Integrating Standardization With Research & Innovation to Enhance the Socio-Economic Benefits of Standards
Director General Message
Mr. Endalew Mekonen

Mapping the Integration of Standards with Research & Innovation

Roles of Standards and Their Impact on Research & Innovation

Procurement for Sustainable Development: An Analysis on the Ethiopian Public Procurement Regime

Aflatoxin and Salmonella Contamination In Peanut Butter and Roasted Peanut In Addis Ababa Market

Role of Standard for Regulating Food Quality and Safety: The Case of Ethiopia, A Review

Costs of Quality in Shoe Factories of Ethiopia
Director General’s message

Endalew Mekonen
Director General

ESA is the National Standard Body of Ethiopia established under the Councils of Ministers Regulation No. 193/2010 for the activities of standardization.

Indeed, over the last three years, ESA has made many changes. One must ask, why change? Change is necessary for growth, it prevents stagnation, and it fuels creativity, innovation, and promise for the future. It is required to stay ahead of our ever-changing world. And with it brings new life, new energy, and prosperity for our Country. We change because we believe these actions are in our citizen’s best interests.

While looking forward to the future, ESA has been made positive changes in the harmonization of regional and international standardization systems, Setting up relevant national standards, expanding number of TCs from 101-201, research and innovation activities, active participation in ISO works from 68-104, substantial benefits to the national economy in a number of ways and construction of new Standards Training Academy. The Standard Academy will greatly support the industry professionals, government policy makers, researchers and regulators.

In addition, Sustainable development is at the core of our strategy and integrated into everything we do. As we pursue greater value for our country, we also deliver value for our stakeholders, including communities, customers, governments, suppliers, our employees and partners. Our activities aim at bringing long-term benefits to the places where we work. It is through living our values – accountability, transparency, credibility, supportiveness, partnership, participatory, continual improvement and integrity. Our engagement with stakeholders is a core principle of our standard development approach and we remain the only standard setting body of Ethiopia.

Apart from engaging in excellent research, ESA continues to play an important role in creating platform through standardization. We realize that there is more we can do to improve our standards development performance through research, and to build on the strong foundations we have already created. Among our priorities, we shall continue forging strong, transparent relationships with our stakeholders. We must continue developing a workforce of outstanding employees, who represent the increasingly diverse national, regional and international in which we operate, and who can lead our standardization into the future. And above all we must continue to improve our efficiency to reach our goal of high quality research on quality and standards, through the support of strong leadership, engaged employees and collaborate with University scholars. It is not just about what we say, but about what we do on the ground at our operations every day.

Sincerely,

Endalew Mekonen
Director General
Chapter One

Introduction

1.1 Background

The highly demanding and ever-changing business environment especially after the liberalization, privatization and globalization has necessitated countries and organizations to be intelligent in the competitive market, offering products and services of superior quality. Such products and services enable them to attract new customers and strengthen their relationship with the existing ones. Timely adoptions of technological innovations have served to break the geographical boundaries, resulting in more informed and demanding customers than in current years. Increased pressure from the customers, competitors and the environment is forcing the managements to implement strategies for lowering the operating costs and improving efficiency, without compromising quality.

Align with this, standards make a positive contribution as a common language to the world we live in. They facilitate trade, spread knowledge, disseminate innovative advances in technology, and share good management and conformity assessment practices. Standards also provide solutions and help to achieve benefits for almost all sectors of activity, including agriculture, construction, mechanical engineering, manufacturing, distribution, transport, healthcare, information and communication technologies, the environment, energy, safety and security, quality management, and services.

In Ethiopian context, there are many reasons for enhancing and necessitate the promotion and application of quality and standardization. Among the many reasons economic development and technological progress are the main one. In addition the following are the main reasons: To fulfil international requirement and regulation,
to fulfil national needs and responsibility and to support the country export and import trades.

One of the key aspects of the mission of National Standards Bodies is being able to validate the tangible benefits that standards bring to manufacturing and service giving industries and the society as a whole. It is therefore essential to bridge with organizations from all stakeholder groups to engage them in standardization activities to help them get the most from standards.

Various strategies have been implemented by responsible bodies in different period to address the goal of the above contexts. However, linking standardisation with research, innovation and markets has been recognised as a strategy in recent political initiatives across the world.

In addition to the interface between research and standardization, the research about the benefits and needs for standardization should also be further developed. Standardization-Research integration has rather stagnated despite its increasing relevance for policy and strategy. This represents interesting challenges for researchers. However, one important reason for the stagnation is due to the difficulties in accessing data on standardization processes and standards. There is not a lack of data, but deficits in the quality, completeness, homogeneity and transparency of data.

Current realities revealed that in order to remain competitive at global level, countries shall connect standardisation with research and innovation and contribute to achieve the goals of the country’s strategy in terms of smart, sustainable and inclusive growth. Escalating the significance of standards through research and development program is a critical issue that should be addressed since research will increase the interest of different companies by providing solid facts and pull different professionals
to participate in standardization process that will bring more potential as well as it magnifies the benefit and acceptance of standards.

Beyond helping peoples and organizations to assess whether standardization can bring benefits to their area, it also helps foster a better understanding by the wider public. Since the development of standards relies on input from consumers and independent experts, reaching out to people with clear information through research helps build interest in taking part.

This document pursues to improve the mutual awareness and collaboration between standardisation on the one side and the research communities and innovators on the other. While doing so, this document focuses on an aspect that is close to the researcher's heart: can they participate in and contribute to standardisation without losing the opportunity to exploit their research outcomes through other channels? Do standards have a significant role for research and innovation? Does standardization body will help them? And we say yes!

1.2 Standards and Standardization Concept?

1.2.1 Definition
A standard is a document, established by consensus and approved by a recognised body, which provides for common rules, guidelines or characteristics for activities or their results and having the purpose of achieving an optimum degree of order in a given context.

- They include terminology, symbols, packaging, marking or labeling as they apply to product, service, process and production method.
- Standards should be based on the consolidated results of science, technology and experience, aimed at the promotion of optimum community benefits.
Standardization is the process of agreeing on technical contents in formulating requirements to develop a standard, issuing and implementing the standard. Although there are many thousands of standards of various types, they can nevertheless be categorised into four major types:

- **Fundamental standards** - which concern terminology, conventions, signs and symbols, etc.;
- **Test methods and analysis standards** - which measure characteristics such as temperature or chemical composition;
- **Specification standards** - which define the characteristics of a product (product standard) or a service (service activities standard) and their performance thresholds such as fitness for use, interface and interchangeability, health and safety, environmental protection, etc.;
- **System standards** - which describe the functions and relationships of a company, as well as elements such as quality management and assurance, maintenance, value analysis, logistics, project or systems management, production management, etc.

1.2.2 **Who develop standards?**

In most cases, the initiative to develop a new standard is taken by interested stakeholders who consider that a particular standard would be useful as a way to address specific needs. Other interested parties then join the standardisation activities at national, international or regional levels. In this process, companies, academic experts, researchers, SMEs, consumers and regulators bring together their ideas and experience concerning products, materials, processes or services in order to agree upon and produce a standard. Standards are thus drafted by experts in the specific field covered by the standard.
1.2.3 Benefits of standards

A. Traditional Role of Standards

1. Standards ensure quality of products: they improve the quality of products, applying state-of-the-art technologies and techniques and at the same time ensuring safety aspects.

2. Standards facilitate trade: they support exports by removing technical barriers to trade in the Market, and globally by aligning with international standards as far as possible.

3. Standards further the creation of new markets: they can help ensure compatibility and interoperability of products and services. The end-user benefits from reduced prices.

4. Standards strengthen regulation: by implementing referenced standards, industry can meet legal requirements for placing goods on the market.

5. Standards increase safety and environmental protection: they lay down basic rules not just for safe, environmentally sound products, but also to ensure that companies make standards a fundamental part of their culture in fields such as safety, consumer protection and the environment.
B. Valued-added role of standards

1. **Standards promote innovation**: they help promote innovative products and services by building confidence among industrial users and consumers and creating a large scale market. Speeding up innovation by providing the requisite knowledge base (technology transfer).

   *Standards as link between invention and innovation.*

2. **Standards support research**: they codify and disseminate the state of the art, and offer a level playing field for competition during the next phases of R&D.

3. **Standards enhance visibility**: standardisation is essential for market penetration of R&D results, helps reduce production costs and avoids lock-in to proprietary or immature solutions.

4. New ideas, technologies and products need standardization to get into the marketplace
Chapter Two

Why the Integration of Standardization with Research and Innovation

The Integrated Approach aims at: Raising the awareness of the benefits of standards in the socio-economic development of the country; transferring research results and outcomes of innovation activities into standardization to improve the quality of standards; fully exploiting the functions of standards for research and innovation activities in order to increase the competitiveness of the market and Supporting the regulatory framework by providing solid facts on standards implementation process. Therefore this approach has a mutual benefit for the standardizer and the researcher. Standardization needs to be able to incorporate the findings gained in research in order to integrate the latest knowledge into standards. By incorporating the latest knowledge into new standards they can provide the foundation for further developments of new research and ultimately new knowledge, creating a virtuous knowledge circle of standards and research.

*Figure 1: Knowledge Transfer Links (source optimat, 2014)*
It is apparent that standards provide solutions and achieve benefits for almost all sectors of activity and has a direct link with economy. Since 2000, a significant number of studies have been conducted and approve the benefits of standardization and the use of standards on micro and macroeconomics. Therefore, the following rationales will answer “Why the integration approach is needed”:

1. To enhance the integration of standards with The Country Socio-economic Direction (Policy, Strategic Direction and Regulation)

To demonstrate the benefit of standards and to link with the country’s economic development program a new arrangement is practicing in different part of the world. This recent approach is linking standardization with research and innovation.

For all standardization activities having a public and societal impact, the following aspects are important: A comprehensive impact analysis of standardization through research including aspects of market and societal needs and expectations, and Involvement of disadvantaged stakeholders e.g. SMEs, consumers, trade unions.

The International, regional and national Standards developed by different bodies are voluntary. And while they do not seek to establish, drive or motivate public policy, regulations, or social or political agendas, they can certainly provide valuable support to the implementation of public policy.

Health and safety, the protection of workers, consumers and the environment are the pillars of public interest. The impact of standardization on society, and the dimension it takes in support of legislation, under the legislative framework explain the legitimate interest of public authorities and societal stakeholders in the
Key areas for public and societal policy objectives are:

- Consumer protection and Healthcare
- Equal access to products, services, Transportation and information for people of all ages and abilities
- Open access to products, services and information for all people without specific, single vendor platform or application requirements
- Environmental protection
- Distribution and use of energy and water
- Good public governance and Social responsibility
- Underpinning the digital age and the information society

Based on ISO concept standards and public policy often share similar objectives – for example, enhancing economic competitiveness and efficiency, and facilitating international trade. Standards are useful tools for policy makers for a number of reasons: Firstly, the use of standard is consistent with the obligations of countries that are members of the WTO to reduce technical barriers to trade. Public authorities’ can therefore be confident that they are meeting these international obligations when using international standards and that the standards they are using are globally relevant. In today’s globalised world where public policies can no longer be developed and implemented in isolation, Standards also offer a means of communication and cooperation across borders, making them increasingly useful tools in the policy maker’s kit.

To come to Ethiopia context; FDRE Government Communication Affair Office publicized that; during the five years of the GTP I period, the industrial sector has grown by 20% where its contribution to GDP reached 15% by the end of the period, 2015. This is 3.8 percentage points less than the expected 18.8% target. In terms of
sectorial contributions, the construction sub-sector was the leading contributor to the industrial growth, despite various efforts to develop the manufacturing sector.

During GTP II, special focus will be given to develop large and medium scale manufacturing companies through the industrial park development programs and related incentive packages. Industrial efficiency and productivity initiatives, like KAIZEN philosophy and benchmarking initiatives will continue to play an important role during GTP II in order to achieve the expected industrialization agenda of the country. (From the bulletin (book) of “An Overview of Ethiopia’s 2nd Growth and Transformation Plan”).

Here it is important to note that competitiveness of the country with in the challenging global market will be sustainable if and only if it link with quality and standardization. However, the government initiation to link the development program and sectors activities with standards and putting standards as major tool to enhance the efficiency and effectiveness as well as the competitiveness of the country in global challenging market is weak but there are some interests to bring quality like KAIZEN.

The National Quality Infrastructure Strategy Document that was launched in 2009 also address the issue the interaction between research and standardization can be described in terms of knowledge and technology transfer.
Better connections and motivations improve the flow of new knowledge into standardization.

*National Standardization Organizations have an important role to play in enhancing these linkages, but they are not the only stakeholders that can perform this role. Standardization experts in other Organizations (e.g. industry associations, conformity assessment bodies and metrology institutes) can also play an important role.*
2. The Advantages for NSBs

The second rational is that the benefit that brings for the standard bodies. In general for NSBs, integrating research/innovation and engaging with researchers in standardization will have the following benefits:

2.1 Enhance the benefit of standards in all sectors

Standards bring prominence benefits to almost every area of our world. But despite the widespread use of standards, they often remain hidden, working modestly behind the scenes to underpin the technology and services that we rely on. This means that sometimes the contribution made by standards can be hard to quantify. This approach is essential to get the most from standards that standards bring to the businesses and society and to demonstrate their benefits realistic through producing materials that measure their benefits at both the micro and macro levels.

A significant number of studies have been conducted on the benefits of standardization and the use of standards abroad. Those studies made substantial progress in understanding the economic impacts of standards. However, in our country, the level of exploiting the use of standardization and standard through research is almost a null stage.

Linking research and standardization approach helps to show the benefits and role of standards through concrete data and evidence. It therefore addressing both standardization and standards as an output of research and innovation as well as a supporting infrastructure for research and innovation is another strategic approach for NSBs.
2.2 Increase the quality of the standards

Following the principles of standardization is highly a matter of the quality of the standards. As principle of standardization, standards are developed by groups of experts from all sectors that are part of larger groups called technical committees. These experts negotiate all aspects of the standard, including its scope, key definitions and content. To come to consensus and to determine the scope, key definitions and content of the standard the experts must come with solid facts and evidences. Researchers have a wider potential to provide these facts and evidences specific to each sector.

On the other hand existing standards may not be suitable for new generation products or technologies without significant revision. The adoption of new technologies, especially disruptive technologies, can be affected by the scope and focus of established standards. Better connections of standardization with research are particularly help to improve the flow of new knowledge into standardization.

2.3 Identify new areas for standardization and new market

Standards are only developed if there is a market need for it. It is recognised that commercial interests are one of the drivers of standardization; these interests can affect the adoption of standards related to new technologies The Linking of research and standardization communities will improve in identifying the future standards needed to accelerate market acceptance and is to meet rapidly market needs in fields which are particularly innovative or not ready enough.

2.4 Increase network and interaction with other communities

Standardization bodies work closely with the research community in order to include research results in standardization to promote their dissemination. NSBs also get an opportunity to access various resources including research documents and to share experiences; knowledge, skill and ethical considerations during the practical work.
It also increases the number of researchers in Technical Committees and other technical bodies and builds competence through involvement in research projects.

2.5 Provide new services to stakeholders
Standards will be available to the industry and the general public at an earlier time, Standards bodies can reduce overlap and better organise flow of relevant material, to promote and use standards in order to further support internal and external markets, especially for the quality and safety of services provided by the market including business-to-business, business-to-consumer and networked services and in support of the growth and competitiveness of the services sector.

2.6 Provide an additional potential for NSBs
NSBs also gain knowledge, skill and share resources from research organizations. Beyond from this it enhances influentially and gives opportunity to introduce the issues of standardization in research organizations policy.

3. The advantage for researchers and innovators and their organizations
Researchers/Innovators and/or their organisations can also benefit from standards and participating in the standardisation process will in turn give benefits in terms of:

3.1 Standards support all stages of innovation& research
✓ At the level of basic research, standards can have an underpinning or connecting function, such as agreeing terminology or basic testing. As research and innovation moves further towards development, so can standards: by enabling and supporting aspects such as design, testing, compatibility and quality. Standards play an important role for innovation. By codifying information on the state of the art of a particular technology, they enable dissemination of
knowledge, interoperability between new products and services and provide a platform for further innovation.

3.2 **Faster to market with standards**

- Standards are a good tool to ensure fast introduction of innovative products and technologies to the market.
- Standards play a multiple, catalytic role in the innovation system. The catalytic role seems to be particularly important for market acceptance of technology-based innovation. In the other hand standards improve the marketability of research and innovation results. They help to disseminate the research results to a wide community using unambiguous wording.
- Standardization process create an opportunity for Networking with other researchers, industries and stakeholders for future research and innovation;

3.2 **Standards play an important role in research projects**

- Standards play an important role in research projects. They improve the process of research by providing common terminologies, harmonised methodologies and comparability between research activities.
- Enhance the interoperability of the project's outcomes with what is already out there in the marketplace, and ensure compatibility with what exists, and enable the comparison of performance of the project's results with what exists,
- Reassure users when the research results are exploited,

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**Chapter 3**

**How to Integrate Standardization with Research and Innovations**

As indicated above Research and standardization should go hand in hand (Integrated Approach) to gain the mutual bilateral benefits. It is also important to overcome the various obstacles that may be encountered between research/innovation and
standardization. To actualize this approach different models are implemented by different NSBs to facilitate the integration of standards with research and innovation.

A. The DIN Approach to Integrating Standardization and Research

The DIN’s Model focus that Standards can influence the way investment in the generation of new knowledge is organized and thus supports potentially radical innovation. Standards are also considered especially important in specifying the content of research with more incremental innovation objectives. This is an issue that some National Standardization Organizations have investigated. DIN makes use of mechanisms that correlate to the different stages of the ‘product life cycle’, supported by three different types of project, as shown in Figure 2The DIN model extract in phases that incorporate

1. Integrates standardization in R&D projects early
2. Identifies the standardization potential of current innovation projects

Figure: DIN’s Tools for Linking R&D and Standardization (source optimat, 2014)
3. Integrates practitioners and experts from research & development in standardization

4. Transfers content relevant to standardization into publicly available specifications (PAS) and CEN workshop agreements (CWA)

5. Standards as instruments of exploiting research results
   - Transfer, networking, dissemination
   - Standards are recognized results of R&D projects

B. BSI’s approach to linking R&D and standardisation

The right standard at the right time

Figure: BSI’s approach to linking R&D and standardisation (source optima 2014)
In the perspective of BSI model at early stages of the innovation life cycle, standards may facilitate the process of research in various ways that enable effective communication between researchers and allow for the systematic collection of results and data. However, as we get closer to commercial applications, standards provide important elements of marketability and may also assist companies to show that they are meeting regulatory requirements. In this case, standards are therefore part of the ‘demand pull’ side of the innovation system – which in turn creates flows of knowledge from products and markets back into research and innovation.

C. Proposed Integration Map in the Context of Ethiopia

Fig 4 Proposed Mapping for the Integration (developed by the compiler)
3.1. Strategy

3.1.1. Define strategy

In order to develop the integration between standardization and research in an organized and fruitful way, standardization body should start by defining a strategy. The strategy should set out the vision and approach to addressing the integration of standardization and research and the general aims and expectations that NSBs wish to achieve. Developing the strategy will entail establishing concrete objectives and developing a plan to achieve them. Naturally, this strategy will be aligned with the overall strategy of the particular NSB. Below we will find some advice on how to establish a strategy.

3.1.2. Gain commitment to support the strategy

To support any decision to work together with researchers, NSBs will need to commit time and resources. Given that any new roles and activities will be managed and supported from within our organization, standardization body top management will also need to support and recognize those as being part of the everyday activities of the NSB.
### 3.1.3. Do own homework in advance

Make sure standardization body have all the knowledge that need to complete the strategy successfully. Base the strategy on both an internal analysis of the organization and an external analysis of the environment.

In general, many of these aspects will influence the NSBs choice of research-related activity and the objectives that are appropriate for them.

**TABLE 1: ASPECTS TO CONSIDER IN THE INTERNAL AND EXTERNAL ANALYSES**

<table>
<thead>
<tr>
<th>Internal analysis</th>
<th>External analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ the resources (e.g. human, technical) available to the organization</td>
<td>➢ the identification of stakeholders (researchers, policymakers, industries and intermediate organizations;</td>
</tr>
<tr>
<td>➢ previous organization’s contact with research organizations</td>
<td>➢ the identification of the needs of these stakeholders</td>
</tr>
<tr>
<td>➢ current levels of participation of researchers in national committees</td>
<td>➢ the level at which standardization is already routinely considered in national research policies and programmes</td>
</tr>
<tr>
<td>➢ existing knowledge of procedures for participation in research projects</td>
<td>➢ the main research areas/activities in the country the success rates of previous project proposals in your country</td>
</tr>
<tr>
<td>➢ previous experiences with participating in research projects</td>
<td></td>
</tr>
<tr>
<td>➢ capacity for fulfilling the obligations entailed in performing standardization work (e.g. secretariats)</td>
<td></td>
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</table>
3.2 Organizational capability

3.2.1 Resource allocation

It is desirable to have staff members dedicated to innovation and research. The number of staff will depend on the NSBs involvement in research and innovation activities and on the resources available.

It is important for staff to have well-defined responsibilities for developing activities, fulfilling objectives and coordinating interaction with the research community. Staff should have (or be prepared to develop) knowledge of or experience in the following areas:

- Standardization procedures and policy
- The concept, benefits and application of the Integrated Approach
- Funding programmes for research and innovation
- Project and portfolio management

Knowledge of these topics can be acquired by doing desk research, attending informative events, enrolling in specific internal or external training courses, etc.

