advantage moves from a relatively abundant country in skilled labour to one of unskilled labour.

The next section presents the theoretical link between standards, market access and foreign trade.

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[5] Posner proposed the technological gap theory that makes use of the sequence of innovation and imitation particularly as it affects exports.

2.4 STANDARDS, MARKET ACCESS AND FOREIGN TRADE

This section presents the three theoretical perspectives on the impact of standards on market access and foreign trade. The first perspective relates to standards and the theory of comparative advantage, whilst the second relates to the trade deterrent impact or comparative disadvantage of standards. The third perspective is on the intra-industry role of standards. Section 2.5 deals with the important question of who should be responsible for standardisation.

Over the past years global market conditions were changing rapidly. Firms are now required to meet more diverse, personalised and refined societal preferences and customer tastes. Consumer demand forms the basis of both voluntary standards that are informal rules that are applied in industries as well as formal rules. Failure to comply with standards that are mandatory in national and international law prohibits market access and reduces trade. According to Wilson[6] & Abiola (2003) standards are supposed to enhance market access which in turn would contribute to export led growth.

Chen et al. (2006) argue that standards impede market access and thus negatively affect trade. As stated earlier this is because standards can be used in a protectionist manner and may cause relatively high compliance costs, because countries do not have the necessary technical as well as administrative capacities. Contrary to the mainstream perspective, other economists argue that standards can help in the success of exports and thus stimulate trade. The main reason for this is that standards can be a source of competitive advantage (Jaffee & Henson, 2004:1).

The next section presents the three theoretical perspectives on standards and trade.

2.4.1 Standards and Comparative advantage

It is clear from the literature that price competitiveness alone does not determine the development of world market shares. World market shares are determined by the quality of products and service competition. According to Blind (2004:45)

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[6] John Wilson is the leading economist at the World Bank and an authoritative figure on standards and trade. He will be quoted extensively in this paper.

competitiveness within the context of international trade is being determined by absolute differences in product quality. The perception of quality can be increased by national standard systems, which will then boost trade performance. Both international and idiosyncratic standards can generate comparative trade advantages by raising the level of product quality (Swann *et al*, 1996).

Wilson and Abiola (2003) claim that standards facilitate trade through reduced transaction costs and improved linkages between firms across industries. Variety reducing standards that allow for economies of scale, thereby assisting in the reduction of transaction costs. Furthermore Tassey (2000) claims that standards can improve economic efficiency because they can decrease transaction costs. Lower transaction costs can enhance market access as well as promote exports. In addition Blind (2004:47) argues that other types of standards, such as compatibility and quality standards stimulate export performance. The perception of the quality of domestic goods can be increased by a national standardisation system abroad and at home, thereby increasing their competitiveness. Furthermore, increasing the quality of products or exploiting economies of scale create price advantages which in turn lead to trade advantages.

2.4.2 Standards and Comparative Disadvantage

The traditional view argues that national standards can inhibit trade and competition. This is linked to the growing concern that standards are being used as discriminatory non-tariff barriers to trade. Some of the reasons are to avoid negative environmental effects and to use as instruments for strategic industrial policies. Furthermore as domestic products are manufactured according to domestic standards, this can lead to incompatibility with export market standards leading to sales problems (Blind, 2004:47).

According to the *Competitive disadvantage hypothesis* "…if domestic standards look idiosyncratic to foreign buyers, then export markets will be hard to find…also if idiosyncratic standard which is difficult for foreign producers to meet may act as barriers to imports" (Swann *et al*, 1996). The *Competitive disadvantage hypothesis* according to Blind and Jungmittag (2005:1387) "…states that national standards can also lead to a competitive handicap for the domestic producers, because conforming

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to them increases the production costs and the length of the registration procedure." Wilson & Abiola, (2003) further argue that meeting these standards involves costs known as compliance costs.

Chen *et al.,* (2006:4) refer to channels through which standards affect exports. Firstly if domestic products are manufactured using guidelines that are particular to the national standards, then these may not match the standards in their export markets. Secondly, standard setting institutions can set standards peculiar to the technology capacity of domestic firms. This has the impact of increasing foreign exporters' costs when they try to meet the requirements. Increasing costs for exporting firms can inhibit market access and trade. Thirdly, delays in obtaining information that is related to standards can create implicit barriers for firms exporting.

According to IISD (2003), should standards be set at a reasonable level and they restrict market access then they would have the intended effect. However, market access problems occur due to:
-        lack of information on the particular standard;
-        contents of standard are not relevant for exporter due to differing environment situation;
-        standards being set without timeframe;
-        different export markets applying different standards;
-        capacity constraints in meeting standards;
-        inability of exporters to prove that they complied with the standards
Should market access be restricted due to the above reasons, then it would be considered as unfair.

2.4.3 Standards and Intra-industry Trade
The third theoretical perspective relates to regional and international standards. The reason is that common and harmonised standards can be conducive to trade (Blind, 2004). Agreements on quality, size and weights lead to the demolishing of trade barriers. According to Swann et al (1996) common standards in two countries can help to facilitate trade between the countries. Furthermore, international standards are able to increase intra-industry trade by making specialisation in trade more predictable. Common compatibility standards have a general trade promoting effect,

whilst variety reducing standards will promote intra-industry trade. Also replacing an idiosyncratic national standard by an international standard may have a general trade-promoting effect or on the other hand it may result in a reduction in variety. This would make the overall effect on trade unclear. The '*Intra-industry trade hypothesis*' states that using international standards that are equal to idiosyncratic national standards is more trade creating than using idiosyncratic national standards (Swann et al, 1996). Table 3 summaries the three theoretical perspectives on standards and trade.

TABLE 2: Three theoretical perspectives on standards and trade

Theoretical Approach	Type of standard	Economic Effects	Impact on Exports	Impact on Imports
Competitive Advantage	International: Yes National: Yes	Improve Quality/ Reduce costs of National product	+ +	− −
Trade Distortion / Comparative disadvantage	National Product Standards National Process Standards	Reduce openness of national Markets Increase production costs of domestic producers	− −	− +
Intra-industry	International National Compatibility standards Quality standards Variety reducing Standards	Increase openness Of national markets Increase openness of national market Reduce product variety	+ + −	+ + −

Source: Blind & Jungmittag, (2005); Swann et al. (1996)

According to Jafta (2006), issues around market access for developing countries were discussed at the Doha Development Round, in particular how "…the (ab)use of anti dumping measures to limit market access…". This is also another area of concern.

Trade and environment standards

Copeland and Gulati (2003) point out that the stringency of environmental standards is likely to be dissimilar across countries. More stringent environmental standards

would thus be likely in rich countries than in poor ones. Furthermore increases in income due to trade could increase the demand for environmental quality thus leading to a demand for further stringent environmental standards.

The main hypothesis is the *race to the bottom hypothesis*. The race to the bottom hypothesis states that "…countries that are open to international trade (and investment) will adopt looser standards of environment regulation, for fear of loss in international competitiveness" (Frankel and Rose, 2002). Beghin (2000) also points out that the race to the bottom phenomenon is seen when there are open movement of goods across countries that have different environmental regulations - it causes developing countries to draw dirty industries and become pollution havens.

Xu (1999) indicates that the *race to the bottom hypothesis* is a concern that was raised by developed countries. It basically states that "…If free trade occurs between countries with different environmental standards, countries with higher environmental standards will be forced by their domestic interest groups to lower their standards to ensure the survival of their environmentally sensitive industries" (Xu, 1999:1216). This would therefore lead to a race to the bottom when trade is opened. An opposite hypothesis from the one above is the *gains from trade hypothesis*. It is argued that countries caught up in trade are able to obtain more of everything that they want such as environmental goods. It is further argued that the international ratcheting up of environmental standards can help in openness and this can have a positive impact on environmental quality (Frankel and Rose, 2002).

Frankel and Rose (2002) further point out another hypothesis concerned with the impact of trade on the environment known as the *pollution haven hypothesis* that states that some countries will use lax environmental standards. They do this is order to attract multinational corporations. On the other hand countries with high environmental quality will use high standards and will import pollution-intensive goods. According to Cropper and Oates (1992:697-698), the pollution hypothesis basically states that "…if free trade occurs between countries with different environmental standards, countries with lower standards will tend over time to develop a comparative advantage in environmentally sensitive industries which will result in 'havens' for the worlds dirty industry" (Cropper and Oates, 1992:697-698).

