# Assessment of Green Supply Chain Management Practices in Bottled Water Manufacturing Companies In Addis Ababa-Ethiopia

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# DECLARATION

I, hereby, declare that the work which is being presented in this thesis entitled "Assessment of Green Supply Chain Management Practices in Bottled Water Manufacturing Companies In Addis Ababa-Ethiopia" is original work of my own, has not been presented for a degree to any other university and all the materials used for the thesis have been duly acknowledged.

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This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

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Assessment of Green Supply Chain Management Practices in Bottled Water Manufacturing Companies In and around Addis Ababa-Ethiopia

Master of Arts in Logistics and Supply Chain Management

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# ABSTRACT

*Bottled water manufacturing is now alarmingly flouring in Ethiopia. The sector has been extracting public water with concerns of waste disposal, used thrashed bottles inundating the country and bottled water distribution fossil fuel trucks jamming our cities and villages. The study was conducted to assess the Green Supply Chain Practices (GSCM) in bottled water manufacturing companies (BWMC) in and around Addis Ababa. Three independent factors economic, environmental and social perspective; five dependent variables of GSCM practices-reverse logistics, eco-design, green manufacturing, green purchasing and green distribution were measured using Likert scale. Based on non-probability purposive sampling, questionnaire was filled by one respondent from willing 20 factory. Different level of managers participated in the study who are mainly general, deputy, factory/plant, and operation and production manager. SPSS used for analysis and reliability test for Cranach alpha was found to be >0.738 in aggregate. Validity of the measurement and presence of significant relationship between variables were analyzed using Chi Square non-parametric test, correlation using bivariate analysis Spearman/Pearson independence test. It was found out that 100s of millions of bottles are disposed at the customer end. The practice of GSCM is almost non-existent in concept and practice except with few traditional signs like battery forklifts used because of the regulatory obligation and collection of jar for reuse; otherwise, the sourcing does not take into account environmental friendly like recyclable materials, use of reusable bottles like glasses, paper labels and packaging materials. Production does not consider eco labelling. Excess, demineralized and waste water is disposed to the surrounding drainage or river. Moreover, tens of 100s trucks distribute bottled water to customers using fossil fuel. The companies has collaboration challenges in the sector and with suppliers, regulatory bodies, recyclers and customers. It is also unsure that they are accountability to their nearby community and public at large and many other related issues. Finally, GSCM and its practices are new in the sector. Much broader study and other related issues of reverse logistics, use of recycled materials, waste water management, collaboration with recyclers, strategy and way of distribution of bottled water to customers and minimizing fossil fuel trucks and accountability can be future study interest areas.*


***Key Words:*** *Green, recycle, reuse, reduce, reverse-logistics*

# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| 4Rs: | Reduction, Redesign, Reuse and Remanufacture |
| AAU: | Addis Ababa University |
| BWMC: | Bottled Water Manufacturing Companies |
| BSC: | Balanced Scorecard |
| CES: | Conference of European Statisticians' (in UNESCO European Commission) |
| CS: | Challenge of certification |
| CSpS: | Challenge of Specification, sectortal |
| CSR: | Corporate Social Responsibility |
| CSS: | Challenge of standard, sectoral |
| CRC: | Challenge of regulatory Capacity |
| CRP: | Challenge of regulatory procedure and rule |
| ECAE: | The Ethiopian Conformity Assessment Enterprise |
| EFM: | Environmental friendly materials |
| ESA: | The Ethiopian Standards Agency |
| FDA: | Food and Drug Administration |
| FGE: | Fossil Gas Emission |
| FMHACCA: | The Food, Medicine & Health Care Administration & Control Authority |
| GBSC: | Green Balanced Scorecard |
| GHG: | Green House Gas |
| Green SCOR: | Green Supply Chain Operation Reference Model |
| GSC: | Green Supply Chain |
| GSCM: | Green Supply Chain Management |
| GSCM/PM: | Green Supply Chain Management performance measurement |
| ISO: | International Standardization organization |
| JIT: | Just In Time |
| MoTI: | Ministry of Trade and Industry |
| NRDC: | National Resources Defence Council |
| PDCA: | Plan-Do-Check-Act |
| SC: | Supply Chain |
| SCM: | Supply chain management |

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|---|---|
| SD: | Sustainable Development |
| SSC: | Sustainable Supply Chain |
| Std: | Standard Deviation |
| TQEM: | Total Quality Environmental Management |
| TQM: | Total Quality management |
| WHO: | World Health Organization |

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# CHAPTER ONE-INTRODUCTION

## 1.1. Introduction

This chapter introduces the background of the study, statement of the problem, research questions, research objectives, significance and scope of the study, definition of terms and organization of the study.

## 1.2. Background of the Study

Supply chain management (SCM) is the coordination and management of a complex network of activities involved in delivering a finished product to the end-user or customer. It is a vital business function and the process includes sourcing raw materials and parts, manufacturing and assembling products, storage, order entry and tracking, distribution through the various channels and finally delivery to the customer (Hervani, Helms and Sarkis, 2005).

These days, our actions are going beyond limit that the globe is under threat of global warming due to emissions and disposals that include plastics bottles-which are difficult to decompose and release toxic gas, to the level of compromising the survival of the future generation (Parag & Opher, 2011).

Therefore, the supply chain performance measurement has to go beyond conventional approaches to include environmentally friendly actions-that sustain the health, economic and other wellbeing of human beings in a closed loop. In their research article by Kafa, Hani and Mhamedi, (2013) indicated that Srivastava (2007) defined Green Supply Chain Management (GSCM) as integrating environmental considerations into SCM including product and service design, procurement, manufacturing processes, distribution, and end-of-life management of the product to achieve sustainable competitive advantage. Therefore, GSCM was defined and elaborated to distinguish it from the conventional SCM (Mathu, 2019). The industries have started integrating green technologies in product designs, production, and distribution which is a gradual trend of shifting toward environmentally friendly supply chain (SC). The benefits of GSCM encompass green initiatives such as green materials, green production, reverse logistics, closed-loop supply chains, sustainability and green initiatives, and green procurement to ensure sustainability for the present and future generation (Wang and Gupta, 2011). Surmacz, T. (2017) indicated that Greening seems to be more effective on the supply chain level than on the single company level because many negative environmental impacts (waste, transportation, etc.) can be eliminated or minimized by companies as a result of cooperation in sourcing, manufacturing and distributing goods.

Bottled water manufacturing and distribution is no exception that it needs to apply GSCM in a unified manner in its supply chain as an imperative sustainable development strategy through development of environmental friendly processes, products and services (Green, Zelbst and *et al*, 2012).