As participation in research projects is often externally funded, a large financial contribution on NSBS part may not be necessary. Nevertheless, NSBs should bear in mind that the cost of preparing a proposal is not usually covered by project funding, and any resources required for this should be considered as being integral to any staff role. NSBs level of existing experience may influence how much time they allocate to developing project proposals: the more often NSBs have done that, the easier it will be and the less time it is likely to take. However, once a project has been approved and starts, the budget (mainly personnel and travel for an NSB) may be totally or partially covered by the programme that is funding the project.
3.2.2 Internal communication

To avoid conflicting messages, a lack of coordination and lost opportunities, a fluent and meaningful internal information flow within the organization will be essential. NSBs colleagues in standardization should be informed, trained and involved. NSB should ensure that they understand the concept of the Integrated Approach as well as specific approaches to the integration of standardization within research projects. They will also need to know who is responsible for research-related activities within NSBs.

3.3 Engaging Appropriate Stakeholders

3.3.1 External Communication and networking

Communication and networking are core activities when it comes to forging a better link between standardization and research. Both are important when NSBs are planning the first involvement in research projects but also on a continuing basis throughout their participation in research.

A good planning and design of for communication activities will support NSBs in their efforts to raise awareness about the link between innovation and standardization, the opportunities that standardization can offer to research, and the role of standardization as a facilitator of innovation. As one NSB cannot possibly reach all relevant stakeholders, it may find it useful to consider how best to make use of that parties might be able to convey the message and thus act as information multipliers.

Networking will help NSB become known within relevant organizations and institutions and among the people who are actively involved. The concept of networking is different from that of communication, but it can also include a strong promotional component. Building and working across networks implies interaction
between all the different members of the network, collaboration, brokering, searching for opportunities.

Communication is not an end in itself but should play an important role in helping to link research with standardization. Achieving communication goals will enhance the organization’s credibility as a potential research partner and thus increase the likelihood of success. It is therefore essential to have a good communication plan with clear goals and actions.

Defining the goals of communication is the first step in choosing target groups, materials, forms of communication, and timing. NSBs will also need to consider the different purposes of communication, as follows:

3.3.2 Raising awareness
The aim here is to create awareness of the role that NSBs can play in research projects and the kind of services they can provide; usually this does not involve any “deep” knowledge of standardization, but it could be helpful to use the example of an existing project or of ongoing activities and their outcomes. An NSB/NC may wish to inform research organizations about the services it can offer researchers, using supporting materials such as flyers or brochures targeted to research organizations.

3.3.3 Promoting understanding
The aim here is to communicate information relating to the benefits of the standardization activities and to help the target groups acquire a deeper understanding of own activities and services. For example, an NSB may wish to organize a promotional event, providing information and interacting with stakeholders.
3.3.4 Calling for action
Communication with the aim of calling for action has the deepest impact on the target groups. Here, the audience are those individuals who are in a position to influence and bring about change within their organizations or structures. For example, the NSB/NC could contact a decision-maker to present the opportunities that standardization offers as an added value to research projects in order to secure the engagement of the NSB/NC in a research project.

3.4 Target Groups
Standards play an important role for every stakeholder in the research community. While there may be significant differences between countries in this respect, it is always important to consider the following groups of stakeholders:

- **Policymakers/government organizations**
- **Researchers**
- **NGOs**
- **Certifying agencies and conformity assessment bodies**
- **Technical Committees**

3.4 How to communicate
These include sector associations, research platforms, and clusters. Often they facilitate groups creation and composition as well as idea generation and they are willing to provide information to their members or associates.
Not all activities will suit all stakeholders. Keep in mind while networking that many stakeholders will have little or no knowledge of standardization, and may simply not be interested in it as a topic. It can be very useful to develop informative material in advance and focus on the value that the services can add rather than simply listing what services provide.

Once the network is built, it is important that maintain it. One of the main issues will be the availability of a contact at NSB. Consider the following methods of promoting the engagement of standardization and research:

✓ **Creating a dedicated webpage**

This can be a low-cost way to reach a potentially wide audience. Make sure the target group will be able to find it by using relevant keywords, such as “standardization”, “research”, “innovation”.

✓ **Organizing dedicated events**

These can be very useful for communicating to a wide range of target groups. Such events could be conferences or seminars. It is important to clearly identify the topic of the event, the target audience, the aims as well as the information to be presented and the focus given to the specific interests of the audience.

With these kinds of events, the way in which NSBs contact the potential audience and advertise the event to attract attendees is crucial. **Holding face-to-face meetings or creating a forum/platform which is useful as a way to provide detailed information to specific stakeholders (e.g. policymakers,**
research contacts at a university, industries) and to obtain a high level of feedback.

✓ **Integrating technical committees with researchers**

This is simple, because NSBs are using their existing committee contacts. Often technical committees are not aware of the benefits of integrating standardization and research. The same is true for researchers and they will not understand the way standards developed and the content what standards has and their benefits for research and innovation. Hence, develop improved mechanisms to facilitate and encourage the research community to participate in standardization and establish effective mechanisms to support standardization experts to contribute standards related knowledge to relevant research projects.

✓ **Raising awareness**

Increase awareness of standards, the standardization process and the benefits that they offer to the research and innovation community (including relevant government organizations and funding agencies). It Encourage research and innovation actors to consider the role of standards and standardization in research projects. This can be done in various ways: *Distributing brochures and flyers*- These can be used for general purposes but also for specific target groups or events. As the amount of information they contain is limited, it is important to carefully select the main topics to be included. *Giving presentations at external events*- These can be useful to “sow the seeds” of information to identified target groups and as a first contact for further conversations.

✓ **Integrate with the country development program**

National Standardization Organizations need to reach out to the research & innovation community, including government departments and research agencies, in their country by going beyond simply providing an expert service to R&D projects. They need to ensure that the catalytic role of standards can be maximized to help overcome the
market barriers to the adoption of new technology-based products and services. Designing a policy or strategy that will help to link the country’s development programs and standardization activities is a baseline.

3.5 Link standardization with education
In addition to communication and networking targeted at research, NSBs can also strengthen the link between research and standardization by educating the wider community about standardization.

Understanding standards and standardization and being able to use them effectively is of great importance to current and future researchers, as well as to other organizations participating in research.

Through education about standardization, researchers can better understand the benefits of standards, how to use them and how to contribute effectively to the process of making standards. This will increase the likelihood that researchers will include standardization from the beginning of their projects, thereby reaping the full benefits that standardization can offer. Basic knowledge about standardization is necessary to ensure that researchers will recognize how their projects can benefit from standards and standardization.
Chapter Four

Recognized Points to the Integrated Approach

There are barriers on both sides to improving the links between the research & innovation and standardization systems. The important barriers that inhibit participation in standardization are; lack of understanding of the standards benefits, a lack of the resources to participate, and limited motivation for academic researchers and constraints for industrial researchers to participate in standardization although this does vary by their field of research. There is also absence of platform, policy and strategy that govern this highly important issue. Therefore, the following points should be considered to make the integration effective:

- the potential of standardization to contribute to develop innovation and competitiveness ‘by facilitating access to markets, enabling interoperability between new and existing products, services and processes, enhancing protection of users, giving consumers confidence in innovations and disseminating research results’;
- public research bodies and public sponsors of research programmes at national level examine the potential interest in developing standards in order to exploit research results;
- standardization bodies work closely with the research community in order to include research results in standardization work to promote their dissemination;
- the NSB take action to increase the value of participation in standardization activities in the careers of researchers; both standards and patents be recognized as innovation dissemination tools;
- the potential of standards to encourage innovation in areas such as services; legislation promoting the free circulation of goods and services and the role of standards to support the better regulation policy; the importance of competitiveness outside the country in the context of increasing globalization.
- government shall support the use of standards in matters relating to sustainable industry policy, lead markets, public procurement, information and communications technology and the better regulation policy;
the potential of innovation existing in the services sector be highlighted, and the possible benefits linked to the development of standards in that area be better promulgated, in order to improve the quality and competitiveness of the country’s services;

The government shall improve the position of standardization in education programmes and academic curricula to familiarize students with the strategic benefits and challenges of standardization.
Source Documents

- An Integrated Approach for Standardization, Innovation and Research (CEN & CENELEC)
- Bridging the Gap between Research & Standardization (DIN, 2013)
- Economic Benefits of Standards (ISO, 2014)
- Fact Sheet How To Reap The Benefit of Standardization In R&D (European IPR Helpdesk, 2014)
- How to Link Standardization With EU Research Projects (CEN & CENELEC, 2015)
- Research Study on the Benefits of Linking Innovation and Standardization (optimat, 2015)
- Standards To Support Research and Innovation (CEN AND CENELEC, 2015)
- The Economic Benefits of Standardization (DIN, 2000)
- The Economic Benefits of Standards To New Zealand (Dr Amapola Generosa and Dr Ganesh Nana, 2011)
Papers of the First Annual Research Conference of Standard & Standardization

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Roles of Standards and Their Impact on Research & Innovation: A Review

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Executive summary

Standardization is considered as a technology transfer channel while standards are as enablers and facilitators for research. There are many contradictory views about importance of standards in research and innovation. Hence, the purpose of this study was to investigate the role of standards in research and innovation and the relationship between standards with research and innovation by examining their role from existing studies for research and innovation output and result dissemination. In order to come up with the conclusion and findings, it has used data from existing literatures and interviews of researchers in universities and industries people. The finding of this work from literature revealed that the researches were conducted in line with the role of standards for researches and innovation has been found important in globe but Ethiopia need to start from the base. The respondents of the questions and the data sources indicated that there is less consideration of standardizations in research and innovation process. Therefore, this research has attempted to show the importance of standards, the relationship of standards with research and innovation; and its impact on researches and innovations. However, the finding of this study is not exhaustive but just as a highlight for the future work studies and motivation for the policy makers like Ethiopian Standard Agencies.

Keywords: Dissemination, Innovation, Researches, Standards, Transfer,
1. Introduction

Standards can play a key role in facilitating researches and innovation. The standardization of research and innovation helps in catalyzing the operation better than the classical one. Researches those were undertaken in previous studies indicated that standards and standardization have played an important role in the evolution of information and communication technology. According to the study conducted by Münstermann and Weitzel (2008) while there seems to be a consensus on the desirability of process standards, the concept has not yet been fully developed, and there is even less of a clear definition let alone a systematic understanding of the how and why of its value impact than with data and communication standards.

Researcher considered standards as a catalyst for innovation which does facilitate the process of new idea creation or improvement without affecting the process of innovation (Blind, 2009). He also stated that standardization has often been perceived as a contradiction to innovation. However, standards are important elements in the framework conditions for future research, development and innovation facilitation process.

Standardization is considered as a technology transfer channel while standards are as enablers and facilitators for research. There is a large potential for standards and standardization to promote innovation for policy makers (Münstermann and Weitzel, 2008, Blind, 2013). These researchers’ highlights the aim of standardization is producing documents by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context, particularly in researches and innovation.

The report of EUC also stated that the economic impacts of research results and
intellectual properties right (IPR) can only be realized through their successful transfer into innovative products and processes (Blind, 2013). Which indicate standards help in leveraging (forcing) and diffusion mechanisms of research and innovation intellectual properties right.

As indicated above standards are the efficient and effective research and technology transfer channel’s even though unconsidered in many researches especially in developing countries. Ethiopia has challenges of innovation and even the word that is not known by many of the companies. The preliminary data was collected on textile, garment, chemical products, leather and leather products industries has resulted in the term were not known by many. The term research and innovation is prominently known and well defined by majority of Universities academic staff. However, the importance of standards to research and innovation is not the thematic area of many researchers. It needs much work in the future. In the global scenario, it is very important even though some positive and negative impacts of standards in research and innovation are remaining in debate.

1.1 Concepts of Standards and Standardization

A Standard is a document established by consensus, and approved by a recognized body, that provides, for common and repeated use, guidelines or characteristics for activities or their results aimed at the achievement of the optimum degree of order in a given context (ISO/IEC Guide, 2004, ISO, 1996, Vries, 1999).

Standardization is the activity of establishing and recording a limited set of solutions to actual or potential matching problems directed at benefits for the party or parties involved balancing their needs and intending and expecting that these solutions will be repeatedly or continuously used during a certain period by a substantial number of
parties for whom they are meant (Vries, 1999). Standardization as the degree to which work rules, policies, and operating procedures are formalized and followed (Jang and Lee, 1998).

Study conducted by Gepp, Steinmann, Vollmar & Voigt (2012) standardization is a common approach in industry to manage complexity. It enables enterprises to realize e.g. cost savings and quality improvements. This study indicates that also numerous empirical studies examining different aspects of standardization have been carried out, but the research landscape itself has not been subject of many studies yet. Standardized process activities and interfaces lead to a less complex exchange of goods and services between business units as well as external customers, suppliers and partners. Standardization is an essential tool in the research and innovation of products, process and services.

1.2 Concept of Innovation

An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (either new to firm, market or the world) (OECD, 2005). Innovation activities cover all scientific, technological, organizational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations (OECD, 2005). The studies conducted categorized innovations into two groups: technical and non-technical factors (Pot et al. 2012a). For example, non-technical factors are high performance work systems and new ways of working. Such non-technical innovations are considered by studies interchangeably as organizational innovation (Hage 1999; Lam 2004), workplace innovation (Pot 2011; Totterdill, 2010), and social
innovation in the workplace (Eeckelaert et al. 2012; EUDG 2012; Pot et al. 2012b). These innovations are neither the end products (new products or services), nor the R&D expenditures. But they deal with renewal and improvement of the deployment of people, management, human resource, organizational structure, primary process, marketing methods, production methods, organizational policies, redesign, workplace improvements and refreshment of systems. So, innovation can be defined as renewals, either radical (revolutionary) or incremental (gradual), in a process (Pot et al. 2012a).

In general, previous studies ratified that innovations the process of creating new ideas or adopting existing ideas from the other sources into a new community (Ecuru, Lating, and Trojer, 2014; Trojer, Rydhagen, and Kjellqvist, 2014). Innovation of process requires infrastructure development so that its diffusion and process gets smooth implementation. This is proven by the studies that the infrastructure is a key resource for the effective functioning of innovation and for economic performance more widely (Marion & Ray, 2012). According to this study innovation can be available in different variables as indicated in Table 1.

### Table 1: Variables feeding into the innovation modes (Marion & Ray, 2012)

<table>
<thead>
<tr>
<th>s/n</th>
<th>Variable Name</th>
<th>Variable Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Product innovation</td>
<td>Enterprise introduced a good or service only new to the firm</td>
</tr>
<tr>
<td>2</td>
<td>Process innovation</td>
<td>Enterprise introduced a new process</td>
</tr>
<tr>
<td>3</td>
<td>New-to-market</td>
<td>Enterprise introduced a new product or process that was new to the market</td>
</tr>
<tr>
<td>4</td>
<td>Strategy</td>
<td>Enterprise introduced corporate strategy</td>
</tr>
<tr>
<td>5</td>
<td>Management</td>
<td>Enterprise introduced new management technique</td>
</tr>
<tr>
<td>6</td>
<td>Structure</td>
<td>Enterprise introduced a new organizational structure</td>
</tr>
<tr>
<td>7</td>
<td>Marketing strategy</td>
<td>Enterprise introduced a new marketing strategy</td>
</tr>
<tr>
<td>8</td>
<td>In-house R&amp;D</td>
<td>Enterprise carried out in-house R&amp;D</td>
</tr>
<tr>
<td>9</td>
<td>Sourcing</td>
<td>Enterprise bought in R&amp;D or other knowledge, e.g. licensing-in</td>
</tr>
</tbody>
</table>
Table 1 data indicates some variables which are related with innovation. Innovation areas can consider these variables for the interaction of research and innovation while standardizing. This factors and others which are not included here aims was to consider a comprehensive range of innovation activities, including activities leaning towards the technological end, such as in-house R&D and to the non-technological end of the spectrum, such as the introduction of new management techniques.

The policy relevance of standardization for research and innovation is progressing from the European members of innovation to the international wide including especially the large and fast growing emerging countries. Nevertheless, the potential of standardization as an effective and efficient mechanism to promote innovation has not yet fully perceived and used by policy makers.

Innovation is a complicated and heterogeneous process, the dynamics of which will tend to vary from case to case. In general terms, the innovation process can however be understood to involve the sustainable generation, distribution and utilization of new economically-relevant knowledge which continuously accumulates and is recombined in the economy (Eric, Esten and Haakon, 2019).

Therefore, the purpose of this study is to investigate standards role in research and innovation to put future research directions based on the literature survey in context of Ethiopian cases.

2. Materials and Method

This study was conducted based on previous research studies’ findings. That means, it has used data majorly from existing body of knowledge. This is because of the thematic area is new for our country to collect data from the industries and institution. This was learnt from preliminary questions that there is a challenge to obtain data related in innovation. However, to highlight the
existing condition interviews of researchers in Universities and from industries on innovation knowledge were conducted. Discussions with professionals and industry people were made.

The research also obtained data from document reviews, e-mail, and telephone and research gate. Therefore, for this paper more inputs were used from the existing literature in order to get insight on the development of standards in research and innovation. The overall research process framework is shown in Figure 1.

The research was conducted starting at problem formulation related to the topic. This problem formulation began from the thematic area and objective of the ESA that lead the author to take action on review of literatures. The literatures reviewed have produced some challenges and gaps that are confusing in related to the role of standards in research and innovation.
The reviewed gaps has been interwoven into the current state of the art and helped to set direction. Based on the review and some preliminary university and industry experience assessment, some results from the response of questions has been include for the purpose of the discussion and substantiation of the research highlight. Finally, as shown in figure 1, the research directions for further consideration of researchers and stakeholders have been recommended to further advancement of studies.

3. **Review and Discussion**

The result and discussion focuses more of its analysis on the literature review and some experiences of individual were collected through interview. The study in literature revealed that the researches were conducted in line with the role of standards for quality researches and innovation has been found undermined. In literatures, standardization care considered as an effective and efficient channel of knowledge transfer besides other well-known channels (like collaboration in research and development, licensing, or exchange of personnel). However, many research institutions, companies and policy makers have neglected this channel, especially research funding organizations (ESS, 2010). Study has showed that standards bodies have also not consistently addressed development of research friendly and innovation-friendly policies (ESS, 2010).

There is a controversial discussion facing regarding the relation between innovation and standardization (Blind, 2009).Studies also stated that there are still only rather a limited number of publications and especially limited empirical research evidence on the interrelationship between innovation and standardization (Swann, 2010). However, according to this review the role of standards in researches and innovation is not contradictory and rather is catalyst and facilitator of innovation and researches.
3.1. **Role of Standards in Researches and Innovation**

In many researches, it seems safe to say that the complexity of products, processes and services in an industrial environment is increasing. The cause of the increasing complexity lies i.e. in megatrends like globalization, individualization of customer needs, or the technological change (Gepp, Steinmann). The commercial success and economic impact of R&D results will only be realized by a successful transfer of these results into innovative products and processes (Blind, 2013). This report found that standardization as an instrument of technology transfer has only recently been recognized in EU.

Standards are a knowledge and technology transfer channel for knowledge integrated within consensus process. Therefore, standardization process is knowledge sharing and knowledge production process. Besides the codification of knowledge in standards, exchange and even the production of tacit knowledge takes place during the standardization process. Standardization provides the chance for the practical implementation of research results in innovative technologies, products and services.

Relation to standardization of procedure, interpretation and scores are very important in researches and innovation (Fischer & Milfont, 2010; Vollmar & Voigt, 2012). This study indicated that globalization for instance promotes globally distributed engineering activities and leads to organizational complexity. It also stated that others like individualization of customer needs and technological change lead to complexity on a technical level (e.g. product variety, number of components in a system, share of mechatronic components).

Since standardization is an approach to manage this complexity, researchers assume that it has become increasingly important.

The relationship between standardization and innovation is the transfer of R&D results into standards and by the market exploitation of the results of standardization. Standardization can be a major facilitator for the validation and exploitation of new technologies and for market access. But there is a disconnect in the exploitation of R&D results by standards development activities, often due to a lack of awareness of the R&D outputs and missing support and incentives (ESS, 2010).

Conceptual model of the role of standards for the various stages in the research and innovation process can be confirmed for all areas of research (INTEREST, 2005) as shown in Fig 2. Addressing the specific role of standards for research, researchers confirm the general relevance of standards for all phases of the research and innovation process. The specific importance of particular types of standards depends crucially on the specific field of science and technology.

Figure 2: Research and standardization in technology transfer mode (Blind & Gauch, 2009)
It is clear from Figure 2 model that standardization is a vital tool throughout the research, development and diffusion process. However, different standard types perform different roles and bring different benefits to the process. Early on standards are needed to understand and transfer knowledge through the basic research into strategic level research. Statistical measurement standards can convert this knowledge from strategic to applied research (Agata, Markus and Philip, 2017, Alexander and Katharina, 2018). Here, raw data does not give sufficient information to unless the data processed to provide the information required. Manager of laboratories and test houses need standard methods for analyzing and determining the precision of test results (Williams, 2010).

![Figure 3: Standards in the research and innovation process](Blind & Gauch, 2007)
For an effective innovation policy, the different stages of the innovation lifecycle need to be taken into account, starting with scientific research from the early development of technologies, through to product development and on to broad adoption for market deployment. The role of standards play is different at the different stages of the innovation lifecycle (Swann, 2010). Standards can support innovation and promote the adoption of new technologies in a number of ways. They can codify and spread the state-of-the-art in various areas, as well as bridge the gap between research and end-products or services. Codification of information in standards on innovations, its accessibility increases to everybody, and so firms, Universities and research organizations can use this knowledge to adopt innovations or generate new ideas (EUC, 2012).

Therefore, standards facilitate the introduction of innovative products by providing interoperability between the new and the existing products, services and processes. They form the basis for the introduction of new technologies and innovations, and ensure that products, components and services supplied by different companies will be mutually compatible. In this way, standards also facilitate international trade, by ensuring the compatibility and interoperability in different markets (EUC, 2012).