2.5 STANDARDISATION INSTITUTIONS: PUBLIC VS MARKET

In the latter part of the 20th century there was a rapid progression in the information and communication technology industries. This in general led to a need for new standards and in addition it put pressure on the form of standardisation[7]. Specifically standard setting institutions that set formal standards were challenged by an increasing tendency towards de facto industry standardisation (Blind 2004:1)[8].

The increasing shift towards consortia (de facto) standardisation is due to the fact that standard setting organisations divided into fragmented organisations. This resulted in independent product development groups in the standardisation process and with it an increase in consortia standardisation (Krechmer, 2006:45). Due to this, some researchers argue that government standard setting institutions should play a less significant role in standardisation while others went as far as to advocate that government involvement in standardisation is not needed.

The next sections analyses reasons why government involvement in standardisation may or may not be desirable. Furthermore the sections present the debate between a public standards setting process and the market process.

2.5.1 Standards as Institutions

Institutions create "…a set of constraints on behaviour in the form of rules and regulations; a set of procedures to detect deviations from the rules and regulations; a set to detect deviations from the rules and regulations; and finally, a set of moral, ethical behavioural norms which define the contours that constrain the way in which the rules and regulations are specified and enforcement is carried out…". In other words, institutions are the "rules of the game" of social interaction (North, 1991)

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[7] According to Krechmer (2006:44) Standardisation "…includes the implementations of the standard (by implementers) and use of the implementations of the standard (by users)."
[8] According to Belleflamme, (2000:2) formal standards "… are mandated by government bodies or arise out of deliberation of voluntary standards-writing organizations" while de facto standards "…are produced through unfettered market processes."

It was argued that institutions can lower transaction costs, which can help in facilitating specialisation and exchange, by rendering behaviour more stable and predictable. By being able to predict behaviour, institutions can assist in lowering transaction costs. This is done by lowering information costs and spreading risk (North, 1991:105).

"For economies to work towards an institutional framework that consists of growth enhancing incentives, trial and error is essential. No one knows what the 'right' policy choices are, but through feedback and incorporating this feedback in future policy, the country stands a much greater chance of developing a growth enhancing institutional framework. Unfortunately, this important element was absent in Zambia in the first thirty years after independence" (Du Plessis, 2006:16).

Marasco, & Dodson, (2004:56), points out that variety reducing standards that allow economies of scale assist in reducing transaction costs. Furthermore standards were found to be efficiency enhancing because they are able to decrease transaction costs. In addition variation reduction standards reduce production costs for suppliers, while for buyers it was associated with lowering search and testing costs. Standardisation also reduces the costs of uncertainty. These costs are associated with assessing product quality. Cost savings are revealed in the decrease of time and effort which consumers use on search (Jones, & Hudson, 1996).

The next section presents the economic rationale for government involvement in standardisation.

2.5.2 Economic Rationale for Government in Standardisation

The economic rationale for government's involvement in standardisation is based on market failure that needs some kind of public intervention. The relevant market failures are externalities, asymmetric information and increasing returns to scale.

Government participation in standardisation requires that at least two pre-conditions be met. Firstly the market outcome must not be efficient and secondly government's participation should result in an improvement (Swann, 2000:33). Indeed, there are

some reservations that government involvement in unsatisfactory market results can make an improvement.

According to Brown & Jackson ( ), governments have a role to play in regulating the behaviour of producers in order to protect consumers. Regulation is there to protect the public interest against the undesirable outcomes from unregulated markets. Consumers cannot assume this responsibility due to the "…high costs in obtaining and interpreting information relating to product safety and design." Furthermore consumers may also not have the necessary resources to establish and enforce minimum standards. Therefore government has a role in constructing a regulatory system that will provide the necessary information and establish and enforce minimum standards.

However, according to Brown & Jackson (   ), others argued against the regulatory role of government. This role inhibits efficient choices of markets as well as personal freedom. Furthermore this role imposes costs such as bureaucratic costs of administrators and conformity costs in respect of consumers and producers. In particular recent experiences in the US and UK have highlighted this perspective. In the US it was estimated that between 1970 and 1980 the cost of regulatory activities increased from $0.9 billion to $6.5 billion ($3.3 billion at 1970 prices). Comparing the benefits and costs of regulation in the US and UK, led to arguments in favour of deregulation in areas such as automobile safety standards, environmental controls, etc.

Another argument is with regard to whose interest do the regulators serve. According to the 'capture theory' of regulation the regulators are serving the interests of sectional interest groups, in particular the big businesses and not the public interest. (Brown & Jackson,   ). This section will discuss the first two types of market failures. These are externalities and asymmetric information.

2.5.2.1 Externalities
According to Black *et al*. (2005), externalities drive a wedge between private and social costs and benefits associated with everyday transactions. The main problem with externalities is that one or more economic units' actions influence the costs or

benefits of other economic units. These actions can be of a technological nature, when they have a direct effect on the level of production or consumption of the other party. This happens without them paying monetary compensation or respectively being paid. Furthermore the market will under-produce when the externalities are positive as some socially desirable investments would not appear profitable to them. On the other hand when there are negative externalities the market tends to over produce as these socially desirable investments would appear profitable to them (Swann, 2000:34).

Blind (2004:37-39), argues that standardisation was seen as a form of soft infrastructure that is a public good or contains characteristics of a public good. If the market mechanism was left to produce standardisation in the presence of positive externalities, it would produce inadequate standardisation. This would happen if the positive externalities (from network externalities) are not fully internalized and the costs from standardisation processes are borne only by the standardizing party. When government accepts the role of the standard setting institution, it could result in a suboptimal solution, if the standardisation succeeds in internalizing the external effects.
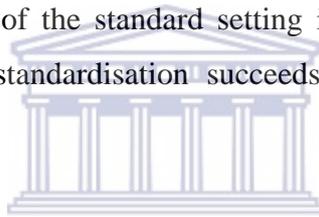
According to Weiss & Cargill, (1992), consumers obtain benefits in markets that contain network externalities, both from consuming the product as well as from the number of consumers who purchase the product. The telephone network is an example where the value of this network to the consumer increases as the number of people that they can call increases.

2.5.2.2 Asymmetric Information

According to Black, *et al.* (2005:21-22), consumers do not always have at their disposal the information necessary to make rational decisions. In this case consumers may be unaware of potentially harmful properties in some goods and services that they consume. They may also be unaware that they could obtain the goods at a lower price.

On the other hand producers may not be aware of the latest technologies that are available in the same line of business. Furthermore even if they were ready to pay for the information, it would not be possible as they would need to calculate the cost. It would not be possible for them to calculate the cost without the additional

information. Both consumers and producers must accept that the lack of information is a binding constraint on them.

The ascertainment of a market price was singled out as the main problem of information (Stigler, 1961:1). This type of market failure is known as asymmetric information that is present among producers and consumers and makes it impossible to find an acceptable price for trade (Swann, 2000). Gresham's law is an example of asymmetric information that points out that 'bad drives out good if the exchange for the same price'. This law was first proposed by Sir Thomas Gresham (1519-1579) (Swann P, 2000:34). The law basically says that currency in circulation that has both bad and good money, and that the two forms are accepted as legal tender by law on equal value. Then we would expect the bad money to become the dominant money. This would happen because people would not spend the good money and prefer to hand over the bad money instead.

The law was applied in many circumstances. In a paper presented by Akerlof (1970) he shows how the interaction between quality and asymmetric information may lead to a market disappearing. The model shows how quality is unkown by the buyer due to asymmetric information. Thus it presents incentives for the seller to sell a low quality good as a high quality good. The buyer will take the quality of the good as being uncertain and therefore this leads to the average quality being considered. This will therefore drive the above average quality goods out from the market. This leads to markets not existing were there is quality uncertainty. This model was described by Akerlof in terms of the used car market were he found that bad quality cars drive out good quality cars. Leland (1979) shows that suboptimal quality levels are present in markets with asymmetric information. Quality standards can therefore help to overcome Gresham's law. The quality standards would assist consumers to distinguish between high quality and low quality. This would allow the high quality seller to maintain a price concordant with their superior product. This shows how quality standards have a role to play in alleviating market failure. It led to some researchers arguing that government has a responsibility in providing individual citizens with information. The standards institutions can therefore provide information to consumers about the goods that they are buying.