According to Mekuria (2016), Ambo mineral water was the first bottled water in Ethiopia since 1930. After Ambo, in 1999 plastic bottled water brand known as highland mineral water was famous until it went out of market in few years. Currently, the sector is flourishing that in 2018 there were more than 72 bottled water is Ethiopia-that this trend was estimated to reach 90 in 2020 (Addis Fortune, 2018). These bottling companies produce 3.5 billion bottles every year, serve 5%

of 105 million Ethiopians of which the majority are located close to Addis Ababa where they can access the biggest number of consumers in the country (Sisay, 2018).

Therefore, in view of environmental friendliness and health of consumers, a conceptual framework to investigate the application of GSCM in bottled water industries in Ethiopia will be developed by this research as derived from existing empirical models and frameworks.

It was found out from this study that the 20 BWMC alone under the study produce 365515 bottles per hour (BPH) (using standrad halfliter measurement of capacity), while the have got design capaciy of 502300 bottles per hour. As the majority work more atleast 8 hours per day, they actually produce over all 2,924,120 bottles per day; which is 58,482,400 bottles per month and 701,788,800 bottles per year supplied to the market.

Therefore, in Ethiopia, it can be inferred that billions of bottles remain at the customers end environment. On the contrary the practice of GSCM is few like electric forklifts used because of the regulatory obligation, collection of jar for reuse; otherwise, the sourcing does not take into account environmental friendly and easily recyclable materials, the production does not consider the use of eco labelling, use of bottles like glasses that are easily reusable. So reverse logistics, waste/excess water management that flow out of the factories, use of recyclable materials, and collaboration with recyclers and issues of distribution of bottled water using massive number of fossil fuel trucks has have been observed problems during the study.

## 1.3. Background of Water Bottling

### 1.3.1. History and bottled manufacturing worldwide

History of bottled water has been addressed by different writers. Some of the historical narratives of bottled water manufacturing is discussed below.

Although vessels to bottle and transport water were part of the earliest human civilizations, bottling water began in the United Kingdom with the first water bottling at the Holy Well in 1621. The demand for bottled water was fuelled in large part by the resurgence in spa-going and water therapy among Europeans and American colonists in the 17th and 18th centuries. The first commercially distributed water in America was bottled and sold by Jackson's Spa in Boston in 1767. Early drinkers of bottled spa waters believed that the water at these mineral springs had therapeutic properties and that bathing in or drinking the water could help treat many common ailments (Wikipedia, 2020).

Miller (2006) wrote that the earliest modern bottled water company was founded in the United States in the middle of the 19th century. In 1845, the Ricker family of Maine bottled and sold water from a so-far unidentified source. Their small operation quickly grew, capitalizing on the spring’s supposed medicinal properties, eventually becoming the Poland Springs water company. (polandspringinns.com, 2006). Mirroring the Ricker success, in 1905, the Ozarka Spring Water Company was founded in Eureka Springs, Arkansas. Since then, the bottled water landscape has expanded tremendously.

According to Parag & Opher (2011), the origin of bottled water industry is in the early 1800s. Amongst the early sellers of bottled water are names that are still known today: Evian, San Pellegrino, Perrier, and Vittel, among others. Regulation of the bottled water industry began in the mid-nineteenth century in Europe. In order to sell mineral water, a company had to prove that the mineral content of water was stable over two years. In the early 1900s clean water was not widely available everywhere and the bottled water industry thrived, both in the US and in Europe. Regulation of bottled water in the United States had begun in 1938, when bottled water was defined a packaged food under the FFDCA. Bottled water competes with soft drinks and tap water. While it is healthier than most other soft drinks, studies indicate that it does not have a real benefit over tap water. In many places around the world bottled water is regarded as a food item, and as such is less regulated than tap water. The production and consumption of bottled water entails various impacts on health, environment and society. The health risks are related not only to the quality of the water, but also to the quality of containers and to storage conditions. The environmental hazards are linked to the energy used and resources consumed in the processing, bottling and shipping of bottled water and to the huge amounts of bottle waste which is not recycled. These, in turn, raise social, equity and justice questions, such as who is being exposed to the risks and who should pay for the damages (Parag & Opher, 2011). Hence, Ethiopia is no exception that we frequently encounter similar issues and if uncontrolled it may have same damage.

### 1.3.2. Bottled water companies in Ethiopia

According to Mekuria (2016), Ambo mineral water was the first bottled water in Ethiopia since 1930 and was state owned until it was purchased by a private company SABMiller in 2009. Until it started flavoured Ambo in 2014, it was manufactured in Bottled glass with reverse logistics of empty bottles for rebottling.

After Ambo, in 1999 plastic bottled water brand known as Highland Spring Water was famous until it went out of market in few years, but paving the way for tens of similar companies of different brand flourished in the country that reached to 57 brands in 2017 (Ayele, 2017). Highland Spring Water, produced by the Appex Bottling Company, established by Ermias Amelga and partners; although it has disappeared now, the brand name has become the generic term used to refer to bottled water as a whole. Currently, the sector is flourishing that in 2018 there were more than 72 bottled water brands-that this trend was estimated to reach 90 in 2020 (Addis Fortune, 2018), which the majority are located in Oromia Region close to Addis Ababa where they can access the biggest number of consumers in the country. All together the water bottling factories produce close to 3.5 billion bottles of water per year serving only 5% of Ethiopia's population. 105 million total populations. One healthy person is supposed to drink two litres of water every day, according to the World Health Organization. Meanwhile in the case of Ethiopia all bottled water factories operating in the country are providing around 100 millilitres of water per head per day when their total production is divided to the total number of Ethiopian population, which is close to 105 million (Sisay, 2018 ).

As per Ensermu (2014), though they have price and environmental concern users in Addis Ababa are willing to pay for bottled water. This is well illustrated by Tilahun and Melaku (2020) where they assessed the purchase intention and behaviour in their article Customer's Perception and Preference towards Packaged Drinking Water in the context of Addis Ababa Ethiopia.

The Food, Medicine & Health Care Administration & Control Authority (FMHACCA), the Ethiopian Conformity Assessment Enterprise (ECAE) and the Ethiopian Standards Agency (ESA) play an essential role in the pre and post-manufacturing of bottled water. The latter set a compulsory standard in 2013 that all bottlers must follow to become operational in Ethiopia (Hailemariam, 2019).

Therefore, in view of environmental friendliness and health of consumers, a conceptual framework to investigate the application of GSCM in bottled water industries in Ethiopia will be developed by this research as derived from the GSCM empirical models and frameworks.

### 1.3.3. Bottled water manufacturing

Water bottling follows different steps. Different bottling companies adhere different steps that range from 9 main process for majority of companies to 12 main process in the case of Nestel-Water (2020) which include plant quality control to corporate quality assurance (appendix-4).