Standards might obstruct innovation; the evidence from a number of detailed studies suggests a rather different story. Surveys of innovating firms have found that many enterprises report that standards are a source of information that actually helps their innovation activities (EUC, 2012).

In Germany, innovation and standardization are two sides of the same coin (Volker Stich, 2010). On one side, innovating means making something new and different from anything else existing. In contrast, this can seem to go against the principle of unifying products and processes. In fact, there is
no opposition between innovation and standardization. It is only through having standards and best practice that companies are able reliably and systematically to identify potential for optimization. This potential can give rise to innovations which are then tested in a stable environment. If innovative products and processes become successful, they should again be brought into a standardized format. Hence, innovation and standardization are two iterative stages of continuous improvement (Volker Stich, 2010, Agata, Markus and Philip, 2017, Alexander and Katharina, 2018).

In general, we can learn from standardization of innovation that standardization generates standards, which are an essential component of companies’ infrastructure. Thus, they have the power to enable innovation, but also try to hinder undesirable outcomes (Swann, 2000). He identified that standardization helps to build focus, cohesion and critical mass in the emerging stages of technologies and markets; standards for measurements and tests help innovative companies to demonstrate to the customer that their innovative products possess the features they claim to have, but also acceptable levels of risks for health, safety and the environment.

In principle innovative technologies and products contain often a higher level of risk for health, occupational safety and environment, but also policy makers. Hence, standardization of innovation helps in reducing these kinds of risks and hazards to society because the importance of standards are for the improvements of the quality of the product or service provided, increased ability to demonstrate the quality of products or services, increased confidence in the research output and innovative product or service, and its products or services, improvements to organization image, ability to cooperate using a common ‘language’, interoperability between different products and systems, improved ability
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to meet legislative and regulatory requirements, improved access to and success in public procurement, facilitated innovation, improved access to state-of-the-art knowledge, improved internal risk management and planning, reduced costs and increased competitiveness of researches and innovation. Standardization of innovative technology also helps to avoid the old technologies and replaces by the new once which are environmental and societal friendly technologies or products and services.

In the other hand standards codify and diffuse state of the art in science and technology and best practice; and open standardization processes and standards enable a competition between and within technologies and contribute therefore to innovation-led growth.

3.2 Categories of Standards and Their Effects on Research and Innovation

In previous time, there was less studies on the relationships of standards and innovation. However, in recent time, there are publications those addresses the interrelationship between innovation and standardization. For instance, Swann (2010) showed standards were used as facilitators of researches and innovation. He also tried to put that there are four types of standards having positive and negative effects on research and innovation (Table 2).

As drawn out from the studies standardization converts new knowledge from scientific research into market in areas like nomenclature/terminology and metrology, measurement and test methods for reliability, quality and safety, conversion in products, processes and systems, interoperability. Regarding the adoption of new technologies, standards are supported by innovation-friendly policy and understandings about the implications of intellectual property rights are a key instrument for technical validation and market access.

Thus, the transfer of innovative technologies into commercially
successful product and solution offerings are essential. The availability of standards as a widely-agreed, accepted and implemented base level of new technology provides in itself platform for innovation and triggers further innovation in the implementation and application.

The respondents of the interview for which “Do you have a knowledge on standardization and innovation of product and process” resulted in that has a knowhow on standards with confusion. However, none of the interview from textile, garment, leather and leather product and chemical industries has responded they know innovation. Regarding University academician, they know the definition of standardization and innovation. But most of the respondents have no clear insight of the importance of standardizing research and innovation.

Table 2: Types of standards and effects on research and innovation (Swann, 2010)

<table>
<thead>
<tr>
<th>Types of standards</th>
<th>Positive effect</th>
<th>Negative effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility/Interoperability</td>
<td>• network externalities,</td>
<td>• monopoly power,</td>
</tr>
<tr>
<td></td>
<td>• avoiding lock-in old technologies,</td>
<td>• lock in old technologies in case of strong network externalities</td>
</tr>
<tr>
<td></td>
<td>• increasing variety of system, products,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• efficiency in supply chains</td>
<td></td>
</tr>
<tr>
<td>Minimum Quality/Safety</td>
<td>• avoiding adverse selection,</td>
<td>• only raising rival’s costs</td>
</tr>
<tr>
<td></td>
<td>• creating trust and reducing transaction costs</td>
<td></td>
</tr>
<tr>
<td>Variety Reduction</td>
<td>• economies of scale,</td>
<td>• Reducing choice,</td>
</tr>
<tr>
<td></td>
<td>• critical mass in emerging, technologies and industries</td>
<td>• Market concentration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Premature selection of technologies.</td>
</tr>
<tr>
<td>Information</td>
<td>• Providing codify knowledge</td>
<td>• only raising rival’s costs</td>
</tr>
</tbody>
</table>
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For these matters, the researcher focused more on the literature results to come up with “Are standards important for research and innovation?”

Question was also raised to the same companies related to “Do standards enable or constrain innovation?” In this regards, the companies were not familiar with innovation and standards, unable to give response. The researchers responded that in Universities there is no uniformly standardized research process. As they responded that each units of the University follow their own format and which is confusing in research line for the researchers to have uniform understanding of result generation and dissemination. They agree that unstandardized research and innovation process is confusing and difficult to produce realistic result in the research out comes in the end. Global as discussed in literature, there is less consideration of standards in research and innovation process in the so far studies. But in the recent time, European Union Commissions like German industries have proved that standards facilitate and catalyze the research and innovation processes (Swann, 2010).

Even though, standardization processes are time consuming, which may create also some delay in the transfer process, its benefits in research and innovation has found to be essential (Berger et al., 2012). For instance, metrology, measurement and testing standards are more relevant for applied research; quality, health and safety standards are crucial for market introduction by restricting possible risks of innovative technologies and products; and compatibility standards can promote the diffusion of technologies and products especially in network industries. Across all these dimensions, standards can supplement (complement) governmental regulations. For example, in early stages of emerging research and technology fields, self-regulation via standardization allows stakeholders to set flexible framework conditions, which can later
be transferred into governmental regulations. In order to exploit these various potentials of standards for research, they have to be developed in time, which requires systematic standardization foresights (Goluchowicz and Blind, 2011).

### 3.3 Proposed Role of Research and Innovation Process Framework Path

Research and innovation standardization is not a simple issue but requires great attention by the agency plus universities. The Ethiopian Standard Agency should have own the standardization role in research and innovation as many researches revealed their concern in the literature review as contradicting issue. Ethiopian University should work on the research and set standards to their researches so that the research results get catalyzed.

![Proposed Role of Research and Innovation Process framework path](Author, 2018)

Figure 4: Proposed Role of Research and Innovation Process framework path (Author, 2018)
This research result is the innovation after dissemination helps to promote the inclusion of standardization practices and benefits in higher education and encourage the development of studies and surveys to assess quantify and communicate the economic and social benefits of standards. The diffusion of knowledge about standards and standardization is not yet under taken in universities and industries by the standard agency. Standardization and the benefits and working processes of standards for research and innovation enhancement are not a regular part of education curricula. This is a big assignment in front of Ethiopian Standard Agency to promote this serious issue of technological innovation and green environment development process.

Universities have two main missions. The first mission is to extend the stock of knowledge through academic research and the second mission is to disseminate this knowledge through the provision of research-based education. These are that facts behind every universities and institutions of teaching and researches.

As shown in Figure 4, in general, universities and standard agency with other stakeholder should work more on research and innovation standardization considering the following important benefits and advantages. University should be initiated to conduct researches related to standardization of researches and innovation to reach on consensus. As the figure 4 indicated that universities are responsible to generate research and convert the result into innovation. But it needs throughout all process codification and standardization of the research process to dissemination or changing to innovation. After conducting the research and innovative products/service, the standards have to be set. Based on the standards implementation to researches and innovation, it is important to measure the result of the implementation from the practice to see the impact it has on quality and economic of scales. The
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continuous improvement process continues throughout life of the process.

The standard agency and the university should measure the achievement in preference to the standards contribution obtained from the practice of other studies or own implementation. The agency should look into the contribution of standards from the prospective point of view of the following benefits of standardization.

Standardization contributes to global market access for innovative solutions, thereby increasing the competitiveness of country organizations in the context of an innovation-friendly framework; the protection of health and the environment, and helps ensure safety, especially in relation to innovative technologies and services; economies of scale and cost savings; compatibility and interoperability. It also contributes to economic growth via faster and broader diffusion of innovations; international competitiveness via enhanced productivity and innovativeness; the knowledge economy via the gathering and diffusion of knowledge; benefiting society by protecting health, the environment and helping to ensure safety. It helps to the dissemination of knowledge in addition to scientific publications and patents, as standards represent the state of the art in science, technology, services, tools, techniques and management; the exploitation of funded research results, including intellectual property rights, which are integrated into standards; maximizing the practical application of research results. With no doubt, standardization also facilitates the transfer of knowledge and technology into marketable products and services; the dissemination and exploitation of research results; the enhancement of recognition and reputation; networking with other researchers, industries and stakeholders for future research and innovation; the inclusion of all interested parties in framing the rules relevant for future research and leveraging licensing
revenues of own patents by referencing them into standards.

3.4 Intellectual Properties Right and Standardization

Intellectual Property (IP) is a term referring to a number of distinct types of creations of the mind for which temporary property rights are recognized by the law (EUC, 2012). Under IP law, owners are granted certain exclusive temporary rights to a variety of intangible assets, such as: musical, literary, artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Common types of IPR include copyrights, trademarks, patents, industrial design, and domain names rights. As we see here research IPR is not in consideration unless it is protected by international research agenda and plagiarism protocol. However, the result of the research should have to be patented as more researches are coming into the stage of the globe. Especially for those who are residing in Africa.

Intellectual property rights and standardization are important social institutions that play active roles in technical innovation and researches. They share certain similarities as institutions: for example, both patenting and standardization essentially serve to codify technical information into no dubious, replicable language (Blind and Thumm, 2004).

Research results are increasingly protected by intellectual property rights (IPR), especially patents, driven by policies and strategic motives to patent (Blind et al., 2006). Intellectual property rights IPRs are important in the context of standardization and innovation. The relationship is complex. Both IPRs and standardization encourage innovation and facilitate the dissemination of technology. However, they contribute to these common objectives by different means to owners of research result (ESS, 2010). Hence, due regard needs to be paid to the interrelationship between IPRs and standardization through
research and further studies. Hence, due regard needs to be paid to the interrelationship between IPRs and standardization through research and further studies.

It is also important that standards organizations continue to ensure innovation-friendly policies including a balance between the interests of the users of standards and the rights of owners of intellectual property as almost all standards bodies do today.

In general, intellectual property rights are supposed to be an important incentive for research and development, and they are held to be a necessary precondition for science and technology to progress. A patent on an invention grants certain rights to the applicant for the use of that invention (Blind and Thumm, 2004).

4. Conclusion

The researches and preliminary survey in Ethiopia has resulted no awareness of what innovation is in the context of industries and only the high light knowledge is known by higher institutions. The preliminary questions and discussion made with higher institutions and industry people are not sure with what standards role is in research and innovation.

However, the researches merely conducted reconciled with literature substantiated that role standards in research and innovation are very essential for research and innovation management. In general, Standards are important in research & innovation in line with supporting all stages of innovation, enhancing introduction of research output and innovation to market, increase impact of research results, build trust on innovative product by users and standards help in research and innovation universally recognition.

Standards transfer knowledge from research to standardization, can serve as framework conditions for the next generation of research. Standards not only reduce the time to market
inventions and innovative technologies, but in the first place allow their marketing; accelerate the diffusion of innovations, control the researches output; and standardization as a powerful tool for transforming innovations arising from R&D projects into marketable, tangible results and future business opportunities. Related to finding of Ethiopian case, it is a highlight for the future work studies and motivation researchers like Ethiopian Standard Agencies, Universities and other stakeholders.

This study recommends further studies how research and innovation codification is functional in Ethiopian context, resources in line with the terms diffusion to industries and service sectors. This helps the standard agency to manage the research and innovation voluntary and regulation framed based. The standardization of the research and innovation in Ethiopia should start with Universities research gate and industries as private or organizational actors. The Ethiopian Standard Agency should work on standardization of research and innovation output generation and dissemination.

As mentioned above the study showed that standards are very important to research and innovation to facilitate and catalyze the process. The remaining thing is to determine how, when and in what context research and innovation be standardized, especially in Ethiopia context is the future research area. The second area should be in the promotion of the inclusion of standardization practices and benefits in higher education and encourage the development of studies and surveys to assess quantify and communicate the economic and social benefits of standards in the context of Ethiopia.
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The Role of Standards in Procurement for Sustainable Development: An Analysis on the Ethiopian Public Procurement Regime: A Review

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EXECUTIVE SUMMARY

The objective of this paper is to analyze standard requirements applied in public procurement in Ethiopia. Each year, Ethiopian public organizations spend a significant amount of the gross domestic product in public procurement of goods, services and works. This paper argued that Public procurement, being a policy strategy instrument, must integrate standard considerations in the contract award procedures. To this end, the study was conducted based on comparative insights and analysis of relevant legislatio and literatures. The paper contends that standard requirement can have a role in indirectly stimulating social and environmental benefits through exerting pressure on suppliers to reduce their own impacts. Furthermore, the paper argued that requirement of conformity with standards is also equally applicable to conformity with other technical specifications. The paper maintains that quality consideration also commits procurements at upholding ethical conduct, social responsibility, transparency, auditability and accountability, and sound risk-management in the context of procurement. This paper after examining the relevant laws has concluded that in Ethiopia least-cost criterion is the dominant awarding rule in bidding process and suggests additional legislation and amendments of current laws to ensure coherence with the standard strategy. To this end, multi-faceted approach which includes solid legal basis that determine what is considered sustainable public procurement is recommended.

Keywords: Environmental considerations, public procurement, sustainable procurement
1. Introduction
Since the public procurement budget of developing nations has been often large (about 60% of total government expenditure),\(^1\) a well regulated public procurement system will certainly promote sustainable development. Procurement processes that consider social, economic and environmental factors are able to drive sustainability along value chains. States have nowadays realized that it is imperative to devise their purchases to contribute to the low-carbon transition. Research outcomes also showed that public procurements can play indirect impact of low-carbon procurement through the creation of lead markets for low-carbon products and services, along with demonstration, learning, network and reputation effects. Public procurement is being used by a growing number of countries to support sustainability objectives, something which has been recognized by international policy frameworks. The Sustainable Development Goals also encourage the use of public procurement to support sustainability. There are many communities of practice and valuable information-sharing at national and international level, an acknowledgement that public procurement can be a powerful tool to promote various public policy objectives. The starting point of this paper is that at the very least, public procurement should not contradict a country’s climate policy objectives. There are many opportunities to take sustainable public procurement (SPP) consideration into account throughout the procurement process. It has been argued that SPP can have a role in indirectly stimulating social and environmental benefits through exerting pressure on suppliers to reduce their own impacts.

\(^{1}\)See Kingsley, Nigerian National Council on Public Procurement: Addressing The Unresolved Legal Issues, 2015 available at http://applj.journals.ac.za
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In view of this is argued that SPP is an important tool to achieve environmental policy goals relating to climate change by giving priorities to environmentally preferable products.\(^2\)

However, without having credible standards that determine what products count as SPP, governments find it difficult to implement.\(^3\) Public procurement must work within the broader policy environment and can sometimes benefit from policies that apply to markets, goods and services beyond government expenditures.

Therefore, the aim of this paper is to explore role standards can play throughout the procurement process for sustainable development. In doing this, it will assess the place of SPP in Ethiopia by referring the legislative and regulatory frameworks. Further, the paper seeks to unveil the concept of SPP, its relevance in governance, and significance of its application for sustainable economic development.

1.1 Concept Clarification

1.1.1 Public Procurement

According to the UN public procurement is “an overall process of acquiring goods, civil works and services which includes all functions from the identification of needs, selection and solicitation of sources, preparation and award of contract, and all phases of contract administration through the end of a services’ contract or the useful life of an asset. Although procurement process is the heart of a sound procurement system, public procurement involves more than the procurement

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\(^2\) Environmentally preferable products and services are as those that have a lesser or reduced effect on human health and the environment when compared to other products and services that serve the same purpose. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance or disposal of the product or service.

process and it should not only consist of supporting, but also important. Public procurement is about matching supply and demand, in order to deliver the goods, services and works which the public sector is responsible for providing. Value for money is clearly a key consideration, as is the need to ensure a good level of competition and to respect the legal framework. GPP can be combined with these objectives and in many cases will positively contribute to them.

The basis of the public procurement regime is primarily economic, requiring public purchasers to obtain best value for public money. However, the concepts of promoting and maintaining an acceptable level of standards and achieving value for money in public procurement are not incompatible. While issues such as identifying economic advantage and observing procurement rules may occasionally give rise to tensions, the issue should not be seen as one of conflict between securing best value and promoting the sustainable development, but rather recognizing the synergies that can exist between the two. Public procurement systems are at the center of the way public money is spent since budgets get translated into services largely through the government’s purchase of goods, works and services. In reality, public procurement masks the ability of government to transform taxes and other revenues into consumption by government institutions at federal, state and local levels, apparently for the public good.

1.1.2 What is Sustainable Development?
Sustainable development can be defined as development which meets the needs of the present without compromising the ability of future generations to meet their needs.

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4 This is included under the FDRE Constitution under the right to development which stated that: The people of Ethiopia as whole and each nation, Nationality and people in Ethiopia in particular have the right improved living standards and to Sustainable Development.
own needs. It means not using up resources faster than the planet can replenish, or re-stock them and it’s joining up economic, social and environmental goals.\textsuperscript{5} Sustainable development is a normative concept based on ethical principles. It formulates a vision of how the world should be like and requires an integrated approach, which takes account of social, economic and environmental objectives. It also includes how business is run and the care they take about the local environment. According to ISO/DIS 20400:2017, sustainable development means making sure that the goods and services that an organization acquires have the lowest negative and the most positive environmental, social and economic impacts feasible. In relation to this ISO 26000:2010 also serves as an important reference for an organization wanting to improve its contribution to sustainable development. To achieve development objectives, the capacity to plan, manage, implement, and account for results of policies and programs is critical. However, there is a striking contrast between the increasingly recognized importance of capacity and the difficulty of achieving it.

1.1.3 Mapping Sustainable Procurement (SPP)

According to ISO/DIS 20400:2017 on SPP, SPP is procurement that delivers long-term social, economic and environmental benefits. According to this definition SPP is means of making sure that the goods and services that an organization acquires have the lowest negative and the most positive environmental, social and economic impacts feasible. SPP should not be viewed as an abstract, idealistic goal but as a reasonable, practical and achievable aim for all private and public organizations, irrespective of their activity or their size. Procurement is a powerful instrument when an organization considers requirements for sustainability. In 2002, the World

\textsuperscript{5}Ibid
Summit on Sustainable Development acknowledged that public procurement can contribute to achieving sustainable development goals and the Johannesburg Plan of Implementation effectively institutes SPP as a crosscutting issue. The plan encourages public procurement practices that stimulate development and diffusion of environmentally sound goods and services and promotes the integration of the three pillars of sustainable development which are economic development, social development and environmental protection. These pillars are interdependent and mutually reinforcing components.

SPP\(^6\) is about taking social and environmental factors into consideration.

\(^6\)According to Procuring the Future, “Sustainable public procurement is a process whereby public organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organization but also to long side financial factors in making procurement decisions. It involves looking beyond the traditional economic parameters and making decisions based on the whole life cost, the associated risks, measures of success and implications for society and the environment.\(^7\) Making decisions in this society and the economy while minimizing damage to the environment.” It incorporates social considerations in addition to environmental considerations. Also Sustainable procurement is the process by which organizations buy assets, supplies OR services by taking into account a number of factors including: Value for money considerations such as, price, quality, availability, functionality, Environmental aspects; the effects on the environment that the assets, supplies and/or services have over the whole lifecycle ("green procurement") and Social aspects: effects on issues such as poverty eradication, inequality in the distribution of resources, labour conditions, human rights, fair-trade.

\(^7\)See Factsheets on Sustainable Public Procurement in National Governments Supplement to The Global Review of Sustainable Public Procurement, (2015) 2 APPLJ

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way requires setting procurement into the broader strategic context including value for money, performance management, corporate and community priorities. SPP\(^8\) is an effective way to pursue social and environmental goals. SPP seeks to procure goods, services and works with a reduced environmental impact throughout their life-cycle when compared to goods, services and works with the same primary function that would otherwise be procured.

Many States have developed formally recognized the role of public procurement to support sustainability, including an explicit reference in the Sustainable Development Goals and UN also urges states “to promote public procurement practices that are sustainable, in accordance with national policies and priorities. Another development is the recent World Bank initiative to reform its approach to public procurement and to introduce value for money and sustainability as criteria and those SPP criteria for a number of product and service groups, which are regularly reviewed and updated.\(^9\) The criteria are designed to be inserted directly into tender documents and include information on verification methods. National and international organizations have gathered best practice information and developed various guidance documents and online systems to support the deployment of public procurement for sustainability innovation. For example, EU has identified the product and service groups covered in SPP. This includes (At time of writing): Cleaning products and services, Copying and graphic paper, Green procurement is the selection of products and services that minimize environmental impacts. Environmental considerations include, among other things, the reduction of pollution, improved energy and resource efficiency, reduction of waste and toxic and hazardous materials.

\(^8\) Green procurement is the selection of products and services that minimize environmental impacts. Environmental considerations include, among other things, the reduction of pollution, improved energy and resource efficiency, reduction of waste and toxic and hazardous materials.