2.5.2.3 Public Standardisation versus Market Standardisation

Some economists argue that the process of setting standards by public standards setting institutions takes too long. Therefore when the public standards reach the market it arrives too late and is therefore of no use to the firms using it (Swann, 2000:14). Part of this argument is related to the timing of standards on innovation. It was found that a standard that is presented too early can prevent the use of superior technology. On the other hand a standard that is presented too late raises the cost of using the standard and this can ultimately prevent diffusion.

Farrel and Saloner (1988) were the first economists to compare public standard setting institutions and market institutions in standardisation. They find that according to the common view standards defined by the market mechanism known as consortia are quicker compared to formal standards set by standards institutions, which take much longer to produce. The market mechanism works when one dominant agent openly choose to commit to one standard. When this happens other agents in the market know that by using that standard they will be compatible with the leader. Furthermore they will also possibly be compatible with others that may choose to use the standard. This type of mechanism has a kind of bandwagon effect. This bandwagon effect is sometimes able to achieve effective and rapid coordination. Farrel and Saloner conclude that formal standardisation, although slower, is able to achieve productive coordination and outperforms the market mechanisms even when speed is taken into account.

There are a number of reasons as to why market led standards are set much quicker than government institutional setting bodies. Firstly the participants are all motivated to reach some kind of result. Thus they tend to ignore formal procedures. Furthermore the participants tend to exclude certain interest groups (Updegrove, 1995:144). This exclusion of certain interest groups is done in order to speed up the setting of standards. The argument is that the greater the group the slower will be the process of producing standards. The main interest groups that are excluded from the process are consumers and small micro and medium enterprises. Contrary to the perspective that was highlighted above, is that market driven standards are not open and tend to monopolise the market.

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According to Belleflamme (2000) formal standards are much slower in being formulated compared to de facto standards within the context of rapid technological progress. However, formal standards are preferred to de facto standards as they are "…developed through agreed, open and transparent procedures, based on a consensus of all interested parties. They represent thereby a particular legitimacy and avoid costs, associated with de facto standards, of adopting privately profitable, but socially undesirable technologies."

Wegberg (2004), points out that the introduction of consortia into standardisation resulted in the fragmentation of the standardisation processes. This further led to multiple standards. According to the common view public standard setting institutions are too slow due to their lack of inflexibility and bureaucratic structures. Consortia on the other hand are able to speed up the process of standardisation. However they do so at a cost, therefore public standard setting institutions still have a role to play. A more balanced view shows that in certain cases public standard setting institutions may be faster than consortia.

Table 4 summarises the problems with market and public standards.

Table 3: Market Failure in the Provision of Standards

	Will the Market define a standard?	Problems with Market Standard	Problems with Public standard
Compatibility	yes	• Lock-into inferior standards • Not necessarily open • Severe risk of monopoly	• Slow to define • Risk of regulatory capture
Minimum Quality	Not as much Though there are Other mechanisms	• Risk of Gresham law • Any standards is liable to be self serving	• Risk of regulatory capture
Measurement	Can do but incomplete	• Incomplete may not be open • Unlikely to measure characteristics that show product in bad light	• Risk of regulatory capture

Variety	Yes	• May not help to define focus or cohesion	

Source: Swann, 2000

2.6 SUMMARY

This section presented the mechanisms through which standards affect innovation and growth. Furthermore the chapter presented theoretical perspectives on the impact of environmental standards on trade. Here the 'race to the bottom hypothesis', 'gains from trade hypothesis' and 'pollution haven hypothesis' were presented.

In addition the chapter presented the three theoretical perspectives of standards on foreign trade. The first theoretical perspective examined how standards assist trade by improving a country's competitive advantage. Here it was shown how improvement in product quality can generate trade advantages, while the second theoretical perspective was on the trade deterrence impact of standards. Here it was shown how increments in costs due to standards can inhibit market access and thus exports. Finally the last perspective was on the intra-industry role of standards that argued that harmonized standards can promote market access. The important question of who should be responsible for standardisation was also discussed. The chapter further presented the main empirical studies on standards, market access and exports. The next section presents the three case studies.

CHAPTER THREE: SOUTH AFRICA

3.1 INTRODUCTION

This chapter uses a typology case study method to analyse the impact of standards on market access and exports in four South African sectors. Specifically, the objective is to determine the net impact of foreign/international standards (imposed by developed countries) on market access and export potential of the products of the automobile, fruit, fishery and textile sectors in South Africa. Furthermore the chapter presents an assessment of the impact that environmental concerns have on trade in the coal, steel and citrus sectors of South Africa.

Section 3.2 briefly comments on standard setting institutions in South Africa whilst Section 3.3 presents the four South African case studies. Section 3.4 deals with the impact that environmental concerns are having on trade in the coal, steel and citrus sectors.

3.2 STANDARD SETTING INSTITUTIONS IN SOUTH AFRICA

Pelser (1995:9) points out that the idea of standardisation was a part of human existence since the earliest times. Indeed, standardisation could be said to have began with creation. The most standard things can be attributed to atoms, plants, animals as well as humans. In the Southern African subcontinent standards were being applied by indigenous black nations long before the arrival of the first Arabian and Western influences. The tribal architectures as well as their distinctive planned kraals are examples of this. Another example is the standardisation of the short assegai and longer shield by Shaka Zulu. In South Africa western standards were introduced with the arrival of the Europeans as early back as 1651.

Standardisation in essence means simplification, rationalization and co-ordination. The aim of standardisation is not at uniform sameness but rather to reduce confusing proliferation and furthermore to create order for both the environment and man. The key goal of standardisation is to draw up specifications also known as standards.

According to Pelser (1995:12) "…standards are rules and serve as a basis for comparison". Furthermore they represent a type of order and assist to differentiate between goods that are pleasant to consumers and those that are not.

Carolissen & Nel (2001) point out that formal standardisation started in South Africa at the turn of the century due to increasing sophistication and production in gold mining technology. The development of mines led to imports of a variety of machinery. There was a realization that these products had to be standardized. As early back as 1897 the Mining, Chemical and Metallurgical society of South Africa examined why there were differences in results of local and overseas assays of gold ingots. This led to the development and publication of a standard method of smelting, sampling and assaying of gold.

In 1909 the Committee for the Standardisation of South African Materials was the first official standardisation body that was formed in South Africa. A year later an Engineering Standards Committee was formed and its activities included among other things chemical tests. This eventually led to the establishment of the South African Branch of the British Engineering Standards Association in 1918. However in 1931 this was renamed The South African Branch of the British Standards Institution (SABS). After the Ottawa conference of 1932 the British standards institute (South African branch) was dissolved and this was replaced by the South African Standards Institute (SASI) (Pelser, 1995: 14-20) in 1934. SASI became the only recognized standards body in South Africa (Carolissen & Nel, 2001).

On 11 January 1944 the standardisation committee was informed that cabinet had approved in principle the establishment of a bureau of standards. There were some resistance from industry. Fears were raised by the manufacturing sector that draconian standards would be forced on them by the SABS. However, their fears were dispelled by Dr F de Villiers[9]. In due course industrialist welcomed the establishment of the South African Bureaux of Standards (SABS) in 1945. The reason was that the goal of the SABS to improve quality through minimum standards was seen to benefit everyone. When the SABS was founded SASI operated alongside it for some time and

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[9] Dr de Villiers is rregarded as the father of standardisation in South Africa and was industrial advisor to the Department of Trade and Industry.

was consequently dissolved in 1951 (Pelser, 1995: 14-20). As South Africa's official body for the preparation and publication of standards, the SABS renders important services to government, trade, industry and the consumer in order to achieve its stated aims of strengthening the South African economy and enhancing the quality of life of all South Africans by promoting quality and standardisation. One of the main strategic objectives of the South Africa Bureau of Standards is the promotion of sustainable growth.