In the early age of branding, individual trusted agents were able to use their own names as the magic that could guarantee quality and efficacy. Thus, in 1826 the Quaker John Horniman personally warranted the quality of the first packaged teas ever sold in England by putting his name on each package after it was sealed. While 18th-century products were known mostly by their place of origin (Burgundy wine, Yorkshire ham, China tea), in the 19th-century the same products required a personalized agent to carry them from producer to market, e.g. Libby's meat, Huntley & Palmer biscuits (Rappaport, 2006).

It is noteworthy that water was never personalized this way retaining its connection to the source, suggesting that water's powers still came from nature, rather than from its agent. This may be why most waters continue to be sold by reference to places and natural origins (e.g. glaciers, springs, islands, states), instead of by personal brand names. There are no successful personally branded celebrity waters, or highly technological 'artificial' waters. Most water advertising and labelling today uses images from nature, especially the mountains that formed the first major object of romantic European nature-worship in the late 18th- and early 19th-centuries (Löfgren, 1999).

So as per Löfgren (1999), the predominant color for labels is blue, and bottles are almost always transparent – you never see water in brown bottles. But this form of nature is still, like medicinal waters with their long lists of minerals, mediated by scientific artifice. A typical example is an advertisement for RealPure, which says its water is 'straight from the source at Real Pure's state-of-the-art plant atop a natural spring.'11 A 1999 report by the National Resources Defence Council (NRDC) gleaned a list of keywords used by water brands on labels or in marketing, of which some of the most common were 'pure,' 'pristine', and 'natural.'

On the contrary, though many water brands in Ethiopia (Ambo, Bure, Guna) are named after the origin of the source where the water is extracted, still the majority owe their branding for catchy words like Highland, Yes and Eden. The regulation of bottled water varies from country to country. Four levels of regulation apply to the bottled water industry: international, national, local and trade associations standards. While seemingly heavily regulated, often bottled water may comply with only a few of these standards, while disregarding the others (Parag & Opher, 2011).

## 1.4. Statement of the Problem

Controversies regarding bottled water have gained momentum, lately. These include absence of GSCM practice like reverse logistics (reduce, reuse, remanufacture, recycle and disposal) with the use of plastic bottles and lids that are difficult to easily decompose but seen disposed everywhere. Moreover, there are concerns over the energy and materials that are used for making bottles and shipping water locally and around the globe and the implications for climate change (Parag & Opher, 2011).

In Ethiopia, since 1999 with the introduction of the first plastic bottled water named highland Mineral water, the bottled water industry is flourishing from year to year with high market potential. Few years ago there were 67 bottled water brands (Ayele, 2017). In 2018 the number grew to 72 companies is Ethiopia, and trend was estimated to reach 90 in 2020 (Addis Fortune). Thus, 3.5 billion bottles are produced and disposed everywhere every year, to only serve 5% of 105 million Ethiopians (Gessesse, 2018). It is been observed that these companies doesn't seem familiar with GSCM practice like reverse logistics (reduce, reuse, remanufacture, recycle and disposal), it is not clear if all of them have passed quality standard certification; and it is not clear that this certification is also in line with the principles of greening concept-GSCM. Moreover, there are gaps in regulatory issues to curb these constraints.

Meanwhile, bottled water companies are also reportedly using massive fossil fuel transport for distribution of their bottled water brands throughout the country. Transport in logistics contributes much of the green gas from Fossil fuel (Bask, 2017). In addition, there is very limited information on the quality and safety of bottled drinking waters assessed in Addis Ababa, Ethiopia. Thus, there is urgent need to evaluate and classify the commercially available bottled waters in Addis Ababa, Ethiopia with respect to the standards to safe guard the health and safety of the consumers (G/Mariam, 2018).

Moreover, there are regulatory and controlling challenges and constraints. The result of the study made by Yilkal, Zewge, and Chandravanshi (2018) indicated that the physicochemical variables of the bottled drinking water studied showed large variation in different brands of bottled water which depends on the compositions of bottled water such as natural environment, the source of water composition and type of treatment/purification techniques during the production of bottled drinking water. The number and type of parameters reported on the labels of bottled water showed a lack of uniformity. The comparison of parameters showed major cations and anions were highly variable with each brand. The concentrations of some of physicochemical parameters measured in this study were comparable to the values labelled on bottled water, whereas some other parameters were lower than and higher than values reported on the labels.

In the meantime, there are concerns about the privatization of a traditionally public good, as bottled water companies make huge profits by withdrawing water from public water sources and reselling it; and concerns regarding the impact of the industry on communities in areas in which spring water is over pumped and could run out, hence harming those who rely on this water for their livelihood (Parag & Opher, 2011).

Hence, assessment of GSCM practices in the water bottling sector addressed the above issues and gaps of environmental, social and economic concerns in bottled water companies in Ethiopia-in and around Addis Ababa with respect to variables like reverse logistics (reduce, reuse, remanufacture, recycle and disposal), eco-design, green purchasing, manufacturing and distribution. In addition, assessment of certification and regulatory bodies' implementation of standards and regulations including raising positive consciousness with accountability for environment and consumers' wellbeing was addressed. The challenges that the companies have to implement GSCM practices will also be addressed too.

## 1.5. Research Question

The research attempted to address questions related to application of GSCM in bottled water manufacturing companies in Ethiopia, specifically in and around Addis Ababa with in 45 KM. Emphasis was given with respect to the implication of the social, economic and environmental perspective of sustainable development. Finally, the challenges in adhering GSCM is also part of the assessment. Thus, to assess what are the GSCM practices of Bottled water Companies in Ethiopia, the following are the research questions:

I. How GSCM is being practiced in in bottled water manufacturing companies?
II. What is the sustainability level of GSCM practices of bottled water manufacturing companies from the perspective of economic, environmental and social dimensions?
III. What are the challenges of GSCM practices in water manufacturing companies?

## 1.6. Research Objectives

### I. General objective

To assess the GSCM practices (reverse logistics, eco-design, green purchasing, green manufacturing and green distribution) of water bottling companies in Ethiopia with respect to their environmental, social, economic perspectives.

### II. Specific objectives

The study aims to address the following specific objectives with respect to environmental, social, economic perspectives and GSCM practice in bottled water companies.

I. To assess GSCM practices in bottled water manufacturing companies in terms of reverse logistics, eco-design, green purchasing, green manufacturing and green distribution.
II. To assess the economic, environmental and social perspectives of BWMC in and around Addis Ababa.
III. To assess the challenges of GSCM practices in water manufacturing companies in terms of certification, regulatory, policy, finance, social and technology issues.

## 1.7. Significance of the Study

The basic purposes of GSCM/PM are: external reporting, internal control (managing the business better) and internal analysis (understanding the business better and continuous improvement). These are the fundamental issues that drive the development of frameworks for business performance measurement. It is important to consider both purpose, as well as the interrelationships of these various measurements (Hervani, Helms and Sarkis, 2005) which the bottled water industry has to adhere by going green.