\(^9\) See, Impact analysis on Green Public Procurement in the City of Vienna Impact Analysis,( 2014)
Combined heat and power (CHP), Office Buildings, Electrical and electronic equipment in the health care sector, Electricity, Food and catering services, Furniture, Gardening products and services, Imaging equipment, Indoor lighting, Office IT equipment, Road Design, Construction and Maintenance and Sanitary tap ware Street lighting, traffic signals, Textiles, Toilets and urinals, Transport, Wall panels, Waste water infrastructure, and Water-based heaters.\(^{10}\) As mentioned above, in addition to the EU SPP criteria are included in a number of international, national and regional bodies have developed criteria sets covering a wide range of product and service groups\(^ {11}\).

In this regard, it is imperative to look the role of standards in SPP criteria. Many environmental labels exist which aim to help purchasers identify sustainable products or services. The most valuable labels from a SPP perspective are those which are based on objective and transparent criteria and which are awarded by an independent third party. These labels can play a particular role in developing technical specifications and award criteria, and in verifying compliance.\(^ {12}\)

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\(^{10}\) All of the EU GPP criteria, together with the technical background reports setting out the main considerations for the choice of the criteria, can be downloaded from the GPP website (http://ec.europa.eu/environment/gpp). Assistance in interpreting and applying the criteria is available from the GPP Helpdesk.


\(^{12}\) The different types of environmental labels are used in different countries
2. Review and Discussion

2.1 The Importance of Standards in Public Procurement: an Overview

The existence of standards in a supply chain process, such as public procurement has been well espoused. Standards are used to act as a signal of quality and as a tool to benchmark between ideal progress and actual progress. From the perspective of a producer, standards allow an organization to examine the different stages of the process and determine where discrepancies may exist between the ideal (the standard) and the actual, then make changes in order to move towards the ideal. The importance of maintaining and meeting consistent standards cannot be understated. Having a standard and then working towards it can create both efficiency within the process and greater overall benefit in terms of output produced.

Overall, labels and standards can be used in procurement to verify a product’s ‘green’ credentials, as a minimum requirement, or as a method to create sustainability criteria (UNEP, 2013). As stated, this also reflected in the ISO/DIS 20400:2017 and 26000:2010. The author argued that Standard criteria are important tool to achieve environmental policy goals relating to climate change, water conservation, safe drinking water, resource use and sustainable consumption and production – especially given the importance of public sector spending on goods and services in Ethiopia. To prevent waste and pollution, public procurement programs require executive agencies to

13 The establishment Proclamation No. 102/1998 on Quality and Standards Authority “Standard” means a document established by consensus containing technical specifications or other criteria to be used consistently as a rule, guideline or definition of characteristics to ensure that products are fit for an intended purpose;
15 Ibid
16 Ibid
consider standards, along with price, performance, and other factors, when making purchasing decisions.

2.2 Considering Standards in different Public Procurement Process: an Analysis on Legal and Regulatory Frameworks

SPP can be considering at different process or cycles of PP including not only selection and award criteria, but also in specifications and contract performance clauses. Identifying sources of SPP criteria is an important step in SPP implementation. In order to make SPP work, it is essential to know how to apply in each of public procurement procedures. A SPP policy can, if it is not carefully implemented, falter on practical issues such as which procedure to use, what criteria to apply, and how to properly assess and verify environmental claims. To this end, under this section the writer attempts to assess the place of SPP in Ethiopia by referring Public Procurement Proclamation and Property Administration Proclamation (649/2009) and the subsidiary legislation including the Federal Public Procurement Directive (FPPD) and the Federal Procurement Manual.

2.3 Exploring SPP and the Role of Standards in procurement process

2.3.1 Mapping the Alignment of Basic Principles of Public Procurement with SPP

Public procurement is about matching supply and demand, in order to deliver the goods, services and works which the public sector is responsible for providing what is required. Article 5 of the Proclamation provides some basic principles of public procurement. Those are Value for money, Non-discrimination, Transparency and fairness, accountability and careful handling of properties. For the purpose of this paper only the first two principles are discussed. Those are included in public procurement rules.17

17Public procurement laws and regulations clearly cover the whole scope of public procurement, all stages of the procurement
Contracting authorities have an obligation to get the best value for taxpayers’ money for everything they procure. Value for money which refers to identifying the most economically advantageous tender does not necessarily mean going only for the cheapest offer. In other words, price alone is not a sound indicator and procuring entities cannot necessarily get the best value for money by accepting the lowest price or bid. Best value for money therefore means going beyond the price to get the best available outcome when all relevant costs and benefits over procurement cycle are considered. Value for money requires taking into account whole life costs\(^\text{18}\) to the greatest extent possible. That includes all aspects of cost, such as running and maintenance costs, disposal cost and other indirect costs as well as the initial purchase price. Best value not only measures the cost of goods and services, but also takes into account factors such as quality, efficiency, effectiveness and fitness for purpose. Protection of the environment can be one of these factors and can therefore act as an equal consideration amongst others for the award of the contract. There are clear examples of where economic and environmental interests converge. The author believes that SPP can be combined with these objectives and in many cases will positively contribute to value for money. In other words, SPP and Value for Money are interdependent and mutually reinforcing components.

\(^{18}\) Life-cycle costing (LCC) – Procurement decisions are often still made on the basis of the purchase price. However, for many products and works, costs incurred during use and disposal may also be highly significant – e.g. energy consumption, maintenance, disposal of hazardous materials. Taking life-cycle costs into account in procurement makes clear economic sense. As purchase price, energy and maintenance costs may be paid by different departments within a single authority, establishing LCC within procurement procedures will likely require cross authority cooperation. Further information on LCC...
As stated, non-discrimination is another principle which is provided in the proclamation. This principle clearly adheres on impartiality and absence of any ground of discrimination. Fair competition and equal treatment of bidders are fundamental concerns in the development of rules on public procurement. In this regard, applying SPP criteria is not against this principle as long as the same information is provided to each. In relation to this, the Ethiopian public procurement proclamation contains provisions which prescribe that public procurement should be subjected to a new regime of openness, transparency and fairness. Here it must clear that the fact that technical specifications must not create unjustified obstacles to competition is among equivalents. As discussed below, tenders with different levels of environmental performance should receive different marks under an environmental award criterion as long as applied objectively. However, in this regard, the freedom given those procurers to define the subject of the contracting any way that meets their needs may be an obstacle to this principle. Because, public procurement legislation is less concerned with what contracting authorities buy, than how they buy it. However, in relation to SPP this problem could be rectified by having objective and transparent standards made by independent third party such as Standard Agency to label products. Standards/ labels in SPP criteria are a useful reference point, as they are based on scientific information and life-cycle assessment of the materials and substances found in the covered products and services. Hence, provide that the other criteria fulfilled procurers have the right to insist purchasing to be made from a specific material, or contain a certain percentage of recycled or reused content. They can also set requirements regarding the restriction of hazardous substances in the product.
2.3.2 Technical Specification and Reference to Standards

After defining the subject of the contract, procurers need to express this in the technical specifications which are included in the procurement documents. This is like turning a sketch into a picture. Technical specifications have two functions. They describe the contract to the market so that companies can decide whether it is of interest to them. In this way, they help determine the level of competition. Technical specifications need to relate to characteristics of the particular work, supply or service being purchased— and not to the general capacities or qualities of the operator. Specification will describe the desired result and which outputs (for example in terms of quality, quantity, and reliability) are expected, including how they will be measured. It is also important that they be clear, understandable by all operators in the same way, and enables to verify compliance when assessing tenders. The obligation of transparency implies that technical specifications must be clearly indicated in the procurement documents themselves. It must be

20 Ibid

21 Transparency in public procurement has many goals. According to Giraldo, “it supports nondiscrimination; facilitate participation by suppliers unfamiliar with the system; to improve information for market access negotiations; to improve the decision making process; to widen the supply base; to expose governments decisions to public and social scrutiny; to generate predictability of procurement decisions.” The Ethiopian public procurement proclamation contains provisions which prescribe that public procurement should be subjected to a new regime of openness, transparency and fairness. Section 5 of the Proclamation states that “when an organ of state contracts for goods and services, it must do so in a manner which is fair, equitable, transparent, competitive and cost effective.”
indicated carefully about how you will assess and compare tenders in a fair and transparent way. It may also ask the tender to indicate how the desired result will be achieved and meet the level of quality specified in the procurement documents.

The international or national standards and various other technical reference systems are one of the means by which specifications can be defined. When reference to a standard is used, it must be accompanied by the words ‘or equivalent’. This means that evidence of compliance with an equivalent standard must be accepted. Such evidence may be in the form of a test report or certificate from a conformity assessment body. A tendered may also seek to rely upon a manufacturer’s technical dossier if it is not able to obtain third-party evidence within the relevant time limits for reasons which are not attributable to it. The contracting authority must then determine whether this establishes compliance.

SPP policies are most often implemented by developing requirements and technical specifications for the products and services to purchase that incorporate relevant sustainability criteria. The Ethiopian Federal PP Proclamation article 29/2 provides that: The technical specifications shall clearly describe the public body’s requirements with respect to quality, performance, safety and where necessary dimensions, symbols, terminology, packaging, marking and labeling or the processes and methods of production and requirements relating to conformity assessment procedures.

The law in addition stated that “there shall be no requirement or reference in the technical specifications to a particular trademark or name, patent, design or type, specific original producer or service provider, unless there is no sufficiently precise or intelligible way of describing the procurement requirements of the public body. Here, one may argue that the list mentioned under the article is general that may include
environmental criteria under the guise of value for money. However, the proclamation, directive as well as the manual have not made any explicit reference procures to formulate technical specifications in terms of the environmental and climate performance levels of a product, service or work.

Looking to the provision of the Proclamation, the author of this article argued that it is possible to include requirements regarding production or provision processes and methods in technical specifications for supply, service and works contracts. However, since all technical specifications should bear a link to the subject matter of the contract, you can only include those requirements which are related to the production of the good, service or work being purchased, rather than those which relate to the general practices or policies of the operator. As with all criteria, the contracting authority must ensure that the treaty principles of non-discrimination, equal treatment, transparency and proportionality are respected when specifying materials or production methods. As a contracting authority, you have the right to insist that the product you are purchasing be made from a specific material, or contain a certain percentage of recycled or reused content. You can also set requirements regarding the restriction of hazardous substances in the product. As a starting point you should refer to legislation which restricts. It is not allowed however to insist upon a production process which is proprietary or otherwise only available to one supplier – or to suppliers in one country or region – unless such a reference is justified by the exceptional circumstances of the contract and is accompanied by the words ‘or equivalent.

In this regard, the author argued that environmental labels made by standards authority plays immense role to purchasers in identifying sustainable products or services. The most valuable labels from a SPP perspective are those
which are based on objective and transparent criteria and which are awarded by an independent third party called Standards Authority. Those labels can play a particular role in developing technical specifications and award criteria, and in verifying compliance. Procures can simply refer to appropriate criteria that are defined in labels.\textsuperscript{22} For example, you may require that a computer does not consume more than a certain amount of energy per hour; or that a vehicle does not emit more than a certain quantity of pollutants.

Standards have a major role in influencing the design of products and processes, and many standards include environmental characteristics such as material use, durability or consumption of energy or water. References to technical standards including such environmental characteristics can be made directly in specifications and this helps to define the subject matter in a clear way. Hence, bidders must bring evidence of compliance with an equivalent standard. Such evidence may be in the form of a test report or certificate from a conformity assessment body. In Ethiopia, there is no requirement that obliges parties to proof this obligation. The PPPA law mainly focuses on business licenses for procuring entities to test whether bidders are included on a supplier list as part of the qualification process. Apart from this there is no reference towards eco-label products.

Many countries in Europe incorporate the EU Eco-label criteria in all procurement actions. They also made reference to labels with considerable success. The applicable criteria from the eco-labels are inserted directly into technical specifications and/or award criteria. It is stated that a copy of the eco-label certificate is seen as full verification that the criteria are met. If a

\textsuperscript{22}See Richard Baron, OECD The Role of Public Procurement in Low-carbon Innovation, 2016
contract includes the supply of products or materials, a sample (or description or photograph) may be requested at selection stage. Certificates of conformity or quality may also be requested. These can be useful in verifying that products meet any specific environmental requirements for the procurement, for example in terms of durability or energy consumption. A further option available to contracting authorities is to carry out a check on suppliers’ production capacities or service providers’ technical capacity, as well as their research facilities and quality control measures. This can be done if the products or services to be supplied are complex or, exceptionally, are required for a special purpose. The checks may either be carried out by the contracting authority itself or by a competent body in the country where the operator is established.

Experience with the use of standards and labels shows that they can greatly facilitate the tasks of procurement officers, as they avoid the need to define appropriate qualifications, award criteria and contract clauses.23

In countries like Ethiopia, reference to standards or labels has paramount importance. Though it is not the focal point of this paper, in relation to specification in Ethiopia, in practice the capacity for drawing up technical specifications is very low, where poor specifications are blamed for the poor outcome of procurement. Often specifications are copied without the procuring entity properly adapting the specifications to the situation at hand. Assistance for technical specification issues from standards agency only made when a dispute arises in times of delivery of products by suppliers. Specification is made often made by

committees even without necessary expertise.

The researcher believes that standards/labels could play immense role in solving problem attributed to specification in general and SPP criteria in particular. In this regard, the Ethiopian Standard Agency can play immense role. In relation to this, the author contends SPP criteria are in line to the mandate of agency. Moreover one of the objectives of the agency is to assist in the improvement of the quality of products and processes through the promotion and application of international and Ethiopian Standards. Hence, the Ethiopian Standard Agency and other regulatory institutions can play great role by creating Conformity Assessment System of SPP. This encourages producers to realize economies of scale and consumers to follow the government's lead, resulting in the wider commercialization of green goods and promoting conscious consumption. Social, environmental and economic benefits: Buying green and efficient products and services generates social, environmental and economic benefits, namely a reduced ecological footprint, enhanced innovation and competitiveness as well as an increased availability of green products and services. Generally, Technical standards, labels criteria sets are all valuable sources of information when developing a specification.

24 Here, one may arise a particular concern relates to small and medium enterprises’ ability to take part in the certification process to be included on product lists used by procurers. However, as it is provided in the mission of the Ethiopian Standards Agency the aim of standards is to make local products and services is to be competitive at the international level.

25 The ESA’s Regulation defines Conformity Assessment System” as activities which has its own application procedure and management method, concerned with determining directly or indirectly that relevant requirements are fulfilled. Further it defines ‘Certificate of conformity” as document providing confidence that a duly identified product or process is in conformity with a specific standard”.

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2.3.3 Selecting Tenders and Awarding a contract: Integrating Standards in SPP

Selection criteria focus on an economic operator’s ability to perform the contract and Selection criteria assess the suitability of an economic operator to carry out a contract. An overriding requirement in relation to all selection criteria is that they must be related and proportionate to the subject-matter of the contract. When assessing ability to perform a contract, contracting authorities may take into account specific experience and competence related to environmental aspects which are relevant to the subject matter of the contract. They may ask for evidence of

26They may bring certificates granted by a public or independent regulatory authority (such as Standard Agency), or by a private industry body. Companies operating an environmental management system will receive a certificate. It is important to always check the source, scope and date of any certificate presented. The company can also present test reports may provide evidence regarding the performance of a product or a specific aspect of its production. For example when purchasing vehicles test reports may be requested both in relation to the declared emission levels of the vehicle and the durability of individual components.

27For Example in EU Contracting authorities can exclude an operator where they can demonstrate by any appropriate means that it has violated applicable environmental obligations under EU or national law. If an operator has breached applicable environmental laws a contracting authority may seek to exclude it from a tender procedure. For example, a waste disposal company that has dumped waste illegally could be excluded from a tender for rubbish collection services. The contracting authority may demonstrate such breaches by any appropriate means – however the operator must also be given the opportunity to prove that it has met the self-cleaning requirements set out in the directives.
bidders should fulfill as to registration and legality issues of bidders apart from this it is the procures to evaluate them looking their technical and financial proposals.

Environmental technical capacity can include technical competence in minimizing waste creation, avoiding spillage/leakage of pollutants, reducing fuel consumption or minimizing disruption natural habitats. The ability to accurately assess and verify information submitted by tenderers in response to environmental criteria can be challenging. An increasing number of companies make environmental claims about their products and services, and there is a growing list of standards, certification schemes and labels which aim to give credibility to such claims. Procurers are often called upon to distinguish promotional or unfounded claims from bona fide evidence. SPP requires the application of these skills in order to avoid ‘green-wash’ and identify those products and services which genuinely meet criteria targeting environmental characteristics. An increasing number of companies market themselves as being green or sustainable, not always with the evidence to back this up. For example, suppliers may claim an exaggerated level of energy efficiency, or focus on a relatively minor environmental impact in claiming to be green.

The main difference between technical specifications and award criteria is that whereas the former are assessed on a pass/fail basis, award criteria are weighted and scored so that tenders offering better environmental performance can be given more marks. The weight given to each award criterion determines the influence it has in the final evaluation. The weighting of environmental award criteria may reflect the extent to which environmental aspects are already addressed in the specifications. A number of considerations should be taken into account when assessing whether an
environmental characteristic should be a minimum requirement (specification) or a preference (award criterion). However, there must have law that evaluates on objective basis for distinguishing between tenders. Some key considerations about what kind of environment award criteria to apply and how to determine appropriate weightings must be provided in advance. This means you should consider in advance what means of proof tenderers can offer under each award criterion and how you will evaluate this. For example, European procurement directives require that award criteria and their weightings be set out either in the contract notice or in the procurement documents.\textsuperscript{28} In relation to this in a tender for IT consultancy services, the European Environment Agency (EEA) provided 10\% of marks at award stage to assess the environmental policies which the tenderers would apply in carrying out the contract. It awarded higher marks under this criterion to a company with a third-party certified environmental management scheme than to those without. Following a challenge, the General Court ruled that the EEA was entitled to apply its discretion in this way, as it had assessed each offer on its merits.

Similarly, the US Environmental Protection Agency is drawing up a list of criteria that will allow federal public procurers to discriminate between all environmental labels available on the market. Endorsing certain standards and labels (whether government-run or otherwise) for public procurement can bolster the credibility of those schemes for users in the rest of the economy, another form of positive spill-over from procurement into the broader market\textsuperscript{29}.

\textsuperscript{28}See EU Directive 2014/24/ on public procurement.

In Ethiopia, as mentioned there are two main processes of awarding tender namely technical and financial. Technical specifications are evaluated based on criteria already addressed in the specifications. In relation to this, it can be aid that of technical specification evaluation is based on subject matter. In other words, there is no place for evaluation of against SPP. The author has got an opportunity to look annexes prepared by Public Procurement Agency for specification preparation in bidding document. Accordingly contend that none of the list of provided in this annex made reference to environmental preferred goods and standards. Most of the criteria are with legality and capacity issues. Further, in relation to financial issues the law clearly provides for every types of procurement least cost as awarding criteria. The weight given to each criteria vary depend up on the nature of procurement. Here one may argue that the weight given to technical specification is high. However the author asserts that to the contrary. Because

30 At the award stage, the contracting authority evaluates the quality of the tenders and compares costs. When you evaluate the quality of tenders, you use predetermined award criteria, published in advance, to decide which tender is the best.

31 Article 43(8) Examination and Evaluation of bids: The successful bid shall be:

a) the bid that is found to be responsive to the technical requirements and with the lowest evaluated price;

b) if the public body has so stipulated in the bidding documents, the bid offering better economic advantage ascertained on the basis of factors affecting the economic value of the bid which have been specified in the bidding documents, which factors shall, to the extent practicable, be objective and quantifiable, and shall be given a relative weight in the evaluation procedure or be expressed in monetary terms wherever practicable;

most of the assessment is subject matter\textsuperscript{33} concerned. In other words, there is no place for environmental assessment. Furthermore, in the absence of accurate standard of specification this argument does not hold water. In addition, grounds for exclusion from award under article 43(4) in the proclamation are also far from inclusive. This article made reference to article to 28 as regarding to qualification. Only legal and some blurred requirement are provided in the article. Most of the criteria are related to the bidder’s qualifications aiming at reducing the risk of non-performance.

In Ethiopia, different studies indicated that one of the areas where corruption is believed to be rampant in procurement of consumable and fixed assets\textsuperscript{34}. Even though, corruption and corruption risks can take place at all cycles of the procurement process, it is widely noticed that the prequalification stage is the most vulnerable. Further studies reveal that the supplier identification stage, specifications issues, choice of procurement methods and bid advertisement are the most corruption prone stages in procurement. In this regard, the researcher believes that such reference to standard authorities is very essential in reducing the magnitude of problem by creating objective award criteria.\textsuperscript{35,36}

\textsuperscript{33} The ‘subject-matter’ of a contract is about what product, service or work you want to procure.

\textsuperscript{34} Yrga Tesfahun(2011), Public Procurement Reforms in Ethiopia: Policy and Institutional Challenges and Prospects, A thesis submitted to the school of graduate studies of Addis Ababa University in partial fulfillment of the requirements for the degree of master of art in public management and policy (public policy)Addis Ababa (Unpublished)

\textsuperscript{35} Award criteria must never confer an unrestricted freedom of choice on contracting authorities. This means they must provide an objective basis for distinguishing between tenders, and be adequately specific. In the words of the Court, award criteria must be formulated in such a way that allows all “reasonably well-informed and normally diligent tenderers” to
3. Conclusion

This research sought to unearth the role of standards in SPP. The papers analyses what SPP entails and explored its justification. It also highlighted its objectives and the positive impact to sustainable development. Further. This paper tries to examine the place of interpret them in the same way. A further element of the objectivity requirement for award criteria concerns verifiability. If award criteria relate to factors which cannot be verified by the contracting authority, it will be difficult to demonstrate that they have been applied objectively. It must be considered in advance what means of proof tenderers can offer under each award criterion and how you will evaluate this.