According to Pelser (1995:14-20) the first standard prepared by the SABS and approved by the council was the SABS 1-1947 that was later withdrawn. It was issued to Robertsons Ltd., Durban for Pyagra 40 per cent DDT. Thereafter there were appeals for a SABS mark for the storage of batteries for vehicles. Hospitals and health services requested standards with regard to health services. Other areas that needed standards were environmental concerns, the mining industry, the timber industry and the textile and clothing industry.

By the end of 1947 the SABS had six divisions. These were the chemical, engineering, physics, information services management, industrial hygiene and administrative division. In 1947 the SABS became a founding member of the international organization for standardisation. In the 1980s the SABS through the leadership of Rudolf Teichmann managed to achieve international recognition despite South Africa's isolation over the years. In 1984 facilities for testing motor vehicles for compulsory safety specifications were completed at a cost of R3.6 million. An acoustic laboratory for the SABS was commissioned in 1984 at a cost of R5.5 million.

On September 1st 1993 the new standards act came into effect. The new dynamic era emphasised participatory management. In accordance with this new act the director general became the president and chief directors became vice presidents. On April 1994 the National Party government came to an end and a new government was established. With the objective on service to trade, industry and the general public, the SABS had to continue in this new environment.

According to Carolissen & Nel (2001) there was a recent restructuring at the SABS. The main reason behind this was mainly to separate the institution's non-commercial

activities from its commercial activities[10]. It was recognised that there was a need for government to allocate funding towards SABS activities, in particular to non-commercial activities and standards development. The main task of the SABS is to address standardisation in the widest sense. Furthermore it is there to assist trade and industry and to improve the quality of life of all South Africans.

The main vision and mission of the SABS is to provide standards services that contribute to the improvement of the competitiveness of South Africa. The SABS is a founding member of both the IEC and ISO and is continually being aligned with international standards bodies such as the ISO. Furthermore it provides information to both internal and external clients[11] (Carolissen & Nel, 2001). According to Jooste *et al.* (2003) the SABS is responsible for administering a large range of compulsory specifications in a wide array of areas. As South Africa's national institution it publishes national standards, tests and certifies products and services among other things. Its main objectives are the improvement of market access and exports and this is achieved by being a facilitator and enabler of trade and competitiveness. Furthermore the SABS is also responsible for the promotion of economic growth (SABS website). The SABS is also obliged to protect consumers and direct industry to comply with specifications (Jooste *et al.*, 2003).

Industry Standards

Apart from the South African Bureau of Standards industries set their own standards. Example can be found in the police force, Eskom, The Dept of Water and Sanitation, construction and building, just to mention a few. Some industries collaborate with the SABS in the formation of standards. There are other private standards setting institutions that do not collaborate with the SABS and form their own standards. However only the SABS is legally allowed to form national standards and no other body or industry explicitly or implicitly may form national standards. According to TSD (2006), standardisation has various levels. As a general rule the lower level standards should reference higher level standards. Standardisation bodies collaborate

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[10] According to Carolissen & Nel (2001), commercial activities include those where the SABS must compete on an equal basis with private initiative, for example certification as well as testing services.
[11] Internal clients include SABS non-commercial and commercial clients. External clients include industry, government, educational institutions in addition to private individuals that require standards-related information and services.

and do not generally develop competing standards. However this is not always the case and lower level standards do tend to compete (See Section 2.5.2.3). Furthermore there are cases where industry standards are more stringent than national standards (See Section 4.3.1). The hierarchy of standardisation illustrating the different levels of standardisation are firstly Company (Eskom, Municipality); then Association (NRS); National (SABS); Regional (SADCSTAN); and finally International (ISO). For example, the development of a new NRS specification goes through certain stages. Firstly there is a need to investigate and confirm a project by ESLC. Secondly there is the WG draft stage. Thirdly WG and ESLC approval as well as editing is done. The final stage is the publication that is then released to the SABS and NRS website. These stages depend on the commitment of all users to use the resultant specification. WG members should circulate the draft to their relevant personnel for their input. Involvement of as many IG members as possible is required. In addition, the process should employ standardisation principles and techniques and project management. All participants should be committed to support and contribute to the process. The specifications should be sufficiently edited so that the technical content is acceptable and secondly so that specifications are not conflicting or unclear. Specifications should reference national as well as international standards, in order to promote exports. Finally as a matter of policy during the process of standardisation the ESI, NSB's and other SDB's should not compete but should collaborate in order to achieve synergy in the activities they conduct (TSD, 2006).

3.3 CASE STUDIES

This section provides an analysis of the impact of standards on market access and trade performance in the fruit, automobile, fisheries and textile sectors of South Africa. The last section shows a typology case study table of the three case studies.

3.3.1 The Fruit Industry

The fruit sector of South Africa contributes on average about 27 percent of total agricultural export earnings. Between 2000 and 2004 citrus fruit contributed about 11 percent to total agricultural export earnings. In order to ensure continued international market access to export markets, producers had to make necessary investments in order to comply with quality and food safety standards. Most of these standards were introduced by European retailers (Vermeulen *et. al* 2006). Within this sector,

voluntary standards that exist for exports are much higher than mandatory standards set by government institutions (Wilson & Abiola, 2003) (See section 2.5.2.3). In conforming to international standards the private sector regulates itself. These private standards are mostly obtained from international retailers and passed on to producers for compliance.

For South Africa there are a number of problems related to compliance with the technical requirements that are necessary to gain market access. Wilson and Abiola (2003) indicate that the South African fruit industry faces mainly two kinds of international standard constraints. Firstly, there are specific packing and quality standards that importing countries impose. These standards limit South African citrus crop growers' exports by 60 percent. The second problem relates to the kind of standards set to prevent diseases and the concern that the EU does not always use the ISO standards to which it agreed. According to Cook (2002), the South African citrus industry regards the CBS (Citrus Black Spot) standard imposed by the U.S and the EU as an unfair trade barrier. They believe the standard was imposed to increase production costs. This has a negative impact on export.

There are also high costs in complying with CBS and EUREPGAP regulations. In a sample of selected South African farmers the costs to comply with CBS and EUREGAP regulations are estimated at 4 percent of revenue. When the opportunity cost of foregone trade is included the cost increases to 10 percent. Furthermore South African citrus exporters must comply with both the EUREPGAP and HACCP standards[12] in order to export their products. In one of the packing houses at Kirkwood the total compliance costs were estimated at R1,290,000, in order to meet these standards (Wilson and Abiola, 2003) (See section 2.4.2).

According to Vermeulen *et al,* (2006) South African fruit farmers made significant additional investments in complying with the requirements of quality and food safety standards to gain access to European supermarkets. They found that on one farm that

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[12] The Hazard Analysis Critical Control Point system (HACCP) is a systematic identification of risks associated with the manufacturing, distribution and use of food ingredients. The European Retailers Produce on Good Agricultural Practice (EUREPGAP) is a management programme developed in Europe for fruit and vegetables.

exports mangoes and litchis training costs and managerial costs are estimated at around R130 000. Furthermore annual inspection and accreditation costs amount to R35 000.

Vermeulen *et al,* (2006), refer to the presence of a discrepancy between the standards enforced on the upstream and downstream sides of the supply chains. More specifically the discrepancy is between the standards enforced in the citrus supply chain before and after the farm gate. They observed strict application of the standards up to the South African port, whilst at the other end there was no sign of such strict application of the standards. This can result in quality deterioration, loss of market access and logically also in a financial loss. They conclude that there existed parallel standards among downstream and upstream parts of the supply chain. They hypothesized that the food safety and quality standards were functioning more like a selection mechanism, in order to enable European retailers to purchase the highest quality fruit worldwide. This therefore may lead to the transfer of search and monitoring costs to the producers and away from the retailers or imports.

3.3.2 The Automobile Industry

According to Black (2002), there was little growth in the vehicle market in 1999, where 59,700 compared to 25,900 units the previous year. In 2001, vehicle exports were at 108,300 units and is expected to exceed 175, 000 by 2007. There was rapid export expansion of both components and vehicles.