Moreover, these days, supply chain management of any product or service, including in the case of this study production and supply of bottled water, is not only a mere production and supply of bottled water by companies because there is the demand, but should take competitive advantage by going green, environmentally friendly, from sourcing raw materials and other supplies to end customer consumption point, which in the end boost sustainable development.

Hence, the study will contribute to bottled water production and supply in Ethiopia by making aware the actors in the sector to meaningfully align with sustainability and green initiatives that focus on dematerialization, detoxification and decarbonization (like using less fuel in transportation during distribution) processes that culminate into 5Rs namely reduction, redesign, recycle, reuse, and remanufacture (Mathu, 2019).

It indicates gaps and serves as empirical bench mark for further study and development of better sustainable initiative and regulation in the sector. Therefore, it also serve for further research in the sector in line with GSCM in a more specific terms like sourcing of components, raw materials and chemicals, effect of distribution of bottled water and reverse logistics application in bottled water companies in Ethiopia at large and to the level of a water bottling companies to address more specific issues in line with GSCM.

Finally it can also serve certification, regulatory, financial and policy making bodies make informed decisions to better improve the sector to meet sustainable development in the country.

## 1.8. Scope of the Study

The study addressed the specific sector of bottled water manufacturing in and around Addis Ababa Ethiopia within 45 KM.

It addressed the GSCM application in the sector using empirical GSCM practices-reverse logistics, eco-design, green purchasing, green manufacturing and green distribution based on their environmental, social and economic perspectives.

### 1.9. Definition of Terms

**Bottled water:**
According to Parag & Opher (2011), bottled water is drinking water sealed in bottles with no added ingredients except that, like tap water, it may contain safe and suitable antimicrobial agents. Fluoride may be added within limitations set in the bottled water quality standards (this varies between countries).

**Green Supply Chain Management:**
According to Mathu (2019), GSCM is defined as a supply chain that considers environmental impacts on its operations and takes action along the supply chain to comply with environmental safety regulations and communicates this to customers and partners.

According to Hervani, Helms and Sarkis (2005), GSCM finds its definition in supply chain management adding the "green" component to supply chain management which involves addressing the influence and relationships of supply chain management to the natural environment.

**Reverse logistics**:
Stands for all operations related to the reuse of products and materials. It is "the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. (Meyer, 2011)

**Eco-Design (ECD):**
It is about taking into account systematically issues related to environmental safety and health over the product life cycle with a potential to be reused or recycled at end-of-life (Linton, et al., 2007).

**Green Purchasing**:
Refers to the procurement of products and services that have a reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. (Surmacz, 2017).

**Green manufacturing:**
It is related to product design and production processes having the lowest possible environmental impact, where the number of components should be minimised, the assembly process simplified, the usage of energy, waste and emissions should be reduced to a minimum (Surmacz, 2017).

**Green distribution:**
It is concerned with application of green thinking in planning distribution process which means trying to minimise especially transportation impact on the environment but also packaging practices. (Surmacz, 2017)

## 1.10. Limitation of the study

The study was planned to be undertaken for the BWMC in and around Addis Ababa within 45 KM radius, however, as all of them could not be reached out due to unwillingness, closure, transfer of ownership, and many who are registered as operate in Addis Ababa have only office and the factories are in other regions or are outside the study area.

The questionnaire was also planned to be filled by five respondents from each water manufacturing companies-namely, factory manager, production/operation manager, Marketing manager, Distribution manager and Procurement manager, who are supposed to have the GSCM knowledge and skill including the companies' initiatives towards GSCM. However, it was found out during the field test that the practice of GSCM in the companies can be filled by one person in any of the above positions; otherwise, it was repetitive to ask the same question and the response was the same for the same factory. Therefore, the study was made in 20 Water Bottling factories by physically present to fill the questionnaire with plant, production, factory, general, deputy, operation etc mangers as approved and assigned by the factories.

It was very painstaking to first identify and map the location of the BWMC in and around Addis Ababa based on the list given by MoTI (2021), because phones were unanswered, many decline to talk, some needed time to think about it and has to call them so many times. Moreover, after getting appointment to move from factory to factory, 10s of kms around Addis Ababa, the factories give again repeated appointment and I have to drive many times long distance to fill the questionnaire. It was such an iron gate that the BWMC are closed for Research and development and communication. They seem so suspicious and instigate suspicion on the mind of the researcher in return as why their doors are so closed so tightly. In the meantime, this may show the low awareness of the companies on the importance of research and development for growth and creation of competitive advantage.

Last but not list, physical visit was paid to their offices and interview checklists were delivered in hard and soft copy for the certification, regulatory, financial and other bodies who were supposed to be interviewed as key informants on certification, regulatory and policy issues. However, none of them responded to the online document nor were willing to give time for one to one interview. This includes the office of the Ethiopia Bottled water and soft drinks, fruits and vegetables manufacturing Industry Association.

Timeframe of the submission of the thesis report did not allow further follow up either in water bottling companies who might have been participated in this study.

## 1.11. Organization of the Study

The study has five chapters. First chapter is the introduction of the thesis divided into the background, statement of the problem and then follow the research questions, objectives, significance and scope of the study. Lastly, key terms with regard to GSCM has been defined. The second chapter reviews literature and empirical studies on GSCM, theoretical framework and conceptual framework. Chapter three is composed of method of the study that include description of the study area, research approach, design, population and sampling, data source and type, data collection procedures. Data analysis, reliability and validity taste and last ethical consideration to be followed during the study. The forth chapter is dedicated for the finding of the research that include the discussion of the research result obtained from the structured questionnaire in descriptive and inferential statistics and interviews result of the key informants known as certification and regulatory bodies. It also has summery of the result and discussion. Last, chapter is reserved for the conclusion and finally the recommendation based on the research finding.

# CHAPTER TWO: REVIEW OF RELATED LITERATURE

## 2.1. Introduction

Supply chain management (SCM) is the coordination and management of a complex network of activities involved in delivering a finished product to the end-user or customer. It is a vital business function and the process includes sourcing raw materials and parts, manufacturing and assembling products, storage, order entry and tracking, distribution through the various channels and finally delivery to the customer. A company's supply chain structure consists of external suppliers, internal functions of the company, and external distributors, as well as customers (commercial or end-user). Firms may be members of multiple supply chains simultaneously. The management and coordination is further complicated by global players spread across geographic boundaries and multiple time zones. The successful management of a supply chain is also influenced by customer expectations, globalization, information technology, government regulation, competition and the environment (Hervani, Helms and Sarkis, 2005).

## 2.2. Theoretical literature review

### 2.2.1. GSCM practices

According to Kafa, Hani and Mhamedi (2013) GSCM practices encompass majorly reverse logistics, eco-design, green manufacturing, green purchasing and green distribution.