36 To this end, award criteria and their weightings must be set out either in the contract notice or in the procurement documents. Transparency principle also adheres this open and transparent public procurement system in order to improve information for market access negotiations; to improve the decision making process; to widen the supply base; to expose governments decisions to public and social scrutiny; to generate predictability of procurement decisions.

standards under the Ethiopian PPA legal frameworks. The paper concludes that it is vitally important that to integrate standards in Public procurement so that optimal benefits can be realized. Furthermore, to enhance the overall benefit of the procurement process and SSP in particular, synergies and integration among different stakeholders has paramount importance.

On the basis of the foregoing analysis, the SPP in Ethiopia to be more effective, it should consider the following issues:

.policy formulation: SPP requires a comprehensive policy that deals with Environmentally Preferable Purchasing. To this end, it is recommendation of the this paper that the government to formulate policy on SPP which indicates

What constitute SPP, who is responsible for implementing the policy including a mechanism for appropriately monitoring performance? The policy should also be aligned with any existing policies and strategies relating to
procurement and standards. In order to apply it effectively it should also be supported by operating procedures and e-procurement systems.

**Additional and Amendment of legal frameworks:** The existing PP legislations have to be amended to include SPP. Once a policy is in place some form of operational implementation frameworks should be established, to ensure coherence with the standard strategy. To this end, multi-faceted approach which includes solid legal basis that determine SSP must in place. Then law should outline what is SSP, specific tasks, responsibilities are recommended.

In cooperation with the standards agency and other stakeholders; the Federal Public Procurement and Property administration Agency must enact supplementary legislations that consider sustainability factors in all stages of procurement.

**Conformity with Standards:** The paper recommends that requirement of conformity with standards should be the dominate rule in any public procurement. To avoid the problem in relation to standards, the author recommends reference to standards should be the norm in public procurements. The author believes that standards/labels made by the Ethiopian Standards Agency are equally applicable to technical specifications. Such reference has also minimizes the cost of public procurement process to assure that the product or service offered by the tenderer actually has the characteristics and qualities specified in the technical specifications and award criteria. Furthermore, the author strongly believes that quality consideration also commits procurements at upholding ethical conduct, social responsibility, transparency, audit ability and accountability, and sound risk-management in the context of procurement.
**Awareness Creation:** an intensive awareness creation programs have to be design and deliver to relevant stakeholders. The reality is that public procurement is a process with many steps (technical, legal and financial), methods and dialogues. Gearing this sophisticated instrument toward ‘green’ procurement requires a change of mindset, including among procurement officers who traditionally focus their attention on direct financial costs excluding climate change and other externalities. To this end, there is a need to have access to training programs that improve the level of staff awareness about SPP and prepare core of expertise to assist and advise organizations on sustainable procurement processes and practices.

**Monitoring and Reporting Process:** there must be monitoring and reporting system against the implementation SPP targets. Annual performance reports systems must integrate SPP performances. To this end, there should be hard and fast rule that obliges organizations to report on SPP. An extra work has to done to expand and strength these in to regional States. Audit systems should not be limited to financial investigation. It must also provide mechanisms that include SPP performance.

**Integrated Approach:** SPP requires effective co-operation between different Organizations. High-level cooperation and coordination is generally considered to be an important factor for the success of SPP. While some of the challenges highlighted herein can be addressed by legal or policy reform. SPP acknowledged the need for a multispectral response, a need for clear and harmonized strategies for initiating or scaling up such efforts. It must be proactive and deliberate efforts by all stake holders in a multi-sectoral approach to create the enabling environment. All partners and stakeholders including the Standards agency and the federal Public procurement agency must work closely to make the plan realistic.
The Role of Standards in Procurement for Sustainable Development: An Analysis on the Ethiopian Public Procurement Regime: A Review

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The establishment Proclamation No. 102/1998 on Quality and Standards Author.
Aflatoxin and Salmonella Contamination In Peanut Butter And Roasted Peanut In Addis Ababa Market

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Abstract

Aflatoxins are secondary metabolites produced by the fungi Aspergillus flavus and aspergillus parasiticus that grow on a variety of agricultural commodities and other processed products like peanut butter. Aflatoxin B1 (AFB1) is the most toxic of all the aflatoxins produced by these fungi. To our knowledge, there is no research based data generated on aflatoxin contamination in products of peanuts, except for raw peanut and other commodities in Ethiopia. This study therefore was conducted in order to assess the level of aflatoxin contamination using HPLC method and detection of salmonella by conventional method in peanut butter collected from Addis Ababa market. Analysis of aflatoxin in ready to eat roasted peanut was also part of the investigation. Study samples were collected from all margins of the Addis Ababa through dividing the city in to four directions so as to address every sampling point. Accordingly, forty eight samples of peanut butter and 10 samples of roasted peanut were randomly collected from the market, analyzed by duplicate and mean values were reported. Out of 48 samples, 45 samples were collected from local brands. The results showed that 93% of local samples of peanut butter had aflatoxins ranged from 3.92 µg/kg to 547.85 µg/kg, with mean total aflatoxin of 98.24 µg/kg ± 111.18 SD; showing great variation of contamination among samples. All roasted peanut samples were contaminated with aflatoxin with maximum contamination of 216.48 µg/kg and minimum value was 1.86 µg/kg, having mean value of 58.78 µg/kg ±75.56 SD. Salmonella was detected in 7% (n=3) of samples of peanut butter. Cumulatively, 81.82% peanut butter and roasted peanut found in Addis Ababa markets were found tobe unsafe as per codex maximum permissible limit for aflatoxin<10 µg/kg. Contamination of pathogens in peanut butter was significant as far as human safety is considered. There is a need for awareness creation at all levels of the peanut value chain, especially for end consumers, campaigns to raise consumer demand for safe, high-quality food. There is also a need for close supervision of regulatory bodies to implement local standards and to ensure that products delivered to market guarantees the health of consumers.

Keywords: Aflatoxins clean--up, peanut butter roasted peanut, Salmonella.
1. Introduction

Groundnut (*Arachis hypogaea L.*) is an oilseed produced all over the world and believed to have originated in Central American region from where they spread to other parts of the world (Settaluri et al., 2012). The word “ground nut” is also used interchangeably with “Peanut” (SPG, 2009). It is consumed in the form of snacks such as salted nuts, confectionary sauce, cafeteria drinks, and peanut butter. Botanically, groundnut is a legume although it is widely identified as a nut and has similar nutrient profile with tree nuts (Ros, 2010). Peanut butter is made by grinding dry roasted groundnuts into a paste (Mutegi et al., 2009).

The most serious problem of natural peanut butter is the tendency of the oil to separate. Oil is released during the grinding of peanuts. The improvement of emulsion stability in peanut butter is characterized by the absence of two layers of oil and meal phase during ordinary conditions of storage, and improved texture, consistency, spread ability, flavor, color as well as nutritional value. Without stabilizers, the peanut meal settles at the bottom and forms a hard layer while the oil remains on top (Aryana et al., 2000).

Various traditional methods are employed in the processing and preservation of the peanut and its products and some of these practices encourage fungal growth and mycotoxin production (Nautiyal, 2002). In addition to fungal growth, bacterial growth; like *Salmonella* contamination are usually encountered in peanut butter. This becomes a serious health concern since it is very difficult to remove once in food (Moss, 1996).

Groundnuts that are used as raw materials for peanut butter processing are liable to colonization by fungal molds during handling, storage and transportation, exposing them to the risk of contamination with...
Aflatoxin and Salmonella Contamination In Peanut Butter And Roasted Peanut In Addis Ababa Market

Aflatoxin (Mutegi et al., 2012). Thus, Peanut butter has been monitored for aflatoxin contamination at different stages during its large-scale production starting from raw shelled peanuts up to the final product (Andrew, 2011).

If raw groundnuts are contaminated with aflatoxins, there is a high risk of exposure to the consumer through consumption of peanut butter processed from such groundnuts. Practices such as poor storage and handling within the peanut butter cottage industry could contribute to further aflatoxin contamination of peanut butter (Ndung’u et al., 2013).

Among aflatoxin groups; B1, B2, G1 and G2, Aflatoxin B1 (AFB1) is a great concern in human health. AFB1 has been extensively linked to human an aflatoxin contamination in peanut and peanut products ( Carlos et al., 2009) summarized the data on aflatoxin contamination in peanuts and peanut products from several countries during 1982-1994, including Senegal, Mexico, United States, Philippines, India, UK and Nigeria, and concluded that aflatoxin occurrence is extremely variable worldwide, with incidences ranging from 30 to 100%, at levels up to 2,888 μg·kg-1.

To our knowledge, there is no research based data generated on aflatoxin contamination in products of peanuts, except for raw peanuts and other commodities in Ethiopia. For instance, Fufa et al. (1996) had made investigation and determined the level of aflatoxins contamination in shiro and ground red pepper in Addis Ababa in 1996 and found aflatoxins levels ranged from 100 to 500 μg·kg-1 and 250 to 525 μg·kg-1, respectively. About 4.5 billion people, mostly in developing countries, are affected.

Contamination of aflatoxin in peanut and peanut products has been reported in different countries. Carlos et al. (2009) summarized the data on aflatoxin contamination in peanuts and peanut products from several countries during 1982-1994, including Senegal, Mexico, United States, Philippines, India, UK and Nigeria, and concluded that aflatoxin occurrence is extremely variable worldwide, with incidences ranging from 30 to 100%, at levels up to 2,888 μg·kg-1.

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risk of chronic exposure to aflatoxins from contaminated food crops. Therefore, in order to avoid the toxicity, the levels of aflatoxins and similar toxic compounds in foodstuff have to be monitored closely, and to be kept under control continuously. Otherwise, related health effects like acute and chronic intoxications, and even deaths, will still be an issue (Shuaib et al., 2010).

On the other hand, over the last several decades, a number of outbreaks of salmonellas has been associated with the consumption of ready-to-eat low-moisture products, including chocolate, powdered infant formula, raw almonds, toasted oats breakfast cereal, dry seasonings, paprika-seasoned potato chips, dried coconut, infant cereals and, more recently, peanut butter and children’s snacks made of puffed rice and corn with a vegetable seasoning. Although Salmonella outbreaks from low-moisture products are relatively rare, they often impact large numbers of people. More than 600 cases were attributed to peanut butter in 47 states between August 2006 and May 2007, and more than 500 cases have been attributed to peanut butter and peanut butter-containing products in 43 States between September 2008 and January 2009. Due to the large number of unreported cases of salmonellas is for all types of products, the actual number of cases was likely much higher (Yuhuan, 2009).
Different countries have their own standards regarding food. Food standard is one of the most important standard category for many countries. There are internationally used or accepted food standards prepared by UNICEF, WHO, FAO, WFP, Codex etc. Different countries may adopt standards from those international organizations or prepare their own ones. Table 1 indicates different standards on aflatoxin. Regarding Salmonella, most countries of the world use standards of Codex which indicates absent/125g.

Table 1: Some International and National Permissible Limits for Aflatoxin(μg/kg) (as an example)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Aflatoxin(Max)</th>
<th>AF B1(Max)</th>
<th>Reference</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>4μg/kg</td>
<td>2</td>
<td>PACA, 2012; Judy, 1998</td>
<td>Sorghum and others</td>
</tr>
<tr>
<td>WHO/FA</td>
<td>15</td>
<td></td>
<td>Bhatet al., 1996</td>
<td>Groundnut ready to process</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
<td>Moss, 1996</td>
<td>Any food for human consumption</td>
</tr>
<tr>
<td>Codex</td>
<td>10</td>
<td>5</td>
<td>Codex 2001</td>
<td>In processed peanut</td>
</tr>
<tr>
<td>FDA</td>
<td>20</td>
<td></td>
<td>Chilaka (2012)</td>
<td>All kind of foods</td>
</tr>
<tr>
<td>USA</td>
<td>20</td>
<td></td>
<td>(PACA, 2012)</td>
<td>Sorghum and other foods</td>
</tr>
<tr>
<td>India</td>
<td>30</td>
<td></td>
<td>Bhatet al., 1996</td>
<td>Groundnut ready to process</td>
</tr>
<tr>
<td>Kenya</td>
<td>10</td>
<td>5</td>
<td>Ndung’uet al, (2013), (Mutegei et al, 2013)</td>
<td>Peanut butter and others</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>20</td>
<td>5</td>
<td>Siwela, 1999</td>
<td>Any food for human consumption</td>
</tr>
<tr>
<td>South</td>
<td>10</td>
<td>5</td>
<td>MRC policy brief</td>
<td>In all food</td>
</tr>
<tr>
<td>Papua</td>
<td>10</td>
<td>4</td>
<td>Chilaka (2012)</td>
<td>Peanut butter</td>
</tr>
<tr>
<td>East Africa</td>
<td>15</td>
<td>5</td>
<td>EAC, 2013</td>
<td>Peanut butter</td>
</tr>
</tbody>
</table>
According to specification of UNICEF and MSF (Medecins Sans Frontieres) on ready to Use Therapeutic Foods (RUTF), for example, salmonella is the most serious or highest priority microbes receiving great attention in ready-to-use lipid based therapeutic and supplementary foods. From chemical toxin, aflatoxin is a primary quality requirement in these foods.

In general, there is no research based information on the safety of peanut butter in Ethiopia. However, a personal information obtained from training held by Ethiopian Standard Agency for small and large scale food processors on Food safety during March 2011, it was reflected that there was a lack of knowledge and awareness among processors regarding pathogenicity and mycotoxins. Microbial safety, specifically common outbreaks like salmonella in the product has not been studied as most entrepreneurs are simply engaged in production of peanut butter without any safety knowledge. Hence, due to nature of pathogenicity of salmonella and toxicity of the aflatoxin, health-related issues should be the main concern to all researchers of the field and government. Previous studies have not investigated the status of aflatoxin and pathogenic contamination in peanut butter from cottage industry of Addis Ababa. Hence, more assessments on foodstuff are needed to identify public health strategies that could be integrated with current agricultural and processing approaches to reduce possible problems associated with consumption of aflatoxin and pathogenic contaminated food in Ethiopia. Therefore, this paper is aimed at assessing the aflatoxins content and salmonella in peanut butter and roasted peanut sold in Addis Ababa market.

2. Materials and Methods

2.1 Description of the study site:
The study was conducted in Addis Ababa. Addis Ababa has 10 sub cities having woredas in each of the sub cities.
Addis Ababa is a major trade center for peanut with many cottage industries that process raw peanut, roasted and splitted peanut, and peanut butter.

2.2 Sampling technique
Samples of peanut butter were selected from a variety of retail outlets, including supermarkets, smaller shops and market stalls across Addis Ababa. A wide range of brands was covered in order to ensure that the survey was representative of the supply of the products to consumers in Addis Ababa. Before sampling was employed, sampling sites were divided into four directions for ease of sampling; North, South, East, West, so as to address most locations and minimize missed brands. All brands of peanut butter obtained during sampling periods were included in the study. So, out of 48 samples, 40 samples were from different brands and the remaining 8 samples were selected twice during course of sampling. For roasted peanut, samples were collected from Merkato (potential area) and different streets of Addis Ababa based on the availability.

2.3 Sample collection
A total of forty eight samples of peanut butter were randomly selected from different supermarkets and retailers for both Aflatoxin and Salmonella analyses. All kinds of brands were collected from North, South, East and West to simply address all sampling points. Accordingly, sample distribution scenario was; 12 samples (9 were different brands) from North; 11 samples (10 were different brands) from South; 13 different brands of samples from East and 12 samples (8 were different brands) from Western part of Addis Ababa. Out of these 48 samples, 45 samples were from local producers and 3 samples were imported products (collected from East, West and South). Sample collection sequence was East, West, South and then North. In addition, a total of ten samples of roasted peanut each weighing 3 kg were randomly collected from street vendors and distribution point (Merkato). Approximately 1 kg of each type of peanut butter brand was taken. Where the product was sold in packs of
less than 1 kg, a number of retail packs were purchased, ensuring that all came from the same batch and these were mixed thoroughly before taking a sample for analysis.

3. Data Analyses

3.1 Determination of oil separation

Composition of Peanut butter may vary and it may contain added palm oil or partially hydrogenated vegetable oil (EFSA, 2011). The most serious problem of natural peanut butter is the tendency of the oil to separate during storage as it has negative impact on purchase and general quality of peanut butter. The samples under this investigation were checked if there were oil separation or not. Aryana et al. (2000) explained what oil separation mean; it is characterized by the absence of two layers of oil and meal phase during ordinary conditions of storage. Hence based on this principle, through mere observation, the oil separation was checked. (Table). The extent of surface oil is explained by the word “very noticeable” (borrowed from EAS document) if the surface oil is very visible and could be flow or poured.

3.2 Determination of laboratory analyses

Data obtained during the test of aflatoxin was analyzed and reported by mean ± SD, media, weighted mean and, percentage using Microsoft excel. Regression analysis was also used to determine the linearity of the results for validation. Regarding Salmonella analyses, the percent of the detection out of the total samples was reported.

4. Result and Discussion

4.1 Contamination level of Aflatoxin in Peanut butter

4.1.1 Local peanut butter

All 48 peanut butter samples were collected and assayed in duplicate for total aflatoxin contents. Out of these 48 samples, 45 samples were local products and the mean value for each sample was calculated. From total of 45
samples, 42 samples (93.33%) showed aflatoxin contamination by the level ranging from 3.92 µg/kg to 547.85 µg/kg. These samples showed a mean total aflatoxin of 98.24 µg/kg ± 111.18 SD (The median 54.56 µg/kg). Great variation of aflatoxin contamination was observed among samples of peanut butter as standard deviation is greater than mean value (Figure 1). About 7% (6.77) of samples (n=3) showed below detection limit. Fig. 1: Distribution of aflatoxin contamination in local peanut butter samples.

According to present study, the four types of aflatoxin components were detected in the different ranges; AFB1, AFB2, AFG1 and AFG2 were detected by the concentration range of 2.65 to 270, 0.67 to 21.81 µg/kg, 0.87 to 247.1 µg/kg and 0.5 to 13.03 µg/kg, respectively. Among the naturally occurring aflatoxins (B1, B2, G1 and G2), aflatoxin B1 was found to be the most contaminating type of aflatoxin in 93% of total samples, followed by AFG1 (88.89%).
4.1.2 Imported Peanut butter

From total sampled peanut butter products \((n = 48)\), only three samples were imported product found from the market during sampling period. The reason for limited imported brands in Addis Ababa market may be due to very high price compared to local brands. Meaning, the price of one imported brand product was more than 5 times higher than the price of local brand product. As a result, very limited imported peanut butter brands were found in the market. Thus, comparison between local and imported brands of peanut butter in terms of aflatoxin contamination was not feasible.
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The aflatoxin content of all imported peanut was under an acceptance range of any international limit. The minimum result was ND and the maximum contamination was 2.28 µg/kg. When compared to local products, only three samples (7%) from local products showed below detection limit. It indicates that imported peanut butter might be imported from a country where regulation of aflatoxin is implemented.

Table 2: Aflatoxin (µg/kg) results of imported peanut butters collected from Addis Ababa markets

<table>
<thead>
<tr>
<th>Code of sample</th>
<th>Aflatoxin (µg/kg)</th>
<th>G2</th>
<th>G1</th>
<th>B2</th>
<th>B1</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PB46</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>PB47</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>PB48</td>
<td>ND</td>
<td>1.19</td>
<td>ND</td>
<td>1.09</td>
<td></td>
<td>2.28</td>
</tr>
</tbody>
</table>

ND = Not detected

4.1.2 Aflatoxin Results of Roasted Peanut samples

Samples of roasted peanut were collected from different areas of Addis Ababa sold by street vendors and shops so as to investigate the level of aflatoxin. Those samples would be considered as ready to eat roasted peanuts as snacks. Mostly roasted peanuts have been packed or mixed with other roasted cereals/legumes in small amount and sold in the markets. During the investigation, it was observed that most retailers of ready to eat roasted peanut collected their item from one area, even from limited shops, in Merkato. Very few of them (according to verbal communication) bought
from other places. Representative 10 samples were collected from retailers and shops and analysed in duplicate for their aflatoxin content as depicted in the table below.

**Table 3: Average aflatoxin results (µg/kg) of roasted peanut samples (mean ± SD).**

<table>
<thead>
<tr>
<th>Sample code</th>
<th>Aflatoxins (µg/kg)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G2</td>
<td>G1</td>
</tr>
<tr>
<td>RP1</td>
<td>ND</td>
<td>1.56±0.09</td>
</tr>
<tr>
<td>RP2</td>
<td>ND</td>
<td>5.37±0.165</td>
</tr>
<tr>
<td>RP3</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>RP4</td>
<td>1.41±0.29</td>
<td>3.01±0.129</td>
</tr>
<tr>
<td>RP5</td>
<td>10.11±0.15</td>
<td>25.54±0.317</td>
</tr>
<tr>
<td>RP6</td>
<td>8.77±1.24</td>
<td>18.18±2.81</td>
</tr>
<tr>
<td>RP7</td>
<td>ND</td>
<td>2.51±0.28</td>
</tr>
<tr>
<td>RP8</td>
<td>1.42±0.05</td>
<td>47.02±4.70</td>
</tr>
<tr>
<td>RP9</td>
<td>2.31±0.01</td>
<td>28.13±2.83</td>
</tr>
<tr>
<td>RP10</td>
<td>0.71±0.00</td>
<td>1.15±0.50</td>
</tr>
</tbody>
</table>
ND = Not Detected, or below detection limit (0.5 µg/kg), SD = Standard deviation. From 10 collected samples of roasted peanut, all showed aflatoxin contamination ranging from 1.86 µg/kg to 216.48 µg/kg having mean value 58.78 µg/kg ± 75.56 SD (Median 17.07 µg/kg) which showed a great variability of aflatoxin contamination among samples as the samples have larger standard deviation than mean value.