In the automotive sector producers that are exporting are required by international original equipment manufacturers to comply with strict standards (Jooste *et al*., 2003). According to Barnes (2002) South African automobile firms are not able to meet international manufacturers' standards. Others disagree. The two case studies below demonstrate how automobile manufacturers were able to meet standards and how this allowed them to gain market access.

According to Hartzenberg and Muradzikwa (2002) the South African Bureau of Standards has an important role to play for exporting firms that want access to international markets. The SABS has certification and testing facilities and these facilities are an important passport for exporting firms as it creates more

opportunities. Furthermore the automobile industry is trying to gain international competitiveness and they seek to achieve this by means of collaboration between the SABS and the automobile firms.

The Euro Type test centre is a testing facility situated in the Eastern Cape. The Euro Type Centre is a thirty million rand investment. It contains state of the art emission vehicle testing facilities that is able to perform emission tests to satisfy European, Japanese and American environmental requirements (Hartzenberg and Muradzikwa, 2002). The Euro Type test centre is of strategic importance for South African firms who export vehicles to countries where emission testing is a legal requirement. The centre is therefore critical in promoting the products of automobile firms that want to gain access to international markets. BMW and Daimler-Chrysler are two such firms that are performing emission tests at the centre for all the vehicles they export. This assists them to be competitive in international markets (SABS).

Bosal Automotive produces a wide range of products. This includes exhaust systems, catalytic converters, etc. The main company is situated in Belgium and has thirty manufacturing plants worldwide in addition to its South African plant which is situated in Pretoria. The South African plant was in operation in Pretoria for over forty years. Ford, General Motors and Chrysler determined the international quality standard, which is based on criteria of cost reduction, reduction of inspections required and consistency of quality. Bosal was the first South African exhaust manufacturer to meet the international quality standard set by General Motors, Daimler-Chrysler and Ford (Hartzenberg and Muradzikwa, 2002). The case study shows that Bosal is able to meet the high technical standards set by the international market place. In this way its products gained access to international market.

3.3.3 The Fishery Sector
This sector is not subject any ISO standards. Therefore South Africa like most countries, applies the international CODEX Alimentarius codes of hygienic practices, guidelines and standards. There are two main standards governing this sector and these are SABS 587 for canned fish and SABS 585 for frozen fish.

According to Mold (2005) South African white fish consignments were rejected by Spain in 2001 due to an alleged outbreak of parasite infestation. South African white fish exports were also severely affected in 1994 when France implemented the EU Council Directive 91/493/EEC. This is the EU's main legislation that governs the health requirements of fishery products. Whilst other countries in the EU gave countries time to prove compliance, France did not give enough time to countries to prove compliance with the Directive, as it was implemented literally overnight (See section 2.4.2). Both the Spain and France succumbed to their fishermen as an important interest group.

Jooste *et al.* (2003) indicate that there were problems in meeting standards in different countries. This is due to the problem of differing microbiological standards. These particular standards were not harmonized at the CODEX level. Thus it affects market access to EU markets. Another problem is that the EU does not allow the imports of South African aquaculture and mariculture products. This is problematic for the South African fishing industry as the DTI identified them as a growth industry. One of the main problems was that these are capital intensive as it requires sophisticated monitoring infrastructure. Therefore meeting international requirements was easy or cheap. The leading fish exporters such as I&J, Sea Harvest and Marine Products regard compliance to HACCP to be expensive. For instance, in the 1990s Marine Products invested fifteen million rand in upgrading its canned plants in order to meet HACCP requirements. Sea Harvest and I&J both spent ten million rand each in order to meet EU requirements.

3.3.4 Textile Sector

According to Jooste *et al.* (2003:263-264) there are 1,500 textile standards requirements in South Africa. Over the past five years the South African Bureau of Standards was aligning its textile standards with ISO standards. According to Jafta (2005), textile production produces environmental damage. Consumers therefore demand good quality as well as environmentally safe products. Some consumer safety concerns are the avoidance of textile finishes that could be a potential source of allergy.

The standards are mainly divided into product standards and standards that refer to test methods. With regard to market access the problem is not on the export side but rather on the import side. An example of this is where a European manufacturer tried to export army boots to South Africa. The manufacturer used linen thread to stitch the sole to the upper part of the boot. The boot did not comply with South African standards although it complied with European standards. This is due to the fact that South Africa has stricter humidity test standards as climate conditions differ. This forced the European manufacturer to treat the linen with resin-based varnish (Jooste *et al.* 2003:263-264).

Another example is where a foreign carpet manufacturer neglected to put UV inhibitors in their polymers when they established a company in South Africa. The carpets started to discolour as the white fibres ended up fading due to higher UV exposure in South Africa. Once again this example illustrates the problem created by different environment conditions in two countries if the same standard is applied. On the export side the main problem that exporters experience is with stricter rules of origin in foreign markets and not with standards. The problem is that South Africa does not have origin labelling requirements, while some foreign markets do. This makes it difficult to meet rules of origin requirements for textiles and clothing in foreign markets. With regard to compliance costs they were negligible as they comprise three percent of production costs for the whole industry (Jooste *et al.* 2003:264).

TABLE 4: Typology summary of Case Studies

Market Access/ Exports	Fruit Sector Vermeulen et al (2006) Jooste et al, (2003) Bakker, (2002)	Automobile Sector Black (2002) Jooste et al, (2003) Harzenburg & Muradzikwa (2002)	Fisheries Sector Mold, (2005) Jooste et al, (2003)	Textile Sector Jooste et al. (2003:263-264) Jafta (2005),
Compliance Costs -testing procedures - packing costs -labelling requirements - upgrade costs	- high inspection & accreditation costs -stringent packing/ quality standard -increases production costs - high investments to comply	- meeting quality standards through SABS testing & certification facilities -not meeting manufacturers standards	capital requirements in complying -extensive compliance costs in meeting international standards	Negligible Compliance costs Consumers demand environmentally safe products & of good quality
Multiple standards -voluntary standard -mandatory standard -International standard	-parallel standards -high voluntary & low mandatory standards - not adhering to ISO	Must meet manufacturers standards (voluntary standards)	-differing standards in different countries -lack of harmonization	Differences in degree of standards due to differences In environments Different standards in SA and International market

The above table shows that high compliance costs are hampering market access. In addition to meet different standards increases costs and this negatively impacts on market access and trade. Therefore there is a need to harmonise and regulate the voluntary/informal standards set by the market.

3.4 TRADE AND ENVIRONMENT

This section is concerned with the impact that environmental concerns are having on trade in the coal, steel and citrus sectors of South Africa. Since South Africa's exports depend on resource extraction it is important to examine the extraction and secondary sectors. In South Africa the main trade and environmental concern is whether South Africa's exports are open to environmentally based trade barriers.

South African exports must meet international environmental standards such as the ISO 1400 standard. In general this pertains to standards that industries are expected to meet. In addition this is related to environmental understanding in the export markets. In particular this covers issues such as specialised labelling, packaging procedures, and pesticide residue requirements.

3.4.1 The Coal Sector

According to Yawitch (2006), coal produces more than 70 percent of South Africa's energy. Njobeni (2004) argues that 70 percent of energy produced from coal emits harmful sulphur. There is thus a concern that South Africa's reliance on coal came at the expense of the environment.
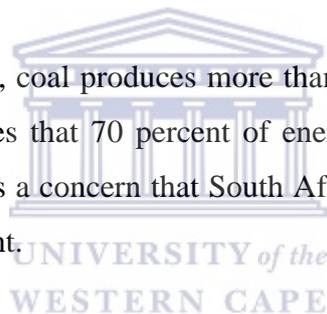
It is estimated that by the year 2020 coal will surpass gold as the main foreign exchange earner for South Africa. The main concern is whether South Africa's coal exporters are vulnerable to environmentally induced trade pressures. Coal combustion emits greenhouse gas that is important with regard to trade; more significant is that regulations in respect of these greenhouse emissions are becoming more stringent (TIPS & IISD, 1999).

Local coal producers are affected by environmental management approaches. However international market access seems not likely to be restricted by formal restrictions on South African coal due in particular to inadequate environment performance. The reason being South African firms don't have greater environmental impacts than their international level (TIPS & IISD, 1999).