**Reverse logistics**:

The process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal. Remanufacturing and refurbishing activities also may be included in the definition of reverse logistics. Any process or management after the sale of the product involves reverse logistics. "The whole idea of **reverse logistics** is to **reduce** what is used to manufacture a product; **reuse** components that can be economically recovered, for as long as possible; then at the end of its life, **recycle** that product to squeeze maximum life and profit out of it," (Meyer, 2011).

**Reduction:** is viewed as an in-process, relatively proactive, measure that can be taken by organizations. Typical programs that may aid in this process include total quality management and JIT programs that seek to minimize waste. Introduction of alternative processes and materials may be used to reduce more hazardous materials. Another example of reduction would be to design the product and process to take into consideration environmental factors (also defined as design for the environment. End-of-pipe practices include the remaining four elements (Meyer, 2011).

**Reuse, remanufacture and recycle practices:** are similar, but only vary in degree of reuse of the material. Reuse typically keeps the original physical structure of *the* material with little substitution. Remanufacturing requires some disassembly and replacement of parts or components around a core. Recycling can take on new physical and chemical characteristics of the product. Each of these practices may require varying organizational processes and technology. For example, disassembly technology would probably be more preferable for a remanufacturing practice than for a reuse practice. ). Reuse may require more cleaning type systems than recycling requires. Clearly, the choice of which practice is best for an organization will depend on the organization and product characteristics. The issue of disposal systems and vendors may have the most long-term significance, where disposal of many materials, if not properly treated, may return to haunt an organization in its future. (Sarkis, 2002)

**Eco-Design**

It is about taking into account systematically issues related to environmental safety and health over the product life cycle with a potential to be reused or recycled at end-of-life. Eco-design process includes design of products to reduce material/energy consumption during production and product use, design of products for (3Rs) reuse, recycle, and recovery of material and component parts, and design of products to avoid the use of hazardous materials (Linton, et al., 2007)..

**Green Purchasing**

Refers to the procurement of products and services that have a reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison can consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and disposal of the product or service. Green purchasing is also known as environmentally preferred purchasing (EPP), environmentally responsible purchasing, green procurement, affirmative procurement, eco-procurement, and environmentally responsible purchasing (Kafa, Hani and Mhamedi, 2013).

**Green manufacturing**

It is related to product design and production processes having the lowest possible environmental impact. When thinking in terms of green manufacturing the number of components should be minimised the assembly process simplified, the usage of energy, waste and emissions should be reduced to a minimum (Kafa, Hani and Mhamedi, 2013).

**Green distribution**

It is concerned with application of green thinking in planning distribution process which means trying to minimise especially transportation impact on the environment but also packaging practices. (Surmacz, 2017)

### 2.2.2. Other practices of GSCM measurement

#### A. The ISO certification

Hervani and *etal* (2006) proposed ISO 14032 as a basis for green supply chain performance management system. But it should be noted that the ISO guidelines are meant for individual organizations. This is why it should not be considered as a holistic performance measurement system. It does not encompass the whole supply chain. Yet it can serve as a very good starting point for companies considering analysing their green performance.

Therefore, the ISO 14031 performance management system design involves collecting information and measuring how effectively an organization manages its environmental aspects on an ongoing basis. ISO 14031 is designed for use in environmental performance evaluation with indicators in three key areas: Environmental condition, operational performance and management performance indicators. They take into account inputs of materials, energy, supplies and services, design installations, maintenance of operation and physical facilities, output of products, waste, emission and delivery outputs.

Other ISO certifications also prepare the organization for GSCM.

### B. The modified Balanced Scorecard (Green BSC)

As per Hervani, Helms and Sarkis (2005), balanced Scorecard seeks to combine short-term financial perspective with those elements of the organization that do not have a financial nature, and determine the future development and prosperity of the company. The original Balanced Scorecard proposed by Kaplan and Norton also focuses on a single company. But Ackermann modified balanced scorecard in order to adapt it to supply chain management. His proposal is also made up of four perspectives:

**Financial perspective:** cash-to-cash cycle is a key indicator because it measures the effectiveness and efficiency of products and information flows between partners in the supply chain,
**Customer perspective:** the proposed measures include the number of points of contact with customers, relative response time and customer value ratio,
**Process perspective:** optimization processes within the organization needs to be extended to the entire supply chain. Metrics of internal processes include supply chain cycle,
**Growth and learning perspective:** the suggested metrics include the number of shared data sets and point of product finalization.

### C. Green Supply Chain Operations Reference (Green SCOR) model

Sarmacz (2017) mentioned that SCOR reference model combines three concepts: business process reengineering (BPR), benchmarking and best practices He also mentioned the following on the development of green SCOR from SCOR model for GSCM/PM. SCOR helps companies to increase efficiency of supply chains by analysing competition and properly configuring their chains. It helps to explain the processes in the entire supply chain and provides a basis for processes' improvement. It encompasses major processes on a macro-level and then their decomposition: plan, source, make, deliver, return. The fact of adding the last process of reverse logistics can be perceived as a result of growing importance of green aspects. But the recent developments and growing interest in the issue of greening of supply chains has also led (as in the case of BSC) to development of the so called Green SCOR. It integrates best environmental practices and metrics into one planning process which should be easily understood and accepted.
Green SCOR includes: industry best practices for making supply chains more environment friendly, metrics focusing on measurement of greening results, as well as processes to address waste management. It also helps to explain the processes along the entire supply chain and provides a basis for how to improve those processes. The metrics in the model were designed to address the environmental impacts associated with each process element. Metrics that captured environmental improvements but did not lead to supply chain improvement along at least one of the performance attributes were not included. The benefits of Green SCOR's adoption should appear in improved environmental management performance, improved supply chain management performance as well as improved green supply chain initiatives. Using SCOR allows possible identification of environmental aspects and impacts (which are often hidden). The Green SCOR elements can help in development of best practices that can mitigate those impacts. Hence green performance can be improved.

**D. Other**

Sarkis (2002) also suggested lean and agile SCM strategies and JIT also help in the measurement of GSCM as they all try to reduce waste and adhere responsive supply chain with less inventory but fast lead time.

### 2.2.3. Economic, Environmental and Social perspectives in GSCM

According to Sharma, A. (2018), the transition from a linear economy toward a resource-efficient circular economy (Ensermu, 2015) is currently underway (Domenech and Bahn-Walkowiak, 2019) and, over the years, there is an increasing formal commitment toward the circular economy with, for instance, the recent action plan toward the circular economy by the European Commission (2015). In the meantime, the rise of green consumption has garnered curiosity from academia over the years (Al Mamun et al., 2018; Chang and Chen, 2013; Chen and Chang, 2013; Chen et al., 2018; Codini et al., 2018; Justin et al., 2016; Lee et al., 2013; Molina-Azorin et al., 2009; Ritter et al., 2015; Romani *etal*., 2016; Song and Wang, 2018; Wang, 2017). As indicated by Diamantopoulos *etal.* (2003), compared to non-green products, green products' specific characteristics – including recyclability, durability, biodegradability, renewability, low emission, local production, energy efficiency – may lead to both green purchase intention and effective green purchase.