Investigation output of this study revealed that all of the samples collected for analyses were contaminated with AFB1, AFG1, AFB2 and AFG2 to the levels of 90%, 90%, 80% and 60% respectively; found in the order of the relative potency of the four aflatoxin types. This evidence leads us to say peanut from Ethiopian farmers and confirmed by study of Eshtetu (2010) from Ethiopia, who studied contamination level of aflatoxin in raw peanut from Ethiopian farmers and reported up to 73% of samples were contaminated between 0.57 µg/kg to 447.02 µg/kg (AFB1 up to 324.34 µg/kg).

Apart from contamination of raw peanut, the high cost of testing discourages the majority of farmers, processors and traders from testing their products. This setback, in the absence of adequate knowledge, is further compounded by the reluctance of consumers to pay the extra cost of a tested product, when there is a readily available alternative (Mutegi et al., 2013).

4.2 Evaluation of aflatoxin results against different standards

More than 91% of Peanut butter samples sold in Addis Ababa supermarkets and retailers could be rejected under European Union (EU) standard, if these products were exported to European countries. Moreover, up to 60% of peanut
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butter samples could be rejected under WHO/FAO standard. When both categorized samples, peanut butter and roasted peanut, were evaluated by a single mean (Weighted mean), more than 90% samples could be rejected under EU. When local peanut butters were compared against East African Standard (EAS), 77% of products were rejected for total aflatoxin content and 89% of products did not conform to the specification of AFB1. In addition, 90% of samples of roasted peanut collected under this investigation did not comply with the EAS ($\leq 5 \mu g/kg$) for its AFB1.

As a cumulative report, 89% of peanut products (peanut butter and roasted peanut) traded in Addis Ababa market were highly contaminated and could not fit for human consumption under East African Standard (EAS). On the other hand, only 7 samples (15.5%) of peanut butter were conforming to Ethiopian Standards on Aflatoxins.
Table 4: Comparison of analyses results of peanut butter, roasted peanut against different standards

All values within the same row are cumulative, thus do not add up to 100%.
4.3 Investigation results on Salmonella

4.3.1 Local peanut butter

This survey was conducted to obtain information on the presence of pathogen in peanut butter currently available in the market of Addis Ababa. In this regard, the study aimed at investigating the presence of *Salmonella* in different brands of peanut butter traded in Addis Ababa markets.

From total of 45 local samples, *Salmonella* was detected in 3 samples of peanut butter (Table 12) and *Salmonella* was absent in the remaining 45 samples.

<table>
<thead>
<tr>
<th>No.</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PB1-PB3 Not detected</td>
</tr>
<tr>
<td>2</td>
<td>PB4 Detected</td>
</tr>
<tr>
<td>3</td>
<td>PB5-BP19 Not detected</td>
</tr>
<tr>
<td>4</td>
<td>PB20 Detected</td>
</tr>
<tr>
<td>5</td>
<td>PB21-PB30 Not detected</td>
</tr>
<tr>
<td>6</td>
<td>PB31 Detected</td>
</tr>
<tr>
<td>7</td>
<td>PB32-PB45 Not detected</td>
</tr>
</tbody>
</table>

Low-moisture products such as peanut butter have been implicated in outbreaks of salmonellas as highlighted in different studies.

As different standards limit *Salmonella* to zero level for human consumption, 3
detections out of 45 samples may indicate the presence of poor manufacturing practices among processors. In addition, based on the specific strain of Salmonella, it might have affected the consumers of the products as small amounts can lead to human illness. These three detections may be meaningful when referred to the report of Yuhuan (2009).

Hence, these three samples can talk more about severity of the problem and indicating: poor sanitation practices, poor equipment design, improper maintenance or poor ingredient control etc. in those facilities of small scale processors found in Addis Ababa.

When come to Ethiopia, how many outbreaks have been appeared and recorded in this regard (as peanut butter processors are appearing at alarming rate)? Unknown! Might any salmonella related diseases come due to consumption of peanut butter yet? No research based data is available so far!

Tracing such cases to the main causes is very difficult or controversial. But the present study would be saying there might be people whose health were affected through consumption of contaminated peanut butter, and necessitate the implementation of Good Hygiene practice and HACCP principle at processors premises, strong regulation by government. If possible processors should: analyze Salmonella in their products as part of quality assurance; establish “high hygiene” zones with more stringent hygiene requirements and procedures, and analyze the air systems as dust is one factor for contamination of salmonella.

### 4.3.2 Imported peanut butter

There were limited numbers of peanut butter brands in Addis Ababa markets. From total of 48 collected samples from the market, only 3 imported brands were found during sampling period.
### Table 6: Analyses result of *Salmonella* in imported peanut butter samples

<table>
<thead>
<tr>
<th>Code of samples</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>PB46</td>
<td>Not detected</td>
</tr>
<tr>
<td>PB47</td>
<td>Not detected</td>
</tr>
<tr>
<td>PB48</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

Analyses of *Salmonella* was conducted on the 3 samples and *Salmonella* was not detected (Table 5). Due to very limited number of imported peanut samples, comparison with local products in terms of salmonella percentage contamination was found to be not feasible. However, *Salmonella* was absent in the three samples because this product might come from countries where stringent follow up of pathogens is implemented, unlike local production system.

### 4.4 Description of quality of peanut butter in terms of oil separation

#### 4.4.1 Local peanut butter

The extent of surface oil is explained by the word “very not iceable” (borrowed from EAS document) if the surface oil is very visible and could be flow or poured. Accordingly, out of 45 local samples collected from markets of Addis Ababa, 11 samples showed oil separation. According to Ethiopian Food Corporation (1998), the use of processed foods such as peanut butter in Ethiopia is increasing. The most serious problem of natural peanut butter is the tendency of the oil to separate during storage as it has negative impact on purchase and general quality of peanut butter. The reason to oil separation may be inappropriate preparation or due to extra added oil. Flor *et al.* (2006) explains output of such problem as; oil separation in peanut butter may develop acidity during storage and gives off-flavor at the point of tasting. According to different literatures, deterioration of peanut butter can arise from oxidative acidity that...
develops in the unsaturated portion of oil when it is exposed to air as it was observed in above samples of this study. Thus, oil separation can potentially be converted to rancidity. However, due to scope limitation and budget constraints, this study did not encompass the analyses of free fatty acids and peroxide value to see the degree of rancidity. When looking further into the previous aflatoxin results and oil separation, both have a common point of interception. Meaning, there were 7 top samples of peanut butter showing maximum aflatoxin contamination (>200 µg/kg) and 5 of them had showed oil separation. This simply implies the logical that the manufacturer of those samples did not know how to select good quality peanut and how to prepare the product. High aflatoxin contamination along with oil separation makes the product risky for consumption.

**Table 7: Local samples of peanut butter that showed oil separation**

<table>
<thead>
<tr>
<th>Sample code</th>
<th>Oil separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PB2</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB4</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB5</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB10</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB20</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB23</td>
<td>Slightly noticeable</td>
</tr>
<tr>
<td>PB25</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB27</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB31</td>
<td>Very noticeable</td>
</tr>
<tr>
<td>PB38</td>
<td>Slightly noticeable</td>
</tr>
<tr>
<td>PB43</td>
<td>Very noticeable</td>
</tr>
</tbody>
</table>

### 4.4.2 Imported Peanut Butter

In three samples of imported peanut butters, there was no observed oil separation.

### 5. Conclusiona

According to investigation conducted, 93% of samples of peanut butter products traded in Addis Ababa markets had total aflatoxins ranged from 3.92 µg/kg to 547.85 µg/kg. In addition, all samples of Ready to eat roasted peanut collected from street vendors of Addis Ababa city were contaminated by total aflatoxin ranged from 1.86 µg/kg to 216.48 µg/kg. High aflatoxin contamination at market levels especially in peanut butter and...
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peanut products implies that the prevailing post-harvest handling practices are insufficient in controlling contamination and in some cases, have worsened contamination levels. On top of this, the absence of awareness about aflatoxin and inefficient technical knowledge on how to produce peanut butter among most cottage processors worsen the problem. Hence, several cultural practices such as sorting, sieving, winnowing and drying should be practiced by the traders and processors as ways of reducing aflatoxin contamination from peanuts to be sure only good, wholesome kernels are used in peanut butter.

The bacteriological quality of traditionally processed peanut butter creates a potential danger with regard to public health, as three detection of salmonella was noted out of 48 samples in this study. The result of the study has suggested that cross contamination plays a major role for presence of salmonella in the products. Cross contamination is the transfer of bacteria from one surface, object or place to another. Limited exposure of processors to the technical knowledge and general awareness of food safety could also be one factor for production of unsafe products.

Therefore, processors of the product should take care of cross contamination during production and should implement HACCP principles to their process line.

In relation to general quality of peanut butter, specifically oil separation, 24% of samples under study have showed oil separation to an extent can potentially cause rancidity. Oil separation in peanut butter may develop rancidity during storage and gives off-flavor at the point of tasting. Consequently, deterioration of peanut butter can arise from oxidative rancidity that develops in the unsaturated portion of oil when it is exposed to air. This problem substantiated the use of improper processing method, absence of knowledge, or wrong formulation.

There is a need for awareness creation at all levels of the peanut value chain,
especially for end consumers, campaigns to raise consumer demand for safe, high-quality food.

Comprehensive, multi-sectoral approaches are required to reduce aflatoxin prevalence and exposure in Ethiopia.

Unless strict monitoring measures for aflatoxin and pathogenic microbes are put in place, condemned nuts will continue to be available in the markets for human consumption. Hence, Quality criteria and controlling mechanisms on those products should be implemented by regulatory bodies to protect the health of consumers.

Education of the local producers by regulatory bodies on the use of the hazard analysis critical point (HACCP) concept from the raw material through processing stages to storage and/or retailing is advocated in view of possible microbial and mycological hazards in traditionally processed peanut butter. There is a need for systematic and universally applicable approach to food safety control; enforcing proper sanitation and monitoring of products by relevant regulatory bodies. Intervention is necessary in this regard!

Traders and manufacturers are obligated by law to countercheck the safety and quality of food products they manufacture, sell, distribute, market or import into the country. Meaning, they should practice to test their products by themselves or via sending their samples to available analytical laboratories for verifying the compliance of safety and quality of their products. In this regard, affordable costs for raw materials and product analysis should be given an attention!

Wider investigations regarding peanut butter produced all the way through Ethiopia are required to precisely generalize the prevalence of the aflatoxin and salmonella in the country. Furthermore, study of other serious pathogens in food items, degree of aflatoxin intoxication among consumers (risk assessment studies); unlike HPLC,
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low cost, rapid and easy methods for aflatoxin determination could be the next works to be handled by upcoming researchers which this study did not address.

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Reference


Determination of aflatoxins in peanut products in the Northeast Region of São Paulo, Brazil.

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Standard for Regulating Food Quality and Safety: The Case of Ethiopia: A Review

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EXECUTIVE SUMMARY
Globally improving the food safety and regulatory system is an important health and economic goal for all countries. It has been noted that food quality and safety regulating laws in Ethiopia faced challenges to meet the supplying of safe and quality to export market. In the first place, the existing standards are not well disseminated with in all relevant sectors for implementation and they focus primarily on the inspection of final products. In relation to this the findings of the critical review showed there is great emphasis on standards as a key to regulate the safety and quality of products in global and national level. Also most of the developed and developing countries follow multi-sector approaches to implement regulation. In the other hand regulation must comprehend all the supply chain from sources, transportation, storage, distribution and marketing of food item and referring standards in regulation is one of the tool to implement the regulation effectively. Thirdly standards should be supported by adequate research and innovative strategies to bring immense changes and benefits in terms of economic, social, research and growth. In addition the review point out that regulating the safety and quality of conventional food items in the supply chain, it is needed to consider regulation of the street foods which are becoming major dish for many consumers, particularly for middle and low income peoples. Therefore, this critical review is prepared to address issues related with standards, regulation, drawbacks and possible recommendations to integrate standards with research, innovative and behavior change activities to meet food quality and safety requirement in a changing world.

Keywords: Ethiopia, Regulation, Safety and Standard
1. Introduction

1.1 Standards and Food Regulation

Food standards are “rules of measurement established by regulation or authority” (Reardon et al., 2011) and are enforced by governments, food companies and retailers. Their aim is to assure the confidence of consumers in the food systems (from farm to table), but also increase the information available to the final consumer, enabling them to make informed decisions concerning the food they purchase. On the other hand, food standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose. Product standards and code of practice assist manufacturers to produce foods that meet minimum specifications for quality and safety. Standardization is a process of ensuring uniformity in products and services by use of appropriate standards (Casella, et al., 2010).

Implementing regulatory standards in the area of food quality and safety protection is one aspect of regulatory mechanisms which is emerged as the result of many problems related to food, the problems that cannot be detected by consumers using their sense of sight, smell, taste, or touch when selecting or consuming foods (Caswell, 2007). Countries require that imported, exported and domestically produced foods conform to regulatory requirements provided for these purposes. With a view to achieve these objectives government employ legal instruments to compel individuals and organizations so that they can comply with the prescribed behavior and regulatory requirements. This is to mean that regulation is provided with a view to inform what can or cannot be done with respect to the matters for which it is prescribed (Food Regulations, 2007).

There are three different kinds of standards: namely process, product or information (Caswell, 2003), but most regulations use a combination of the three to regulate food processing and marketing. Briefly stated, process standards specify how the product should be produced, and
last, information standards are concerned with labeling and other communications that go with the product. The process ensures efficient utilization of resources through reduction of wastes (Donovan, et al. 2001).

Food regulation, which subjects suppliers of goods and services to behavioral control and which penalize those who fail to perform in accordance with the specified standards are the dominant form of social regulation (Nadvi, K. and Waltring, F. 2003). In the history of social regulation, food regulation also occupies a significant place. Since ancient time producers of food products have attempted to alter their wares in an effort to obtain dear prices for cheaper goods by adding water to wine and by skimming cream from milk. This shows that adding worthless substance to food and taking valuable substance from food product was experienced in ancient society. Hence regulation governing what could or could not be added to food products and regulations that require the use of official weights and measures have been introduced to protect consumers from fraudulent and/or unsafe food products (Codex standards, 2009).

The general regulations include detailed regulations for guidance of those who enforce food law, regulations concerning official actions, such as making inspections, collecting samples, making decisions about serious infractions, and the disposition of seized lots of food (Meier et al., 1997). To this group of general regulations also belong regulations concerning licenses (permits), if firms and/or specific foods must be registered, the regulations should specify conditions and requirements. Regulations concerning imported foods should cover all aspects of the handling of imported foods. It is impossible to make an overview of all the types of regulations, the above example hopefully will give readers an idea about fields covered by general regulations. Food regulations generally cover the following: general regulations, food standards, food hygiene, food additives, pesticides, veterinary drug residues, food
advertising, food packaging and labelling (Henson, 2007).

Therefore, the general objective of this review is to show the role of standards in regulating the safety, quality and acceptability of foods by the consumers and for public health protection.

1.2 Types of standards

1.2.1. Permissive or non-preventive standards or voluntary standards

Permissive standards are a type of standards that prohibits the addition of any substances other than those it specifies and is usually employed in connection with food additives, a “permitted list” containing only those additives which may be used to the exclusion of all others. In this type of standards technique, the producer is allowed to use only those food additives specified by the regulatory authority (Henson and Loader, 2001).

Voluntary standards are agreed up on procedures, systems and methods, which producers voluntarily meet to show that their products achieve a stated level of quality and/or performance. This means that the application of voluntary standard is discrentional as compliance to it by producer, distributor or any other concerned body is only optional. Standards drawn up by trade organizations (both national and international) for the guidance of their members may be the common example of voluntary standards (Reardon, et al., 2001).

1.2.2 Technical Regulation

When standards are adopted or used in regulations, they are termed technical regulation, thus, their use becomes mandatory requirements that local goods and imported products must meet (CAC General Principle, 2002). This is to mean that once they are put in regulation adherence to them becomes mandatory for the producers of the product for which mandatory standards are established. In another words products which do not comply with mandatory standards (regulations) cannot be made available to consumers (CAC Rome, 1999). Generally, mandatory food standard is necessitated for the following reasons: to prevent the
transmission or the cause of disease and to limits the sale of unfair products.

1.2.3 Prohibitory Standards

Prohibitory standards on the other hand provides for list of substances not to be included in the food stuff. This is to mean that, for instance, if ‘x’ is prohibited from contained in certain food all that is not ‘x’ is permitted (CODEX STAN 1-1985, Rev. (1991).

Traditionally food laws and regulation had defined unsafe food and has prescribed the enforcement tools for removing unsafe food from commerce and punishing responsible parties after the fact. This indicates that it has been reactive and enforcement oriented rather than preventive to reducing the risk of food borne disease.

To achieve maximum consumer protection and to satisfy importing countries food quality and safety requirements, it is essential that quality and safety be built into food products from production through to consumption (Loken Joan K, 1995).

This calls for comprehensive and integrated farm-to table approach in which the producer, processor, and transporter and all play vital role in ensuring food quality and food safety.

This is because many food-safety hazards can enter the production chain at multiple points and can multiply or cross-contaminate other products one present. Then a farm-to-table approach allows identification of the effective points for intervention (Laurian J, et al., 1998).

2. Materials and Methods

To achieve the objective of this critical review, different literatures search, internet sources, interviews and written material were reviewed and organized to address, scientific information on food standard, and food regulation, role of food regulation, regulation techniques, international agreements, Codex Alimentarius, food regulation system and overall statues of food standards in Ethiopia.
3. Review and Discussion

3.1 Role of Standards

3.1.1 Standard for regulating food quality and safety

For the food processor and retailers, standards are important in differentiating and communicating product quality and safety to the consumers as well as being a competitive strategy. This has become a particularly important issue for developing countries, where the compliance with standards may be difficult, yet mandatory for trade (Donovan et al., 2001).

Governments, international organizations and private companies try to ensure safety and quality by making strong compulsory minimum standards for a product and banning the sale of any item that does not comply with certain minimum criteria.

There are two types food standard approach. The first and more dominant approach focuses on mandatory standards and international standards ruled by the World Trade Organization (WTO), broadening the standards of developed countries (United States, Japan and European Union). Most studies consider standards as barriers, highlighting the technical and managerial difficulties that developing countries face in compliance. (Henson and Loader, 2001).

3.1.2 Standard for Regulation of Internal and External Market

Food standards are mandatory for international trade. They are considered barriers to trade due to technical and managerial difficulties faced in compliance. Harmonized mandatory international food standards are formulated by Codex Alimentarius Commission, an FAO/WHO joint committee on food standards. Codex carries out scientific food research and investigations to enable formulation of appropriate standards (Reardon, et al., 2001). The general regulations include detailed regulations concerning official actions, such as making inspections, collecting samples, making decisions about serious infractions, and the disposition of seized lots of food (Meier et al., 2007). To this group of general regulations also belong regulations concerning licenses (permits), if firms and/or specific foods must be
registered, the regulations should specify conditions and requirements. Regulations concerning imported foods should cover all aspects of the handling of imported foods. It is impossible to make an overview of all the types of regulations, the above example hopefully will give readers an idea about fields covered by general regulations. Food regulations generally cover the following: general regulations, food standards, food hygiene, food additives, pesticides, veterinary drug residues, food advertising, food packaging and labeling (Henson, 2007).

3.1.3 Standards for public health protection
The growing population has placed demands on agriculture for increased production (CAC (2008a). However, the increase of agricultural production is connected with the wider use of chemicals. Protection of food during transport and storage may require the use of chemicals too. In such system, if the consumers can not clearly perceive the quality of food products regulatory intervention becomes necessary to safeguard the health and safety of citizens (Abbott, et al., 2008). Domestic consumers need food that satisfy their expectation, and that do not pose risk to their health and safety. Importing countries also require imported food to conform to the technical regulations and standards that they apply to domestically produced food products for healthy, safety and consumer protection (CAC, 2008b). Imported agricultural products also have to conform to sanitary and phytosanitary measures which are applied to protect human or animal life from food borne risks and from plant carried diseases. Maintaining safety and quality of food measure are required not only in some end point of the food chain, like manufacturing, but also in some starting point, like farm production. This is because agro-chemical residue in food is unmanageable at the point of consumption but it can be managed at the point of production by using good agricultural practice (U.S. EPA, 2007).

In other words food quality regulations have the objective of minimizing...
unreasonable risks to which the public
would be exposed, by providing safety
protection mechanisms, by which food-
borne health hazards could be controlled at
each state of the food chain (Pillay V,
Muliyl V. 2005). Food regulation,
therefore, provides for a transparent
system so that asymmetric information, as
to the quality and safety of food, between
food producers and consumers will be
avoided or, at least, minimized. Thus
regulation that governs as to what can or
cannot be added to products, how products
are labelled, and whether certain products
are safely sold to consumers, can be
justified in the public interest if consumers
do not possess the information to
accurately recognize these aspects of
product quality on their own (Roberts,
1998).

Under Ethiopian law, the consumer
protection objectives of food quality and
safety regulation can be observed from the
beginning of the enactment of legislations
dealing with food quality and safety
issues. Meat inspection proclamation No.
274/1970, clearly provides that the main
reason for the issuance of the proclamation
was to ensure the production and market
of meat and meat products, which are
sound, wholesome and otherwise of a
quality totally fit for human consumption,
and thus to protect foreign and domestic
consumers (Ethiopian Conformity
Assessment Organization, 2011).