Overall it seems that the impact of international market restrictions associated with domestic environmental performance is unclear. What is clear is that the reduction of the whole global market due to environmental concerns would have a significant impact on the South African coal industry.

3.4.2 The Steel Sector

TIPS & IISD (1999) point out that the steel industry is important as it contributes to South Africa's GDP. It contributes 16.9% to manufacturing exports. Although South Africa's emission standards compare favourably with other countries such as Belgium and Denmark, they are however significantly greater than the USA and Germany. In particular South Africa's SO_2 and NO_2 limits are greater than international limits.

In addition the US and Germany adopted stringent environmental standards in packaging and manufacturing industries. This tends to exclude their competitors. There is a concern that the cost of compliance with stricter environmental standards will increase.

3.4.3 Citrus Sector

South Africa is the fourth largest citrus exporter in the world. Citrus exports contribute 4.5% to GDP. International consumers demanded that South African citrus exporters adhere to environmental standards. Citrus exporters customised their production methods to comply to export market demands to stay internationally competitive. Environmental requirements firstly include phytosanitary aspects; chemical residue levels and general cleanliness. Secondly the production process involves the destruction of the ecosystem, labour issues, food safety and environmental sustainability (TIPS & IISD, 1999).

Environmental requirements are becoming minimum standard requirements to access export markets. Particularly in South Africa Capespan standards assisted firms in increasing export volumes by those embracing these standards as they are internationally competitive. The reason is that many buyers abroad only accept citrus fruits grown according to certain environmental standards.

3.5 SUMMARY

This chapter presented the impact of standards on market access and trade performance in the fruit, automobile, fisheries and textile sectors. The general findings were that high compliance costs were inhibiting market access. Furthermore the sectors had to comply with different private standards that led to increased costs, negatively affecting market access and reducing exports.

The chapter also examined the coal, steel and citrus sectors of South Africa to examine whether South Africa's exports are open to environmentally based trade barriers. In the coal sector the overall impact of international market restrictions related to domestic environmental performance is unclear. In the steel sector there is a concern that the cost of compliance due to environmental measures due to stricter standards will increase and the citrus sector had to comply to remain internationally competitive.

The next chapter presents the preliminary conclusions resulting from the study.

CHAPTER FOUR: INTERNATIONAL EMPIRICAL EVIDENCE

4.1 INTRODUCTION

In this chapter international empirical evidence of the impact of standards in developing and developed countries is discussed with specific focus on product innovation, market access and trade performance. Furthermore the chapter discusses the impact of standards on growth in Germany, U.K and Australia. Specifically the study assesses the contribution of standardisation on long term production growth in these countries.

The chapter is arranged as follows: Section 4.2 presents an overview of experiences in different countries, whilst section 4.3 presents a comparative analysis between international experience and South Africa.

4.2 EMPIRICAL EVIDENCE

The following sections provide an overview of experiences in different countries.

4.2.1 Kenya

According to Nyangito, Olielo and Magwaro (2003), the Kenya Bureau of Standards (KEBS) is the national body in charge of standards development and implementation, certification of products, testing and metrology. Kenya's fruit and vegetable sector must meet both technical and market driven standards[13]. It was estimated that the costs of facilities from the farm to the airport in order to achieve international standards is about US$1.2 million for a daily capacity of 10 tons. Daily operational costs are estimated at US$ 25,600. As can be seen the costs of compliance are substantial.

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[13] According to Nyangito, Olielo and Magwaro (2003) technical standards relate to production and harvesting of fruit and vegetables, such as chemical use and spread of harmful insects. While market driven standards are determined by requirements in the consumer markets, such as consumer tastes, social and environmental concerns.

Jaffee and Henson (2004) indicate that in Kenya's fishing sector the costs of compliance were prohibitive and resulted in the closing down of a number of fish processing facilities (See section 2.4.2). They further stress that one of the biggest issues facing the sector is the compliance of standards of hygiene at the landing beaches. According to Henson and Mitullah (2004), efforts to comply with the standards in the fishing sector was stimulated by the sudden loss in market access. They therefore point out the importance of being proactive.

Implementation and Production Constraints:

There are a number of constraints when it comes to complying with international requirements. The main implementation constraints with regard to fully complying with international requirements include compliance of some domestic legislation with international standards; inadequate testing capabilities; weaknesses in export and import certification systems; control and eradication of pests which restricted exports. The main production constraints include infrastructure weaknesses and different standards requirements for different markets. All these make it difficult for exporters to meet international standards requirements. All these implementation and production constraints have a negative impact on market access (Nyangito, Olielo and Magwaro, 2003).
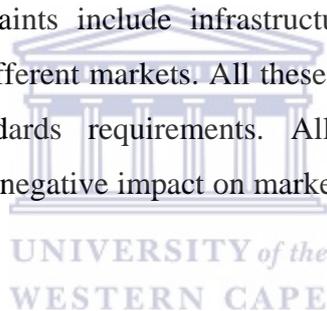
According to Jaffee and Henson (2004), the European Union's standards on hygiene for fishery products had a marked effect on the Nile perch sector in Kenya. However, compliance with European Union requirements helped Kenyan exporters to access and keep European markets. Increasing private and public standards was a challenge to Kenya's fresh produce industry. However, they were a life line for the industry. This shows that stricter standards in well organized industries in developing countries can be used as catalysts for change in addition to profit.

4.2.2 Mozambique

According to Da Silva and Carrilho (2003), Mozambique's APCER and the SABS provide certification services. It was identified that a primary concern is strengthening the infrastructure and internal organization, so that the country can effectively respond to standards that affect trade. Furthermore there is a lack of qualified personnel. In order for Mozambique to access international markets it needs to develop an

appropriate standards regulatory system and develop appropriate standards setting systems as well as facilities for testing and certification, training, and accreditation. The countries participation in regional and international standards setting bodies should be strengthened.

4.2.3 Nigeria

Adeyemo and Bankole, (2003) stipulate that Nigeria's small producers can meet international standards and create and maintain market access in developed countries. They are able to do this by complying with international standards. However SPS and TBT agreements require national standards to be higher than international standards if it is scientifically justifiable. The lack of scientific personnel was identified as another problem. Furthermore the fear by firms of non-compliance with quality standards led these firms to self-impose standards that are sometimes much more stringent than international standards. New or small export industries in Nigeria did not find it easy to achieve. The main standards constraints are ineffective administration and enforcement, inadequate awareness, insufficient and high compliance costs, and evasion of conformity tests.
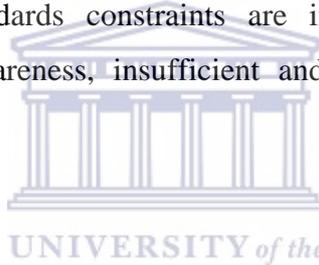
4.2.4 Uganda

According to Rudaheranwa; Matovu and Musinguzi (2003), the Uganda National Bureau of Standards is the statutory body that controls standardisation. Most of the country's exports are destined for Europe. However, quality standards in these markets are becoming more stringent and restrictive. Mold (2005), points out that compliance to standards increased costs for a number of exporting sectors. An example of this is the honey sector where upgrading and construction of facilities amounted to US$ 300 million. Another example is the coffee industry where production costs increased by over 200 per cent once compliance costs are taken into account[14].

Uganda therefore must improve her institutions and infrastructure. There are major problems in enforcing and monitoring standards. Examples of problem areas are the lack of technical personnel and infrastructure, limited awareness of the nature and

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[14] Chen *et al.* (2006), point out that costs can inhibit market access

existence of standards; enforcement at the port and not in the whole production chain; limited international recognition of certification and monitoring and lack of incentives to comply (Rudaheranwa; Matovu and Musinguzi; 2003)

4.2.5 Peru

Peru became one of the world's biggest exporters of asparagus. Earnings in 2002 reached US $187 million (25 percent of total agricultural exports). Access to developed country for its asparagus was gained by adopting national standards. Due to better hygiene practices, the industry experience improved worker efficiency, improved production methods, and product quality. So standards acted as a catalyst for a growth in exports (See section 2.4.1).