Hence, the different drivers of companies to adopt GSCM initiatives are government regulations, stakeholder pressures, economic interests, and ecological interests of firms (Min & Galle, 1997, Hervani, *et al*., 2005 and (Zhu, *et al*., 2007). Many companies have adopted "green" initiatives and implemented GSCM practices to meet their social responsibility (Salam, 2009), examples like: The furniture manufacturer IKEA seeks a sustainable mode of transport that reduces the ecological effects. L'Oreal, HP, IBM, GE, DGL, and Dell have all taken the term "green" as an important value for their business and adopted of new energy saving technologies in order to improve good public image or "green image". BMW, Pepsi-Cola, and Kodak have implemented reverse logistic process for economic benefits (Hervani, Helms and Sarkis (2005).

Other than a mere competitiveness in profit making to survive in the business; SCM must extend beyond organizational four walls to the level or global cooperation taking into account future generation. Though there is no clear cut and agreed definition of GSCM, the different definitions used in various articles of researches, in one way or another, seem to agree on GSCM taking into account environment, end users (social) and economic implications for sustainable development/SD/ (Ensermu, 2014)

Motivated by an environmentally-conscious mindset, it can also stem from a competitiveness motive within organizations. GSCM is defined as: Green Supply Chain Management /GSCM/= Green Purchasing + Green Manufacturing/Materials Management + Green Distribution/Marketing + Reverse Logistics. GSCM is a concerted effort across the enterprise and is more than simply implementing some ecological practices, but rather a coherent approach for improving environmental and organizational performance of all levels of management (Zhu,*et al*., 2007).

Srivastava (2007) defined GSCM as integrating environmental considerations into SCM including product and service design, procurement, manufacturing processes, distribution, and end-of-life management of the product to achieve sustainable competitive advantage. The different processes and activities are encompassed in GSCM have been discussed by (Hervani, *et al.*, 2005). GSCM can therefore be defined by the following equation: Green supply Chain management (GSCM) = Green Purchasing (Min & Galle, 1997) + Eco-Design (Linton, *et al.,* 2007) + Green Manufacturing (Deif, 2011) + Green Distribution (Rao & Holt, 2005) + Reverse Logistic (Pochampally, *et al.*, 2009).

According to Kafa, Hani and Mhamedi, (2013), different definitions of green supply chain (GSC) exist in literature. Some studies defined the GSC as closed-loop supply (Beamon, 1999a). Some have called it as a sustainable supply chain (SSC) (Ageron, et al., 2012) and (Linton, *et al.,* 2007), environmental supply chain, and ethical supply chain (Beamon, 2005). It has also been described as a socially responsible supply chain (Salam, 2009).

Eco-design process includes design of products to reduce material/energy consumption during production and product use, design of products for (3Rs) reuse, recycle, and recovery of material and component parts, and design of products to avoid the use of hazardous materials. It refers to the procurement of products and services that have a reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison can consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and disposal of the product or service. Green purchasing is also known as environmentally preferred purchasing (EPP), environmentally responsible purchasing, green procurement, affirmative procurement, eco-procurement, and environmentally responsible purchasing (Linton, et al., 2007).

### 2.2.4. Challenges and benefits of GSCM

Different authors point out weaknesses and discrepancies of GSCM performance measurement systems and usually they include lack of connection with strategy, focus on cost, lack of a balanced approach, insufficient focus on customers and competitors, loss of supply chain context, thus encouraging local optimization, lack of system thinking. (Surmacz, 2017)

Surmacz (2017) states that most of these weaknesses apply also to GSCM. The topic is new and for many companies not clearly defined, hence lack of shared and widely accepted performance measurement systems. There is not many research focusing directly on GSCM performance measurement. And the existing research show many approaches for measuring GSCM. There is no common understanding of what should be measured. This may also be due to lack of agreement on the definition of GSCM. Here is a list of nine most important difficulties in developing GSCM performance measures: although there is no shortage of environmental indicators, there is a difficulty in deciding on which ones to use, when and how, different supply chain players must agree on which metrics to use and with which data, incompatibility between classical production measures, which are designed for intra-organizational management, and supply chain measures that should have an inter-organizational scope, lack of an oversight agency that controls the whole supply chain, lack of trust in the relationship and fear that data confidentiality may be compromised, difficulties in aligning strategies throughout the supply chain, difficulties in coordination of competencies, difficulty in streamlining the different types of supply chain parties and finally dynamic nature of supply chains.

The benefits of GSCM encompass green initiatives such as green materials, green production, reverse logistics, closed-loop supply chains, sustainability and green initiatives, and green procurement to ensure sustainability for the present and future generation (Wang and Gupta, 2011).

**Increased interaction between client and supplier:** the process of understanding the client's needs and wants, providing opportunity for future product development and encouraging suppliers to continuously improve on their products/services.

**Collaboration between the company (client) and the supplier to create innovative product design:** innovation through identifying substitute materials, creating energy-saving design, and upgrading infrastructure to increase efficiency.

**Requirement for supplier to provide environmental information:** to ensure product conformance with environmental standards, identification of hazardous component in the product, mode of transportation, and weight of products, among others.

**Client and supplier collaboration in creating green product design:** collaboration development of product design and the client to provide the supplier with product requirements that would meet environmental standards.

**Auditing the supplier's green performance:** the client prepares a checklist of green management requirements or environmental audit management system to ensure the supplier satisfies the product requirements that help the client achieve the corporate social responsibility (CSR) goals.

**Supplier initiative in standardization process:** taking initiative to install own testing equipment to ensure meeting the standard of green purchasing.

## 2.3. Empirical literature review

### 2.3.1. GSCM practices

Different studies used various factors to assess GSCM practices in manufacturing companies.

Kafa, Hani and Mhamedi (2013) used the following matrices to assess GSCM practices which is found relevant with the thesis proposal. Therefore, the matrices are used to design the structured questionnaire if Likert measurement scale to be used in bottled water manufacturing companies assessment of GSCM practices.