There are three recognized categories of
food safety hazards: biological hazards,
chemical hazards, and physical hazards.
The origin of these hazards in foods can be
from naturally occurring substances or
agents in foods, from deterioration or
decomposition of foods, or from
contamination of the foods with the hazard
at various stages of their production,
harvesting, storing, processing,
distribution, preparation, and utilization
(FSS, 2003). For some hazards, such as
pathogenic bacteria (e.g., Salmonella
spp.), there is zero tolerance, this means
that the presence or the detection of the
hazard in the food is unacceptable
(Ensuring food quality and safety FAO,
2001).
3.1.4 Standards for Conformity Assessment

Conformity assessment is another techniques employed to determine the compliance with the technical regulation (standards). Hence this section tries to explain conformity assessment and its relevance in the area of food quality and safety regulation. Conformity assessment is the process of testing compliance with standards or technical regulations. It is technical activities such as testing, inspection, certification accreditation, which confirms that products or process fulfill the requirements laid down in regulations and/or standards (UNCTAD, 2010). The purpose of conformity assessment is to provide confidence for users that requirements applicable to products process and systems have been met and then contribute to the market acceptance of those products, process (Geraint and Stephen, 2006).

Conformity assessment is fundamentally important and very widely used techniques at food quality and safety assurance system (Stephenson, 2002). The confidence of consumers in the quality and safety of their food supply depends on their perception as to the effectiveness of the food quality and safety control measures. It is, therefore, through effective conformity assessment procedures that the quality and safety of food produced is assured (Roberts, 2007).

It is also stated that conformity assessment procedures provide a means of ensuring that the products, processor systems produced or operated have the required characteristics, and that these characteristics are consistent from product to product or system to system. Conformity assessment provides assurance that the products we use won’t harm us, that their components will work and that manufacturers are effectively managing the impacts of their activities on health, safety and the environment (Consumer Protection and Competition Policy, 2004). For the purpose of this review it can be said that conformity assessment is a tool that helps to assure whether foods and food products or system of production
meet the requirements of the food standards and regulations and fit for use by customers and consumers.

In Ethiopia, the conformity assessment agency is responsible to assure the product process and methods applied in accordance with the standards and regulations in place. Ethiopian governments employ various controlling mechanisms with a view to protecting public health and consumers as well as to ensure fair practice in food trade (MoST, 2014).

When we see the existing standards, most of them do not respond to new modes of living in which the Ethiopian people is, new kinds of products evolved from time to time, new methods of manufacturing and distribution chain, and new scientific discoveries, all demanding frequently updating of the food standards to coup up with the modern level of food quality and safety control system. Hence, in order to have comprehensive national food standards, it needs integrating standards with research, innovative and behavior change activities to meet the current food quality and safety requirement.

### 3.1.5 Components of Conformity Assessment and Regulation

Conformity assessment contains the following components.

**Certification:** certification is the procedures by which a third party gives written assurance that a product, process, personnel, organization or systems conforms to requirements. With regard to food quality and safety assurance certification, it is provided to assure that food or food control system conform to requirements provided in food standards and food regulations. Here certification is given to show that the products, process or methods of production for which the certificate given is consistent and comply with the regulatory requirement and fit for use or consumption by customers and consumers. Certification is an asset and advantage, both for producer and for the purchaser, consumer or distributor since a person or producer who is given certificate is also provided with quality mark, it gives them an incontestable added value to the
product bearing its mark. For the manufacturer, it opens up market and simplifies relations and for the user, it provides assurance that the product purchased meet defined characteristics or that an organization’s process meets specified requirements. In the case of food and food products certification mark represent an assurance of safety and quality of the food. Certification of food products may be based on a range of inspection activities which may include continuous on-line inspection, auditing of quality assurance system, and examination of finished products.

**Inspection**- Inspection is the examination of products, process, materials, and work procedures to assure that they comply with the requirements. In the food sector inspection is the examination of food or system for control of raw materials, processing, and distribution including in process and finished product testing in order to verify that they conform to requirements. The overall aim of inspection is to reduce risk to the buyer, owner, user or consumer of the item being inspected. Here inspection in the areas of foodstuff is carried out with a view to verifying that the food produced, the materials used, and the process employed is as set out in the regulations (standards).

The federal government conducts inspection services on export animal, animal products and plants and plant products, whereas the regional Agricultural Bureaus and Zonal and Woreda Agricultural Offices are responsible to carry out inspection activities that ensure the quality and safety of locally produced animal, animal products and plants. Likewise, to ensure the quality and safety of agricultural products and to protect animal from diseases, there are agricultural extension workers with the charge of assisting and advising farmers at the grass-root level (Solomon, 1975). They also conduct inspection activities so as to assure the quality and safety of domestically produced agricultural product. At this juncture, it is difficult to assess all the regulatory mechanisms employed to ensure the quality and safety of plants and...
animals and animal products. This warrants the need to have an insight into regulations that deal with the quality and safety of meat and meat products to look into what the practice looks like.

A person, who wants to engage in producing and/or trading in foods, the production or the trading of which requires compulsory Ethiopian standards, should hold quality mark and certificate of conformity to assure that the product conforms to the relevant compulsory Ethiopian standards. Accordingly, where a person is found producing or trading in food and food products, without holding quality mark, the authority may order the closure of the factory or business undertaking or for the cessation of operations and the ban of movements of the products. Hence, it can be said, QSAE plays a pivotal role in promoting and assisting the use of voluntary food standards and in assuring the proper implementation of compulsory food standard so that consumers can be provided with safe and good quality of domestically produced food and food products (National Codex standards, 2009).

**Testing**- Testing is perhaps the most common form of conformity assessment which can include activities like measurement and calibration. It is the main techniques used in product certification.

**Accreditation**- Accreditation, which is one of the components of conformity assessment, is a procedure by which an authoritative body gives formal recognition that a body or a person is competent to carry out specific tasks. It can be said that accreditation is attestation given to a person or an organization to assure that they are capable to undertake activities for which accreditation is given. Accreditation is a conformity assessment activity and is the internationally accepted system that recognizes the competence of testing and calibration laboratories, inspection bodies, product certification bodies and quality system certification bodies. Accreditation establishes assurance of the quality of test data and provides discipline and a sense of professionalism that is internationally...
accepted. This minimizes duplication of re-testing and re-certification reduces cost and eliminate non-tariff barriers to trade and market access delays. Here accreditation is used to facilitate transactions by eliminating the redundancy of certification and testing by establishing confidence between exporters and importers of foods and food products.

3.2 Overview of Ethiopian Food Standards

The national standards are adopted from the codex standards and represent the country’s interest on selected international Codex meetings, identify priority areas on food regulation and develop fundable projects and conduct national awareness program on food regulation and codex standards (Yalemtehay, 2010). The Codex texts are the basic reference materials for standard settings, and serve as enforcing tools to those items such as food additives, pesticide residues, and others where there are no developed Ethiopian standards (FAO and WHO, 2005; Dawit, 2010). Ethiopia, implement both the voluntary and mandatory types of regulator standards, but due to the nature of production, supply and use of agricultural products the non-mandatory standards are dominantly used. Most of the food system is locally produced and distribute, it is difficult to regulate the safety and quality in every supply chain of foods.

It is unable to protect largely the public from possible sources of food borne diseases that could occur even to a failure to apply the well-known principles of food safety that have been established over many years, for instance, basic hygiene practices. There are still foods and food products such as meat, baby foods, bottled mineral water, juices and traditionally processed foods whose compliance with the standards are not still made mandatory. This indicates that there is a need to revise the existing Ethiopian standards to prepare compulsory standards for those foods the absence of which may has an impact on health and safety of the public (Erkyihun, 2010). This indicates that in the areas of food standards much is expected to be done from the standard setting bodies on...
the one hand to revise the existing mandatory food standards to keep pace with current advances in foods production and distribution system.

Food processing industries in Ethiopia are playing a significant role in terms of establishment, employment, and market share. However, the country’s food quality and safety regulatory system is very little developed and is not able to effectively support the production, supply, and distribution of safe and quality food to the domestic consumers and to the export market. Success in today’s highly competitive global market requires producers to be quality conscious that helps them in providing better quality products (Groth, 2001).

Placing great emphasis on producing good quality and safe food products helps to ensure that the products offered to their customers are consistent, reliable and truly meet their customer’s needs. Under Ethiopian law, the consumer protection objectives of food quality and safety regulation can be observed from the beginning of the enactment of legislations dealing with food quality and safety issues. For instance, meat inspection proclamation, clearly provides that the main reason for the issuance of the proclamation was to ensure the production and market of meat and meat products, which are sound, wholesome and otherwise of a quality totally fit for human consumption, and thus to protect foreign and domestic consumers (Ethiopian Conformity Assessment Organization, 2011).

In this regard, the Ethiopian government has enacted a proclamation that regulates the standards of production, import and distribution of food and medicine as well as the standard of health institution (Ethiopian Conformity Assessment Enterprise, 2010).

The role of regulation, in this regard, is of particular importance in countries where consumers are not as such aware of their rights. In addition to this, regulation works for the interest of consumers through the protection of competition (Consumer Protection and Competition Policy, 1997). As already discussed, in the absence of
competition, the free market may fail to efficiently allocate resources in accordance with consumer preferences. When market fails, anticompetitive practices such as abuse of dominance, restriction of production and charging exorbitant prices will be the order. In such situations, regulation may be employed either generally or on an industry by industry basis to correct market failures resulting from the exercise of monopoly powers (Geraint and Stephen, 2006). Adulterations of food stuffs and medicines as well as selling of expired food items and medicines have also been major threats for consumers (Ethiopian Conformity Assessment Enterprise, 2011). Adulteration is also made on other products through complete or partial substitution of their contents by less valuable elements which resemble as if they were of quality.

The adulteration, sometimes, goes to the extent of adding poisonous substances that are harmful to health. There have still been problems on quality and safety of imported products, as well as on imported and locally made food items that are related to the daily need of consumers. Price regulation, in case of inflation, is also important for the protection of consumers’ interests. Inflation affects the consumers as it entails the decline in the purchasing power of currency. However, such measure is, in most cases, taken as a temporal measure for it has adverse effect on competition and also not a reliable means of protecting consumer rights in the long run.

3.3 Challenges of Standard Implementation to Regulate Food Quality and Safety

3.3.1 Rising of Adulterations

Consumers in Ethiopia have for long been victims of irresponsible marketing of goods and services. Adulterations of products have been made by adding deleterious and poor quality ingredients. Adulterations of food stuffs and medicines as well as selling of expired food items and medicines have also been major threats for consumers (Ethiopian Conformity Assessment Enterprise, 2011).
3.3.2 Rising of Street Foods

Although the accessibility and affordability of street foods are their merits, they are perceived to be a major public health risk in view of health problems associated with food hygiene and sanitation that are closely related to improper personal hygiene, unsanitary practices and habits. Irrespective of these possible risks, in many developing countries, street foods are not subjected to formal inspection by regulatory authorities mainly because most vendors operate without license and at undesignated places (Assuring good Quality Food Ingredients and Foods, 2010).

In Ethiopia Street foods are rising time to time in the main cities ad even in rural towns. However, there is no well-established standard to control the quality, safety and acceptability of such foods. This indicates that the risks that might be created on consumers, because of the use of street foods, are not appreciated by regulatory bodies and that there has been no legislation that pertains to the regulation of these foods, and this creates difficulty on ensuring that these foods are free from potential contaminations that expose consumers to unnecessary risks (Temesgen et al., 2015). As regards, enforcement of street food quality regulation, there can be an inspection as well as sampling and testing by government regulatory agencies to ensure the compliance by food producers and distributors to specified standards and government regulatory requirement (Codron, et al. 2005).

3.3.3 Drawbacks

There are many drawbacks in Ethiopia for regulating food quality and safety such as, lack of enforcement mechanism for existing regulation due to inadequately defined, demarcated and streamlined responsibilities and mandate given to regulatory bodies and inspection authorities, under equipped and understaffed public health laboratories to respond to current international food regulation demands, Lack of a single central and accredited food safety analytical and microbiological laboratories to Support regulatory activities, weak

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coordination among lead government agencies, the private sector and the consumer at large. Low level of integration, collaboration and cooperation among inspection authorities/regulatory bodies, support institutes, regional offices, etc, low management capacity and knowledge of regulatory bodies to cope with fast growing science of food regulation, Low level awareness of food regulation in most processing plants on HACCP, GHP, GMP, GAP, GLP and Lack of social awareness on food safety issues.

The basic food hygiene education is not well addressed by the education system starting at an early age to higher teaching institutes. Food regulation issue being taken as secondary to economic benefit insufficient fund allocated by the government for food inspection and control activities. The participation of donor agencies and countries, to food safety issue is not satisfactory, Low level of hygiene awareness of the public to the basic food hygiene practices and Insufficient number of inspection and satellite laboratories at regional and zonal level, inspection tools and mini laboratories and transportation both in the Health and Agriculture Sectors, Lack of technical competence in terms of trained manpower, facilities, and infrastructure, at the federal level and regional level.

### 3.3.4 Relevant stakeholders in food standards and regulation

- **Government**
  The government is the main responsible body in setting standards and regulating the assuring regulation and quality of food, regulation, efficacy, quality and proper use of medicines, competence and ethical practice of health professionals, competence of health and health related institution and services. The supply chain of all foods and non-food commodities are controlled by government and the government should ensure the working of standards.

- **Research institutions and universities**
  In Ethiopia institutions and universities have direct responsibility with regard to food regulation. The research institutions can support the follows areas: Establish measures to protect the consumer from.
unsafe, low quality, adulterated, misbranded or contaminated foods, the measures include provisions for minimum acceptable levels of food quality and regulation, for differences in the ways in which food is produced, processed, packaged, labelled and stored, as well as for the conditions under which it is presented and purveyed, assess food regulations and fortification of foods with micronutrients and should fully take into account the recommended international standards of the Codex Alimentarius Commission, creating transparent communication in food analytical services and accreditation of laboratories regarding food regulation, conduct nutrient analysis and develop food composition to make use of it to control the risk inappropriate food consumption, develop surveillance and monitoring programs for food-borne diseases and contaminants, and by identifying the sources of food-borne health risks and the development of procedures that reduce the magnitude and significance of food-borne hazards.

- **Role of FMHACA in ensuring food regulation**

Ethiopian Food, Medicines and Health Care Administration and Control Authority (FMHACA) established in accordance with Food, Medicine and Health Care Administration and Control Regulation No 189/ 2002.

According to the new proclamation, the Authority is responsible for assuring regulation and quality of food, regulation, efficacy, quality and proper use of medicines, competence and ethical practice of health professionals, competence of health and health related institution and services (Dawit, 2010). The Authority’s Core Process and sub-process Health and health related services and products quality regulation.

FMHACA is undertaking various initiatives to protect the public health by ensuring the quality and safety of food products. FMHACA is mandated to regulate the manufacturing, supply and distribution of all food products that are imported and manufactured locally so that
the quality & safety of food products is maintained through the implementation of GMP. Current Good Manufacturing Practices (GMP) covers all aspects including the purchase of materials, production, quality control, storage and delivery of finished food products and many other related factors to food manufacturing and distribution activities (WHO, 2008).

- **Role of Ethiopian Standards Agency (ESA)**

The previous Quality and Standards Authority of Ethiopia is the National Standards Body of Ethiopia established in 1970 and restructured in 2010 as Ethiopian Standards Agency (ESA) and other entities. The objectives of the Agency are developing national standards, assisting industries through training and technical support. It also conduct researches that are important for the development standards and to enhance the implementation of standards. Therefore, the agency has a big role in food regulation through developing standards and giving technical support and training, and conducting researches that are an input for standard development and providing factual data on the level of implementation of standards to support the regulatory environment.

- **Role of Conformity Assessment Bodies (CAB)**

CABs are those that provide laboratory testing, inspection and certification. These bodies assist the food regulation by providing analytical services of inter-laboratory comparisons assisting in the implementation of GMP, GHP and HACCP and other standards.

4. **Conclusion**

In conclusion, setting standards and regulating the functionalities of the standards are very important for every country. However, existing situation seems there is inconsistent regulation all food and drink supply chain and associated with lack of strong cooperation between stallholders, institutes, NGOs and other partners. Therefore, the following recommendations are drawn from this review to indicate further attention is needed:
There is a need to identify relevant stakeholders to set standards, reach on consensuses and implementing together.

There is need to establish working standards through depth needs assessment and evidence.

There is needed to create awareness the benefit of standards for the producers and consumers.

There is need to give attention by researchers, development partners, about the role of standards to ensure product quality and safety at large.

There is important to have knowledge and technology transfer system to the end user particularly in standards and regulation protocols.

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Costs of Quality in Shoe Factories of Ethiopia

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Abstract
In order to improve quality, an organization must take into account the costs associated with achieving quality since the objective of continuous improvement programs is not only to meet customer requirements but also to do it at the lowest possible cost. This can only be obtained by reducing the costs needed to achieve quality, and the reduction of these costs is only possible if they are identified and measured. CoQ (Cost of Quality) is usually understood as the sum of conformance plus non-conformance costs, where cost of conformance is the price paid for prevention of poor quality (for example, inspection and quality appraisal) and cost of non-conformance is the cost of poor quality caused by product and service failure (for example, rework and returns). Companies face quality problems may be at incoming materials, sample development, mass production process, final shipment, on time delivery and so on. The problem of both product and service Quality affects Ethiopian shoe factories greatly more than expected especially in export market. This is by way of customer dissatisfaction, least average product price (for instance export price for the 2010 E.C budget year was $9/pair-ERCA,2010), low productivity, increased cost of production, etc. On the other hand; the factories always worry about their daily production quantity. They think quality charges them additional unnecessary costs. This study attempted to explore the major CoQ in Ethiopian shoe factories. A questionnaire survey method and a secondary data were used with a triangulation technique to find out the major conformance and nonconformance quality costs usually seen in the sector. The finding of the study is that Ethiopian shoe industries have no concept on CoQ and the way of optimizing. Hence, this research attempts to unveil all quality costs right from the customer requirement analysis to after delivery support in Ethiopian Shoe factories participating in export market. The ultimate benefits gained from the study are improvements in terms of the quality of product/service and the reduction of the company’s failure costs. From the analysis of a sample factory quality data, it has shown that failure costs accounts for 79.58 percent of the total quality costs. Hence, the study recommends prevention activities to eliminate the failure costs before it happens.

KeyWords: Customer, Deficiency, Pareto Diagram, Quality Costs
1. Introduction

A strong control over the management of utilization of resources of all categories in a manufacturing process becomes the demand of the day due to the high competition among the players of the present market. The resources—people, material, machine and time—to be utilized in a most cost effective manner to ensure the profitability of any business and at the same time no compromise in the quality is permissible. This is the highly competitive globalized market scenario today. Hence management and financial accounting have an important role in the measurement and control of the components of manufacturing costs. On the other hand quality improvement programs for attaining continual improvements have become essential to any business organization to thrive forward profitably with enhancement in its customer base. The question is how to achieve both these objective without losing organizational interests.

What survive organization in the today’s competitive market is customer satisfaction which leads to increase sales and profit. One of the most effective items that influence customer satisfaction is quality, so most of the organizations pay attention to quality and spend money to create an appropriate level of quality in their products or services. Also organizations have a special attention to the cost while the reasonable and acceptable level of cost can be another competitive weapon for them. If an organization does not consider to quality they will face with direct and indirect cost resulting from remanufacturing or lost customer respectively [1], so organizations try to reduce these costs where cost reduction will be impossible if they are not recognized and measured and managed properly, as Dane explained “to manage we must control, to control we must measure, to measure we must define, to define we must quantify”[6].

Cost of quality is the sum of conformance and non-conformance costs, the costs of conformance relate to the fee is paid for avoidance of poor
quality (good quality) and non-conformance cost results in poor quality. There are some COQ models to define which cost items can be considered as a quality cost and identify and classify them as the cost of conformance (COC) or non-conformance (CONC), then some metrics should be used to measure these items and be presented to managers as a COQ report to be considered and controlled.

Many models of quality cost analysis have been evolved since the inception of this concept by the quality guru Dr. Joseph Juran in 1950. The classical PAF model by Feigenbaum (1956) which distinguishes quality costs into Prevention-Appraisal-Failure categories, Process Cost Model by Marsh and Ross (1976) classifying quality costs into cost of conformance and non-conformance in the manufacturing processes, Opportunity Cost Model by Sandoval-Chavez (1998) with the addition of opportunity losses to the other traditional models and the ABC-COQ integrated model by Tsai (1998) are the prominent models among them. Many more dimensions have been added to the quality cost analysis by researchers like Steve Elbridge (2006) who has added knowledge management concept to quality, Sower et al. (2007) who has analyzed the quality cost as a measure of system maturity with the analysis of the relationship between quality and quality costs and Ali Uyar (2008) and Zulnadi yakup (2010) who have analyzed quality cost as money invested and money lost.

In order to improve quality an organization must take into account the costs associated with achieving quality since the objective of continuous improvement programs is not only to meet customer requirements, but also to do it at the lowest cost. This can only happen by reducing the costs needed to achieve quality, and the reduction of these costs is only possible if they are identified and measured. Therefore, measuring and reporting the cost of quality (CoQ) should be considered an important issue for managers [7].
To collect quality costs an organization needs to adopt a framework to classify costs; however, there is no general agreement on a single broad definition of quality costs. CoQ is usually understood as the sum of conformance plus non-conformance costs, where cost of conformance is the price paid for prevention of poor quality (for example, inspection and quality appraisal) and cost of non-conformance is the cost of poor quality caused by product and service failure (for example, rework and returns).

The broad concept of the “economics of quality” can be traced back to the early 1950s when the “cost of quality” (CoQ) was first propounded in Juran’s Quality Control Handbook [8] and in Feigenbaum’s Total Quality Control [9, 10]. Since then, many quality-control experts have written about quality-cost systems; see for example Refs [11-14], and the importance of quality-related costs has been increasingly recognized. Quality related costs represent a considerable proportion of a company’s total costs and sales; see for a brief account [15].

The goal of this study is to provide Ethiopian shoe factories full information on cost of quality so that they will produce products that meet or exceed customers’ needs in terms of performance, fashion, timely delivery, or other criteria of importance. A second goal is to sell products that enable the companies to meet their business objectives in terms of productivity, profit, product mix, or other criteria.