4.2.6 Developing countries (Latin America, Africa)

Jaffee and Henson (2004) use a case study analysis to examine the impact that the standards in developed countries in respect of food safety and agricultural health have on the existing and potential export performance of developing countries. They examine cases from Kenya, Guatemala, Peru and find that standards can also act as catalysts for exports as they accentuate the strengths and weaknesses in supply chains (See section 2.4.1). They furthermore find that developing countries are using standards to reposition themselves in competitive global markets.

A more recent study on the impact of standards on exports is done by Chen, Otsuki and Wilson (2006), using the World Bank technical barriers to trade survey database of 619 firms in 17 developing countries. Evidence is presented showing that standards in developed countries affect a developing country's propensity to export. Particularly, they find that testing and lengthy inspection procedures as well as the labelling requirements by importers reduce exports by 9% and 3% respectively.

4.2.7 Developed Countries

Studies on the impact of increasing environmental standards on competitiveness were done in different countries using different methods and time periods. They produced significantly different results. The common perception in developed countries is that higher environmental standards will lead to a decrease in their international competitiveness.

Sorsa (1994) conducted an analysis of trade flows of environmentally sensitive products in Austria, Finland, Norway, Sweden, Germany, Japan, and the United States where high environmental standards prevail. Austria and Finland, having high environmental expenditure and with environmentally sensitive export goods managed to increase their world market shares. Sweden, Germany, and the US managed to successfully maintain competitiveness of their environmentally sensitive industries, in spite of increases in environmental expenditures. Japan decided not to trade in several environmentally sensitive goods, because its market share was halved. However, within most categories of sensitive industries, product level data revealed increases in developing countries' relative comparative advantages (See section 2.4.3).

Other studies in the *US and Japan* indicated that the trade in environmentally - intensive products increased (Kaltz, 1998 as quoted in Grote, 2002; Sorsa, 1994). Jenkins (1999 as quoted in Grote, 2002) found little evidence of a general loss of competitiveness for environmentally - intensive industries in Europe.

Tobey (1990) tested the hypothesis "that stringent environmental policy caused trade patterns to deviate in commodities produced by the world's 'dirty' industries". He uses the cross-sectional Heekscher-Ohlin-Vanek (HOV) model of international trade. His results show that "it is not found that the introduction of stringent environmental control measures caused trade patterns to deviate from the HOV predictions." This, according to him, is due to the fact that both in countries with stringent pollution control policies and pollution-intensive industries the costs of pollution control were not extremely large. The results cast doubts on the balance of trade argument against the imposition of stronger environmental control.

4.2.8 Comparative study of Brazil, Germany and Indonesia

Grote, (2002) analyses the effects of environmental standards on competitiveness in the agricultural sector of Brazil, Germany and Indonesia.

Brazil is one of the biggest exporters of broilers and soybeans worldwide. Environmental groups are concerned that parts of the Brazilian civil society is expanding agriculture into the ecologically sensitive dry savannah. Growing soybeans

resulted in a severe degradation of soils and loss of biodiversity. Furthermore there is increasing concern about deforestation and the impact of the use of fertilisers and pesticides in agriculture particularly on the quality of river water (Grote 2002).

According to Grote (2002), Indonesia is one of the main exporters of palm oil. Conservation of forests in addition to other lands to palm oil is partly done by insufficiently controlled fire clearance. There exists a federal regulation on the conduct of environmental impact assessments.

In Germany the production of rapeseed, wheat and broilers plays an important role. Germany is the second biggest producer of rapeseed in Europe. Decreasing soil fertility and compaction, and long periods of bare soils are typical environmental problems. Standards in agricultural production relate to water and air, the protection of soil, conservation of biodiversity as well as animal welfare (Grote 2002).

Cost Implications of environmental standards in Germany and Brazil
According to Grote (2002) a cost analysis shows low impacts of environmental standards on total production costs of the typical farm. The results are ambiguous, at the processing level. Environmental standards in the investigated German oil mills cost 5% of total processing costs and between 0.5% and 1% for soybean in Brazil. In Indonesia the cost of compliance to environmental standards amounts to between 0.4% and 1.1% for palm oil producers. In Germany estimated costs of environment standards amount to 17% of total processing costs compared to 4% in Brazil. Compliance costs for Brazilian farms amount to 46% – 73 % of the costs of German farms while the compliance cost for oil palm production in Indonesia is even lower. In conclusion the "…costs deriving from environmental standards as a percentage of total costs, are insignificant for the international competitiveness of German farms" (Grote, 2002).

4.2.9 Germany

Blind and Grupp (2000) examined time series data on standardisation and whether it is a good measure of the amount of technological diffusion. They found that a third of Germany's macroeconomic growth is caused by standardisation. In another study Blind *et al.* (1999) used advanced econometric methods to look at Germany's

macroeconomic growth between the period 1961 and 1996. They found that the contribution of standards is 0.9 percentage points per annum towards an economic growth rate of about 3.3 per cent. In this study they estimated an aggregate production function for the period 1960-1996. The methodology is basically to incorporate a measure of standardisation into a production function in which output is related by a mathematical function to a set of inputs. They found that the contribution of standards is 0.9% percentage points per annum towards an economic growth rate of about 3.3 per cent. [15]

4.2.10 The United Kingdom

Swann, Temple and Shurmer (1996) analysed the impact of standards on the trade performance of the United Kingdom. Using econometric analysis they estimated three models of a net trade equation where the dependent variable was the natural log of the trade ratio, In (exports/imports), an export equation and an import equation They found that international standards and idiosyncratic standards enable exports.

Temple, Witt and Spencer (2005), conducted a study on the contribution of standardisation on long term production growth in the UK, using data for the period 1948 to 2002. In this study an aggregate production function was estimated for the period 1948-2002. This study also incorporated a measure of standardisation into a production function. They however only used the ratio of capital to employment and effective stock of standards. They found a positive correlation between standardisation and labour productivity.

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[15] Estimated Cobb-Douglas production function: $Y_t = A \cdot K_t^{\alpha} \cdot L_t^{\beta} \cdot e^{\lambda \cdot t}$, Y_t = Output; K_t = capital employed; L_t = amount of labour; α and β = partial production elasticities for capital and labour; $A(t) = A \cdot e^{\lambda \cdot t}$ = form of efficiency parameter; t is a linear time trend; In log form: $y_t = a + \alpha \cdot k_t + \beta \cdot l_t + \gamma \cdot pat_{t-3} + \delta \cdot lex_t + \varepsilon \cdot std_t + u_t.$; std_t = average of the stocks of standards at previous year's end and at current year's end lex_t = expenditure for licences and patents u_t = error term.

They were able to show that standards contributed about 13% of the growth in labour productivity in the UK.[16]

4.2.11 Australia

CIE (2006) conducted a study on the contribution of standardisation to long term production growth in Australia. They examined standards at an aggregate level. Using standards as a specified variable, they found that a 1 per cent increase in the stock of standards leads to an increase of 0.17 per cent increase in productivity.

Standards furthermore found to contribute to the stock of knowledge. A 1 per cent increase in the stock of knowledge, leads to a 0.12 per cent increase in productivity.

4.3 COMPARATIVE ANALYSIS

This section presents a comparative analysis of empirical evidence. Specifically the focus is on the similarities and differences between international evidence and South African evidence. The next section presents the similarities while the final section presents the differences.
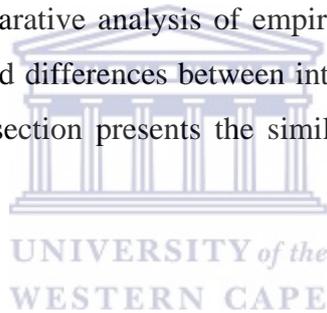
4.3.1 Similarities

There are a number of similarities between international experiences and South African experiences on the impact of standardisation on trade. This section is divided into three main similarities: costs, benefits and main constraints.