***Table 1: GSCM Practices ( adapted from Kafa, Hani and Mhamedi, 2013)***

| No. | GSCM practices/measures | Matrices | Benefits |
|---|---|---|---|
| 1 | Green purchasing | Selection of eco-suppliers<br>Environmental collaboration with suppliers.<br>The 3Rs (reduce, reuse & recycle) | Reduce the environmental cost<br>Good "green" image |
| 2 | Eco-design | Design of products to :<br>Reduce material/energy consumption<br>The 3Rs (reduce, reuse & recycle)<br>Avoid use of hazardous materials | Improved the reuse, recycling and<br>Remanufacturing opportunities<br>Access to green market<br>Higher eco-efficiency |
| 3 | Green Manufacturing | The 3Rs (reduce, reuse & recycle)<br>Advanced environmental technology | Improved sustainability<br>performance by reducing<br>waste and therefore costs |
| 4 | Green distribution | Green packaging<br>Green transportation | Reduce packaging costs<br>Reduce fuel consumption<br>Less noise, pollution, and traffic<br>Better relationship with customer and public |
| 5 | Reverse logistics | Collection<br>Recycle<br>Reduce<br>Remanufacturing | Reduction of environmental burdens on<br>the final disposal<br>Reduction of environmental costs<br>Reuse of valuable components of an end-of life product |

## 2.3.2. GSCM environmental, social and economic perspectives

Meanwhile, apart from massive number of bottles, 3.5 billion disposed every year (Sisay, 2018) which are difficult to decompose and adding toxic gas to the environment, the use of fossil fuel transport for distribution of their brand bottled waters to their customers which contribute highly to fossil gas emission (FGE). As per Bask (2017) transport is responsible for 23 per cent of the EU's Green House Gas (GHG) emissions, being the second biggest source after the energy sector (European Strategy for Low-Emission Mobility, 2016). Thus, a goal has been set for transport to reduce its GHG emissions to around 20 per cent blow.

Moreover, manufacturers in Ethiopia hardly follow uniform production specification (Yilkal, Zewge, and Chandravanshi, 2018) and regulations. Yet, there is weak application of regulations on the side of certification and regulatory bodies (G/Mariam, 2018). As per Ensermu (2014), though they have price and environmental concern, users in Addis Ababa are willing to pay for bottled water. This is well illustrated by Tilahun and Melaku (2020) where they assessed the purchase intention and behaviour in their article entitled 'Customer's Perception and Preference towards Packaged Drinking Water in the context of Addis Ababa Ethiopia'.

Therefore, in our time, there is also concern of privatization of public water sources: impact of the industry on community livelihood by over pumping, Concern of quality and safety standard (G/Mariam, 2018) and Regulatory and controlling challenge (Yilkal and et al, 2018)

For evaluating economic, environmental and social performance to achieve the benefits of green supply chain management in bottled water industry in Ethiopia, the following GSCM performance measurement perspective are used to develop the independent constructs in the research conceptual framework and design the data collection instruments (Kafa, Hani and Mhamedi, 2013).

***Table 2: Sustainability performance measures for GSCM Practices (adapted from Kafa, Hani and Mhamedi, 2013)***

| No. | Sustainable Development (SD) perspectives | Measure | Metric |
|---|---|---|---|
| 1 | Economic perspective | Environmental cost | Cost associated with environmental compliance |
| | | | Recycling cost |
| | | | Cost associated with the consumption of energy |
| | | | Disposal costs |
| | | | Cost for purchasing environmentally friendly materials |
| | | Traditional supply chain cost | Delivery cost |
| | | | Inventory cost |
| | | | Information sharing cost |
| | | | Ordering cost |
| | | Quality | Level of customer complaints |
| | | | Availability of green product warranty |

| No. | **Sustainable Development (SD) perspectives** | **Measure** | **Metric** |
|---|---|---|---|
| | | | Scrap and rework |
| | | | Delivery unreliability |
| | | Flexibility | Demand flexibility |
| | | | Delivery flexibility |
| | | | Production flexibility |
| | | Responsiveness | Manufacturing lead time |
| | | | Purchasing lead time |
| | | | On time delivery |
| | | | Product return lead-time |
| | | | Total supply chain cycle time. |
| 2 | Environmental perspective | Level of process management | Level of process optimization for waste reduction |
| | | | Level of pollution control |
| | | | Level of waste and emissions |
| | | | Amount of Energy consumption |
| | | Product features | Level of recycled material in product |
| | | | Availability of eco-labelling |
| | | | Level of usage of design-for-assembly |
| | | Recycling efficiency | Recycling time |
| | | | Amount energy consumption during the recycling |
| | | | Waste reduction |
| | | Environmental technology | Level of clean technologies |
| | | | Number of new products and process |
| 3 | Social perspective | Management Commitment | Level of effort to motivate employees |
| | | | Availability of control environmental systems |
| | | | Number of environmental management |

| No. | Sustainable Development (SD) perspectives | Measure | Metric |
|---|---|---|---|
| | | | initiatives |
| | | | Level of effort to raise consumer awareness of sustainability |
| | | Customer satisfaction | Customer interest in green products |
| | | | Customer satisfaction from green products |
| | | Employee development | Level of employee satisfaction |
| | | | Number of special green training programs, |
| | | | Number of conference /fairs related to SD |

### 2.3.3. Challenges of GSCM

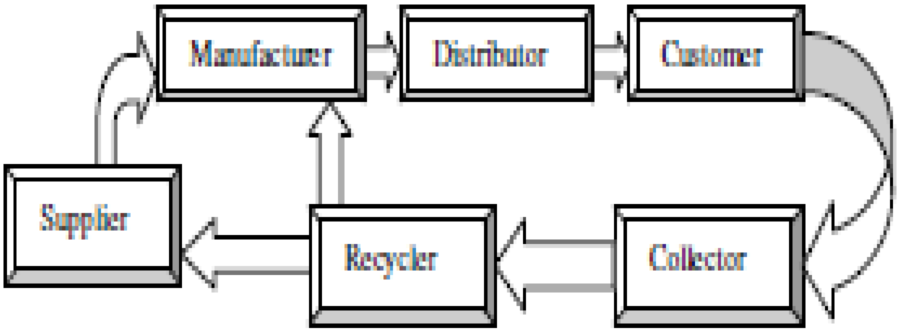
The GSCM topic is new and for many companies not clearly defined, hence lack of shared and widely accepted performance measurement systems. There is not many research focusing directly on GSCM performance measurement. And the existing research show many approaches for measuring GSCM. There is no common understanding of what should be measured. This may also be due to lack of agreement on the definition of GSCM. Nine most important difficulties in developing performance measures include (Surmacz, 2017):

Although there is no shortage of environmental indicators, there is a difficulty in deciding on which ones to use, when and how, Different supply chain players must agree on which metrics to use and with which data. Incompatibility between classical production measures, which are designed for intra-organizational management, and supply chain measures that should have an inter-organizational scope. Lack of an oversight agency that controls the whole supply chain. Lack of trust in the relationship and fear that data confidentiality may be compromised. Difficulties in aligning strategies throughout the supply chain. Difficulties in coordination of competencies.
Difficulty in streamlining the different types of supply chain parties and dynamic nature of supply chains.