1.1 Definition of Quality [22]

1. “Quality” means those features of products which meet customer needs and thereby provide customer satisfaction. In this sense, the meaning of quality is oriented to income. The purpose of such higher quality is to provide greater customer satisfaction and, one hopes, to increase income.

However, providing more and/or better quality features usually requires an investment and hence usually involves
increases in costs. Higher quality in this sense usually “costs more.”

2. “Quality” means freedom from deficiencies—freedom from errors that require doing work over again (rework) or that result in field failures, customer dissatisfaction, and customer claims, and so on. In this sense, the meaning of quality is oriented to costs, and higher quality usually “costs less.”

1.2 Definitions of Other Key Words

The definitions of “quality” include certain key words that themselves require definition.

Product: The output of any process. To many economists, products include both goods and services. However, under popular usage, “product” often means goods only. Product feature: A property possessed by goods or services that is intended to meet customer needs.

Customer: Anyone who is affected by the product or by the process used to produce the product. Customers may be external or internal.

Customer satisfaction: A state of affairs in which customers feel that their expectations have been met by the product features.

Deficiency: Any fault (defect or error) that impairs a product’s fitness for use. Deficiencies take such forms as office errors, factory scrap, power outages, failures to meet delivery dates, and inoperable goods.

Customer dissatisfaction: A state of affairs in which deficiencies (in goods or services) result in customer annoyance, complaints, claims, and so on.

Companies have come to realize that improving the quality of products and services is a necessity in today’s business. The reason for this is the high cost associated with failing to meet the quality standards as well as benefits obtained from customers perceiving the company as a manufacturer of premium quality. Cooper (1995) argues that a combination of three elements is a key to product market success. They include the product costs, the product
quality and the time required for its development. Kato (1998) states that quality is the most important characteristic of a product and that it is crucial to avoid reducing the costs which reduce the quality of a product from the customer’s perspective. It can therefore be concluded that the main goal of improving the quality of products and services is to meet customer needs.

1.3 Quality Costs - Definition and Classification

Quality cost information is an important input to management decision making (Hansen and Mowen, 2009). Traditionally, quality costs have been limited to the costs of inspection and testing of finished products. Other costs of poor quality were usually classified as overhead costs and have not been treated as quality costs. Krishnan (2000) defined the quality costs as “costs that are incurred to prevent a shortfall in quality and a failure to meet customer requirements, as well as costs incurred when quality does in fact fail to meet customer requirements”. According to Shim and Siegel (1999), quality costs are the total costs incurred due to: (1) investments in the prevention of non-conformance with requirements, (2) assessment of product and/or service conformance with the requirements and (3) failures in achieving conformance with the requirements.

Consequently, the mentioned authors classify quality costs into three categories: (1) prevention costs - costs incurred in preventing defects, i.e., costs of preventing production of poor quality products; the costs incurred in this stage minimize the costs of appraisal and costs of failure, (2) appraisal costs - costs incurred during supervision or inspection; they occur because of failures that had not been corrected through prevention and (3) failure costs. The same approach is advocated by Juran (1985) and Juran and Gryna (1993), the only difference being that they divide the failure costs into internal and external failure costs. The costs of internal failures include costs of
repairing poor quality products before they leave the factory, while the external failure costs include costs of poor quality that had not been detected before the product left the factory. The most severe form of external failure is associated with extremely low quality, which leads to a reduction in a company’s market share that is taken over by the competition which consequently leads to the loss of market or the loss of image, and a long-term negative operating result (Peršič and Janković, 2006). The first two categories of costs have a positive impact on the level of quality – the more a company invests in prevention and appraisal, the higher the level of quality. In contrast, the last two categories have a negative impact on the level of quality, which means the lower the product quality, the higher the failure costs, regardless when they were detected.

1.4 Pictorial Representation of Cost of Quality

As it can be seen from following picture, as quality goes to exceptional level, the preventive and appraisal cost increases and as quality level approaches to zero, the failure cost approaches to increases. Therefore; a company should optimize its cost of quality at the lowest total cost where the quality is on acceptance quality level.

1.5 Causes of Defects

Defects occur in a shoe due to one or a combination of more than one of the following reasons
A. Deviation from the specification such as under substance upper material, bottom materials, shade variation, improper thread selection, eyelet color peeling off, improper colored component selection, trim attachment, grain mismatch, print through, use of improper needle point/ thickness, using improper counter molding die, wrong stamping and so on.

B. Mechanical defects such as puckering of thread, grain damage of the lining due to feed roller, color change due to heat chamber temperature and so on.

C. Use of substandard material which includes crack in the folded edge, color bleeding, delaminating interlining, etc.

D. Skill related defects stained or soiled upper by adhesive, components not placed as per marking, irregular stitch to stitch distance, stitch not straight, excess skiving width/ depth, stitch not locked at the end, loose thread end, stitch overrun, needle scratch/ knife cut mark, needle slip from top line, open stay stitch, stay reinforcement, throat reinforcement not stitch, uneven quarter top line trimming, over or under roughing, and so on.

Therefore, the solution has to be recommended after the cause of any defect is identified and analyzed.

2. Methodology

- **Data collection**

This includes both primary and secondary data collection. Primary data were collected using surveys, interviews, questionnaire and direct observations for the specific purpose of the project. Secondary data tends to be readily available from the company’s website, any other publications which has been collected for other purpose but can be utilized for the project. The quality report of all the sections and quality stages of three months were the major secondary data of this project.
Data Analysis:
Both predictive and descriptive methods were used wherever required. In some cases, observations were examined, analysed and interpreted for the purpose of discovering underlying meanings and patterns of relationships, including classifications of types of phenomena and entities, in a manner that does not involve mathematical models. On the other hand, there were data which should be mathematically analyzed. Pareto analysis was the tool mainly utilized for the quantitative analysis.
And finally, important inferences were to be drawn from the data analysed.

Research Objective
To reduce the costs of quality which include prevention cost, appraisal cost, internal failure costs and external failure costs in Ethiopian shoe factories.
To make the products meet the desired quality level for a company’s target market.
The desired quality of a product may deviate from the standard at different stages. It may deviate at design, materials selection, production, packing, delivering and so on. Hence, the company must work on assuring the quality of a product at each stage so that the quality will coincide with the required one.

3. Results and discussion
While the overall survey of the company was being carried on via direct observation, interview and questionnaire, secondary data which are mostly related to the study were also collected in all the departments. These data cover one year, from July, 2015 to June 2016 and they include:
1) Daily quality inspection report of cutting
2) Daily quality control report of closing
3) Daily quality control report of lasting
4) Lab report
5) Daily Acceptance quality level report (AQL)
6) Trial test
7) Customer inspection report
After the daily quality reports of the three months mentioned above were
collected from all the departments, they were organized and analyzed. After the data are collected, it will be organized and will be interpreted using different techniques. Information about the process, equipment, and materials is required for understanding where and how quality can be made. The information is collected so that data analysis can be used to identify possible improvements and suggest strategies for successful implementation.

Analytical tools are used to collect, organize, present, and understand data so that appropriate action can be taken. These same tools are used in planning and analyzing experiments such as complex, multistep processes. These tools include statistical process control, Pareto charts, scatter diagrams, histograms, box plot, distribution curves, cause and effect diagram and control charts.

Pareto chart was used to analyze the data in this study.
### Collected and Examined Data of COQ

<table>
<thead>
<tr>
<th>Types of Quality Cost</th>
<th>Detail of cost</th>
<th>Values in ETB</th>
<th>%ge to sales</th>
<th>%ge to Total COQ</th>
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<td>Internal trouble shooting-repair, re-</td>
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<td>Collect scrap</td>
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<td>Scrap/ Wastes</td>
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<td>Final inspection</td>
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<td>0.29</td>
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<tr>
<td></td>
<td>Spot-check inspection</td>
<td>33205</td>
<td>0.74</td>
<td>3.71</td>
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<tr>
<td></td>
<td>Cost on internal audits</td>
<td>9235</td>
<td>0.21</td>
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<tr>
<td></td>
<td>Customer audit</td>
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<td>1.41</td>
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## Types of Quality Cost

### Cost of Prevention

<table>
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<tr>
<th>Sub Total</th>
<th>Detail of cost</th>
<th>Values in ETB</th>
<th>%ge to sales volume</th>
<th>%ge to Total COQ</th>
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<tr>
<td>Plant quality control engineering</td>
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<td>27868</td>
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<td>Preventive maintenance of equipment and</td>
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<td>Customer requirement review</td>
<td>4567</td>
<td>0.10</td>
<td>0.51</td>
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<td></td>
<td>7600</td>
<td>0.17</td>
<td>0.85</td>
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### Analyzed and Rearranged data of COQ as per Pareto Principle

<table>
<thead>
<tr>
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<th>Detail of cost</th>
<th>%ge to Total COQ</th>
<th>Cumulative %ge</th>
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<tr>
<td>1</td>
<td>Consumer adjustments</td>
<td>22.82</td>
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<td>2</td>
<td>Scrap/ Wastes</td>
<td>10.5</td>
<td>32.78</td>
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<td>3</td>
<td>Document procedures for raw material rejections</td>
<td>7.58</td>
<td>40.36</td>
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<td>4</td>
<td>Rework</td>
<td>7.51</td>
<td>47.87</td>
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<tr>
<td>5</td>
<td>Internal trouble shooting, re-test etc.</td>
<td>4.12</td>
<td>51.99</td>
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<tr>
<td>6</td>
<td>Interest on non-moving inventory</td>
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<td>56.09</td>
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<td>7</td>
<td>Spot-check inspection</td>
<td>3.71</td>
<td>59.8</td>
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<td>8</td>
<td>Machine breakdown</td>
<td>3.12</td>
<td>62.92</td>
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<td>9</td>
<td>Cost of training on quality</td>
<td>3.11</td>
<td>66.03</td>
</tr>
<tr>
<td>10</td>
<td>Lost sales</td>
<td>3.1</td>
<td>69.13</td>
</tr>
<tr>
<td>11</td>
<td>Replacement of defective parts</td>
<td>2.9</td>
<td>72.03</td>
</tr>
<tr>
<td>12</td>
<td>Rejection and rejection analysis</td>
<td>2.74</td>
<td>74.77</td>
</tr>
<tr>
<td>13</td>
<td>Raw material planning errors lead to extra raw</td>
<td>2.74</td>
<td>77.51</td>
</tr>
<tr>
<td>14</td>
<td>Emergency dispatches</td>
<td>2.66</td>
<td>80.17</td>
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<td>Process validation</td>
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<td>82.79</td>
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<td>16</td>
<td>In-process inspection</td>
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<td>84.64</td>
</tr>
<tr>
<td>17</td>
<td>Material written off due to product design changes</td>
<td>1.75</td>
<td>86.39</td>
</tr>
<tr>
<td>18</td>
<td>Cost of maintenance of ISO certification</td>
<td>1.7</td>
<td>88.09</td>
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<tr>
<td>19</td>
<td>Engineering or design mistakes</td>
<td>1.65</td>
<td>89.74</td>
</tr>
<tr>
<td>20</td>
<td>Final inspection</td>
<td>1.44</td>
<td>91.18</td>
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<td>21</td>
<td>Customer audit</td>
<td>1.41</td>
<td>92.59</td>
</tr>
<tr>
<td>22</td>
<td>Incoming inspection</td>
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<td>93.94</td>
</tr>
<tr>
<td>23</td>
<td>Downgrading products</td>
<td>1.3</td>
<td>95.24</td>
</tr>
<tr>
<td>24</td>
<td>Cost on internal audits</td>
<td>1.04</td>
<td>96.28</td>
</tr>
<tr>
<td>25</td>
<td>Customer requirement review</td>
<td>0.9</td>
<td>97.18</td>
</tr>
<tr>
<td>26</td>
<td>Repair of defective parts</td>
<td>0.56</td>
<td>97.74</td>
</tr>
<tr>
<td>27</td>
<td>Preventive maintenance of equipment and machines</td>
<td>0.51</td>
<td>98.25</td>
</tr>
<tr>
<td>28</td>
<td>Plant quality control engineering</td>
<td>0.47</td>
<td>98.72</td>
</tr>
<tr>
<td>29</td>
<td>Cost on administration of quality</td>
<td>0.38</td>
<td>99.1</td>
</tr>
<tr>
<td>30</td>
<td>Production planning error</td>
<td>0.26</td>
<td>99.36</td>
</tr>
<tr>
<td>31</td>
<td>Defective stock</td>
<td>0.21</td>
<td>99.57</td>
</tr>
<tr>
<td>32</td>
<td>Collect scrap</td>
<td>0.17</td>
<td>100</td>
</tr>
<tr>
<td>33</td>
<td>Product recalls</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>34</td>
<td>Warranty claims</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
From the data analyzed above: consumer adjustments, scraps/wastes, Document procedures for raw material rejections, rework, repair, interests on non-moving inventory are the top causes of the cost. These causes are the outcomes of either internal or external failure cost. Hence, prior attention must be given for them. According to the analysis, the total of almost Br. 895,391 per year is large and internal and external failure costs accounts for 79.58 percent of the total. Appraisal and preventive costs accounts for about 20% of the total quality cost. Some consequences of poor quality could not be quantified, e.g., “customer ill will” and “customer policy adjustment.” Here, the factors were listed as a reminder of their existence.
4. Conclusions and recommendations

In this study, proper identification and comprehensive analysis of all quality cost elements which contributes to the quality of products and services in the supply chain line of a footwear manufacturing firm has been conducted.

The external failure and internal failure costs of quality were found to be the major contributions of cost of quality with almost 80% of the total CoQ. The Pareto chart which has high slop at these major defects and gradually flattens which indicates the high slop defects are with the high risk of quality and have to be given more consideration.

As a result of this study, management should decide to increase the budget for prevention activities to eliminate the failure costs before it happens. Before all companies should accustom themselves to the means of counting costs of quality so that they will optimize their cost at the acceptance quality level.

Acknowledgment

The author would like to thank the management and employees of Ethiopian footwear companies participating in export market. I would also like to acknowledge the Ethiopian Leather Industry Development Institute for capacity building arrangement and financial support.
Annex-I: Questionnaire

Cost of Quality in Shoe Factories of Ethiopia

-Questionnaire-

Thank you in advance for giving your time. The purpose of the questionnaire is to get real data concerning quality in your shoe factory for the accomplishment of the research *Cost of Quality in Ethiopian Shoe Factories.*

I appreciate your response.

Worker’s Job Title……………………

1) Do you have formal discussion with other departments on the quality issue?
   - Yes □  no □

2) If your answer for Q.1 is yes, which of the departments do you discuss with?

3) If your answer for Q.1 is yes, how often you meet each other?

4) Have you ever done analysis on different types of quality cost such as internal failure costs, external failure costs, appraisal costs and prevention cost?

5) If your answer for Q.4 is yes, how often you make analysis?

6) If your answer for Q.4 is yes, what percentage of the product cost is quality cost?

7) Do you have daily, weekly, monthly and yearly quality reports?
   - Yes □  no □

8) Please tick the top five defects occurred in your department from those listed below? And also mark on the types of defects controlled in the department by indicating whether they are minor or major defects

9) How many and how often have you received customer complaints?
Annex-II: Observation Checklist
1) Design & product development section assessment checklists
2) Production planning and controlling
3) Store section assessment checklists
4) Cutting section assessment checklists
5) Closing section assessment checklists
6) Lasting section assessment checklists
7) Component section assessment checklists
8) Marketing and merchandizing section assessment checklists

Annex-III: Important Formats Prepared by the Researcher for the Convenience of Data Collection and Analysis

Daily Quality Inspection Report Of Cutting

<table>
<thead>
<tr>
<th>S/N</th>
<th>Defects Observed</th>
<th>Pairs Checked</th>
<th>Defective Pcs</th>
<th>Reworked Pcs</th>
<th>Rejected Pcs</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loose leather</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Open grain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Drawn grain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Fat packets</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Open Scratches</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Shade vibration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Wrong color/shade</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Wrong cutting direction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Growth marks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Under substance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Cuts/flaws</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>12</td>
<td>Wrong size</td>
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<td></td>
</tr>
<tr>
<td>13</td>
<td>Heel grip grain side not buffed</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>14</td>
<td>Others</td>
<td></td>
<td></td>
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Total 145
# DAILY QUALITY CONTROL REPORT OF CLOSING

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<th>Defective Pairs</th>
<th>Reworked Pairs</th>
<th>Rejected Pairs</th>
<th>Remarks</th>
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<tbody>
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<td>Toecap length variation</td>
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<td>Stitch distance from edges</td>
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<tr>
<td>5</td>
<td>Color mismatch</td>
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<td></td>
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<tr>
<td>6</td>
<td>Trimming not proper</td>
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<tr>
<td>7</td>
<td>Fitting</td>
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<tr>
<td>8</td>
<td>Color mismatch in lining</td>
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<tr>
<td>9</td>
<td>Reinforcement</td>
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<td>Skiving not proper</td>
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<td>11</td>
<td>Marking/printing</td>
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<td>12</td>
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<td>Proper edge coloring</td>
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<tr>
<td>14</td>
<td>Marking spot/adhesive spot</td>
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<tr>
<td>15</td>
<td>Others</td>
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<td></td>
<td></td>
<td></td>
<td>printing/loop fitting/stamping/wrinkle/disclose/upper/fiber on leather</td>
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</table>

Total

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*Ethiopian Standard Journal*
AFTER COUNTER MOLDING STAGE INSPECTION,

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<th>Remarks</th>
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<tr>
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<td>Lining and heel grip should not burn</td>
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</tr>
<tr>
<td>2</td>
<td>No wrinkle on inside lining and heel</td>
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</tr>
<tr>
<td></td>
<td>grip</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>No wrinkle at back seam</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>No stiffener impression</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>No toe-puff impression</td>
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</tr>
<tr>
<td>6</td>
<td>No wrinkle on vamp area during lining</td>
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<td></td>
<td>pasting</td>
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</tr>
<tr>
<td>7</td>
<td>Back seem to be straight</td>
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<tr>
<td>8</td>
<td>Mould temperature to be correct</td>
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</tr>
<tr>
<td>9</td>
<td>No adhesive to come on upper during</td>
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<td></td>
<td>lining pasting</td>
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<td>Stiffener should be fitted properly</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>between upper and lining</td>
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### AFTER HEAT SETTING STAGE INSPECTION,

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<th>rejected pairs</th>
<th>remarks</th>
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<tbody>
<tr>
<td>1</td>
<td>Back seam to in the center of the last</td>
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</tr>
<tr>
<td>2</td>
<td>Back height and side height to be equal [pair wise]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Lasting margin to be even</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Alignment of toe-area upper to be proper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>No wrinkle on lasted upper at toe or seat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Leather defects not allowed on toe/ outside quarter/shaft area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Grain and color of leather to match pair wise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Toe lasting hammer impression should not be visible</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Temperature of heat setter to be monitored regularly</td>
<td></td>
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</table>

Total

Cost of Quality in shoe Factories of Ethiopia
### AFTER DELLASTING STAGE INSPECTION,

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<th>rejected pairs</th>
<th>remarks</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Roughing to be exactly as per sole</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>No gaping to be visible on sole</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Back height and side height to match pair wise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The shoe should not rock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Over/under roughing is not ok; fibers should be raised during roughing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dusting is a must before cementing shoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Application of adhesive must be in the specified area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sole attaching should be proper and also the sole alignment</td>
<td></td>
<td></td>
<td></td>
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<td>9</td>
<td>Ensure no hammer impression on toe area</td>
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<tr>
<td>10</td>
<td>Carbon test to be conducted twice a day</td>
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## FINAL INSPECTION REPORTS

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<th>S/N</th>
<th>Defects Observed</th>
<th>Defective pairs</th>
<th>reworked pairs</th>
<th>rejected pairs</th>
<th>remarks</th>
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<tr>
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<td>Finish of the shoe must match the sealer sample</td>
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<td>2</td>
<td>Over/under finish is not correct</td>
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<td>Back height and side height should be correct and pair wise</td>
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<td>4</td>
<td>Dancing/rocking is not permitted</td>
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<td>5</td>
<td>Trim extra thread, etc. and no adhesive mark to be visible on the shoe</td>
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<td>Kindly ensure that shoes are packed pair wise in shoe box</td>
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<td>7</td>
<td>Packing should be followed as per buyer’s instruction</td>
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<td>Brand logo to be positioned correctly</td>
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<td>9</td>
<td>Ensure that cartoon/shoe boxes/tags/pictograms/labels etc are correct</td>
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<td>Sole bond test to be done for all styles and records maintained</td>
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<td>11</td>
<td>Please pack the shoes with tender love and care.</td>
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**Total**
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<th>Test Type</th>
<th>Requirement</th>
<th>Value</th>
<th>Outcome</th>
<th>Test Standard</th>
<th>Pairs Tested</th>
<th>Failed Sample</th>
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## DAILY ACCEPTANCE QUALITY LEVEL REPORT

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<td>Toe damage</td>
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<td>Uncut thread</td>
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<td>Feather edge finishing (whiteness visible)</td>
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<td>Counter stitching burn</td>
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<td>Sole gap</td>
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<td>Grain vibration</td>
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<td>Silver marking on zip guard</td>
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TRIAL TEST

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<td>Loose at counter</td>
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<td>Slight slip</td>
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<td>Gap at counter</td>
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<tr>
<td>Tight fit</td>
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CUSTOMER INSPECTION REPORT

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<th>Customer: Reserved</th>
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Order Quantity: Number of Major Faults: Marks:

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<th>Kinds off Faults</th>
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<td>Discoloring on The Sole Edge</td>
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<td>Damaged Surface</td>
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<td>Broken Stitch</td>
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<td>9</td>
<td>Gap Between Sole And Vamp</td>
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<td>Total</td>
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References


[22] Kanishka Bedi, Quality Management, Oxford University, New Delhi