4.3.1.1 Costs

International experience indicated that standards increased costs for a number of exporting firms. Indeed firms meeting standards had to make significant investments. According to Jaffee and Henson (2004) Kenya's fishing sector is experiencing high compliance costs that have a prohibitive effect on trade, to the point where some firms

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[16] Estimated equation: $y(t) - l(t) = a + \alpha(k(t) - l(t)) + \varepsilon \cdot std(t) + \lambda t + u(t)$; $y(t) - l(t)$ = labour productivity; $(k(t) - l(t))$ = the ratio of capital to employment; $std(t)$ = effective stock of standards ; t = time; $u(t)$ = normally distributed error term

had to close down. Uganda also experienced increased costs in complying with standards. According to Mold (2005) specifically in the honey sector the costs are in the form of upgrading and construction of necessary facilities. Another international experience is Nigeria which also experienced high compliance costs (See section 2.4.2).

South Africa is no exception where costs in meeting standards are being experienced in a number of sectors. For example in the fruit sector there were high costs in meeting EUREGAP standards. Costs are estimated at 10 per cent of revenue. According to Vermeulen *et al,* (2006), these costs came in the form of significant additional investments in complying with standard requirements, training costs; managerial costs; annual inspection and accreditation costs in order to gain access to European supermarkets. Ortman and Turner (1999) note that the ISO 9000 quality standard leads to implementation costs by South African firms. These costs are mainly documentation procedures, redeployment of internal resources, hiring of consultants and staff training.

4.3.1.2 Benefits

However, apart from increasing compliance costs, standards are also catalysts for gaining international market access. Indeed standards are also regarded as benefits particularly in the long term. (See section 2.4.1).

A case to note is in Kenya where Jaffee and Henson (2004) found that compliance with European Union requirements helped Kenyan exporters to access and maintain European markets. Increasing private and public standards were a challenge to Kenya's fresh produce industry. However, they proved to be a life line for the industry. This shows that stricter standards in well organized industries in developing countries can be used as catalysts for change in addition to profit.. Another example is Peru were due to better hygiene practices, the industry experiences worker efficiency, improved production methods, and improved product quality. So standards acted as a catalyst for exports here. Other cases are from Guatemala, were it was found that standards can also act as catalysts for exports as they accentuate the strengths and weaknesses in supply chains (See section 2.4.1). This was the case in South Africa were adhering to both local and international standards assisted firms in accessing

international markets. An example is the *Euro Type test centre* which is of strategic importance for South African firms exporting vehicles to countries where emission testing is a legal requirement. The centre is therefore critical in promoting the products of automobile firms that want to gain access to international markets. Another case is Bosal that is able to meet high technical standards set by the international market place. In this way its products gain access to international market (Hartzenberg and Muradzikwa, 2002). Ortmann and Turner (1999) point out that implementation of the ISO 9000 standard leads to benefits such as improved customer service, quality improvement and improvement in operational efficiency.

Overall in South Africa it seems that the impact of international market restrictions associated with domestic environmental performance is unclear. What is clear is that the reduction of the whole global market due to environmental concerns would have a significant impact on the South African coal industry. This was the case with international case studies where we found different results with regard to the impact of environmental standards on competitiveness.

4.3.1.3 Main Constraints

There were a number of constraints with regard to the implementation of both domestic and international standards. Some of these constraints are found in Kenya, Nyangito, Olielo and Magwaro (2003) pointed out that the first main constraint are implementation constraints with regard to fully complying with international requirements where domestic legislation must take into consideration international standards; inadequate testing capabilities; weaknesses in export and import certification systems and control and eradication of pests which restricted exports. The second is production constraints which include infrastructure weaknesses and different standards requirements for different markets.

All these implementation and production constraints have a negative impact on market access. Mozambique a primary concern is strengthening the infrastructure and adequate qualified personnel. In Nigeria the lack of scientific personnel was identified as a problem, in addition to the fear by firms of non-compliance. The main standards constraints are ineffective administration and enforcement, inadequate awareness, insufficient and high compliance costs, and evasion of conformity tests. Developing

countries in general find that testing and lengthy inspection procedures as well as the labelling requirements by importers reduce exports, and are the main constraints.

South Africa experiences also a number of constraints with regard to meeting international standards. According to Wilson and Abiola (2003) the South African fruit industry faces mainly two kinds of international standard constraints. An example is the packing and quality standards that importing countries impose. These standards limit South African citrus crop growers' exports by 60 percent. Another problem relates to the kind of standards introduced to prevent diseases and the concern that the EU does not always use the ISO standards to which it agreed.

4.3.2 Differences

In South Africa Vermeulen *et al,* (2006) found a discrepancy between the standards enforced on the upstream and downstream sides of the supply chains. Most of these standards were introduced by European retailers.[17]

The other major difference in empirical tests is that the impact of standardisation on economic growth was not done in any developing country. All the studies conducted on the impact of standardisation on economic growth were done in developed countries. These countries are Germany, Britain, and Australia. In these countries standardisation contributes positively to economic growth. However, no studies were done in developing countries on the impact of standardisation on economic growth, including South Africa (See section 4.2.9 – 4.2.11).

4.3.2.1 Constraints

The primary concern in Uganda is her institutions and infrastructure. Other concerns are the lack of technical personnel, limited awareness of the existence and nature of standards; enforcement at the port and not in the whole production chain; international recognition of certification and monitoring is limited and the lack of incentives to comply (Rudaheranwa; Matovu and Musinguzi, 2003).

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[17] To the best of my knowledge this is an on going research that has been identified in South Africa

4.4 SUMMARY

This section presented international empirical evidence on the impact of standards on trade and growth. The general findings were that countries face a number of implementation and production constraints when complying with international requirements. These constraints have a negative impact on market access. The studies also highlighted the need to strengthen the infrastructure and internal organisation. Furthermore compliance costs were substantial and were impacting negatively on market access. The fear of non-compliance led firms to introduce local standards that were more stringent than international requirements.

The proliferation and increased stringency of agricultural health and food safety standards is a concern among a lot of developing countries. Even if standards are not intentionally used to discriminate against exporting countries, there is a further concern that the growing complexity and lack of harmonisation among countries could inhibit trading performance of developing countries. Another concern is lack administrative and technical capacities to comply with standards. Rising compliance costs and institutional weaknesses could undermine developing countries competitiveness.

However, the studies show that standards can also act as catalysts for exports as they accentuate the strengths and weaknesses in supply chains. Evolving standards can improve developing countries competitive advantage. These standards provide a common language in the supply chain. They also promote consumer confidence particularly in food product safety. This confidence assists markets to be maintained and increased. Compliance with food safety standards may be a powerful incentive for modernising a developing country's supply chains. In addition there are spill over effects. The comparative analysis also showed that standards do act as barriers as well as catalysts.

CHAPTER FIVE: GENERAL CONCLUSION

This study focused on the impact of standardisation on product innovation, market access and trade performance in the South African automobile, fruit, fisheries and textile sectors. The four case studies highlighted firstly that conforming to developed country standards results in high compliance costs. The sectors had to meet high inspection; accreditation; testing; certification and packaging costs. Furthermore, they had to make substantial investments in the form of upgrading facilities in order to comply. This all affects their ability to gain international market access. There is thus a need to offer assistance to the three sectors to complying with international standards. Standards were also seen to act as catalyst as they can improve the competitive advantage an industry or country (See section 2.4.1).

The other major concern is that meeting multiple standards by exporting sectors inhibits market access, thus reducing exports. The lack of harmonisation of private standards increased costs which inhibits market access. Furthermore there were cases where private standards are used unfairly to increase costs of South African exporters. It is therefore important to ascertain who should actually be responsible for standardisation and investigate cases where standards are being unfairly used to inhibit market access.

The study also examined the coal, steel and citrus sectors of South Africa to examine whether South Africa's exporters are subject to environmentally based trade barriers. In the coal sector the overall impact of international market restrictions relate to domestic environmental performance is unclear. In the steel sector there is a concern that the cost of compliance due to stricter environmental standards will increase and the citrus sector must comply to remain internationally competitive.

However, the studies show that standards can also act as catalysts for exports as they accentuate the strengths and weaknesses in supply chains. Evolving standards can improve developing countries competitive advantage. These standards provide common languages inside the supply chain. They also promote consumer confidence particularly in food product safety. This confidence assists markets to be maintained

and increased. Compliance with food safety standards may be a powerful incentive for the modernisation of a developing country's supply chains. In addition there are spill over effects. The comparative analysis also showed that standards act as barriers as well as catalysts (See section 4.3).

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