## 2.4. Theoretical framework of GSCM

As Surmacz, (2017) greening seems to be more effective on the supply chain level than on the single company level because many negative environmental impacts (waste, transportation, etc.) can be eliminated or minimized by companies as a result of cooperation in sourcing, manufacturing and distributing goods. A growing interest in environmental aspects led to coining a new term – Green Supply Chain Management (GSCM).

***Figure 1: Green supply chain (Olugu, et al., 2011)***




Therefore, GSCM was defined and elaborated to distinguish it from the conventional SCM. It emerged from the conventional supply chain management (SCM) in the last two decades or so, and supply chain itself is just over a generation old. With increased customer awareness and more stringent regulations, industries have started to integrate environmental factors in all sectors of the organization. Industries have started integrating green technologies in product designs, production, and distribution which is a gradual trend of shifting toward environmentally friendly supply chain (SC). These efforts and the desire to incorporate "extended production responsibility" (EPR) as pertains to environmental impacts are the precursors to the evolution of GSCM. Hence, the theory of GSCM was developed in the 1990s, but emphasis on green production by most industries commenced from around 2000. With the growing consciousness about the environment, SC complexity and the scale of GSCM technologies also increased (Mathu, 2019).

Moreover, Green, Zelbst and *et al* (2012) mentioned that most recently sustainability of environment is one of SCM imperatives together with customer focus, efficiency, quality and responsiveness. Development of environmental friendly processes, products and services require an unified effort by all SC actors/members to avoid sub-optimization at the partner level.

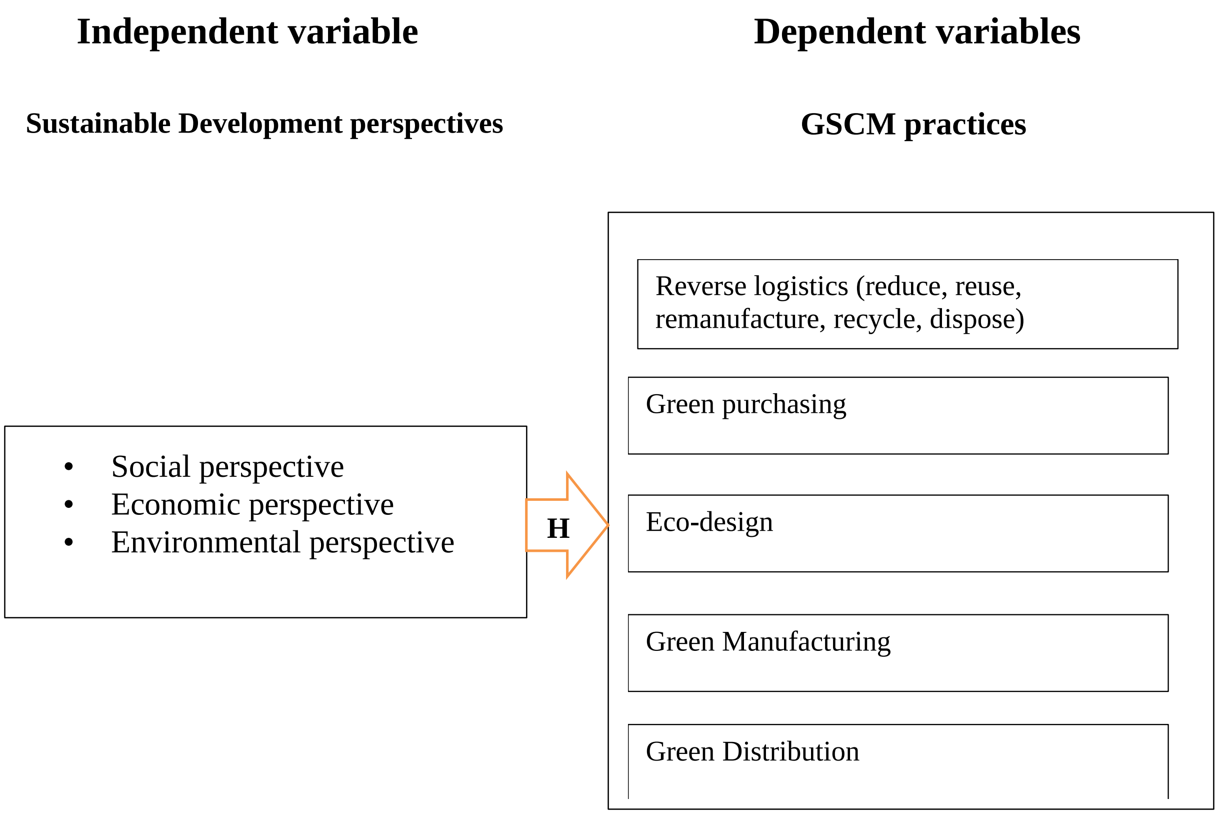
Apart from the traditional supply chain, since the past decade, sustainability and green initiatives focus on dematerialization, detoxification, and decarbonization processes that culminate into 4Rs (reduction, redesign, reuse, and remanufacture) (Mathu, 2013). These days the supply chain performance measurement goes beyond conventional approaches to include environmentally friendly actions in a closed loop. In their research article by Kafa, Hani and Mhamedi, (2013) they indicated that GSCM as integrating environmental considerations into SCM including product and service design, procurement, manufacturing processes, distribution, and end-of-life management of the product to achieve sustainable competitive advantage (Srivastava, 2007).

Therefore, according to Handfield (2005) it is "application of environmental management principles to the entire set of activities across the whole customer order cycle, including design, procurement, manufacturing and assembly, packaging, logistics, and distribution. GSCM is "minimizing and preferably eliminating the negative effects of the supply chain on the environment. GSCM makes enterprises to achieve profit and market share objectives by lowering their environmental risks and impacts while raising their ecological efficiency.

## 2.5. Conceptual Framework

The following conceptual framework is designed from the independent variables called sustainable development perspectives or organizational sustainable performance measurement and dependent variables of GSCM practices (Kafa, Hani and Mhamedi, 2013) for this study to assess the GSCM practice bottled water manufacturing companies in Ethiopia-in and around Addis Ababa. Therefore, the research measures effect of GSCM performance measurements perspective independent variables: social, economic and environmental perspectives on GSCM practices: Reverse logistics (reduce, reuse, remanufacture, recycle, and dispose), Green purchasing, Eco-design, Green Manufacturing and Green Distribution.

Figure 2: Conceptual framework adapted from Kafa, Hani and Mhamedi, 2013




Moreover, what certification, regulatory and control are practiced by concerned government bodies and what challenges bottled water companies have to practice GSM will also be assessed as part of the research question. The following hypothesis are drawn up based on the research questions and are related with the conceptual framework (Figure-6) above as illustrated below.

## 2.6. Research Hypothesis

**Hypothesis (H):** Social, economic and environmental perspectives of BWMC significantly affect GSCM practice of bottled water manufacturing companies in Ethiopia.

# CHAPTER THREE: METHODS OF THE STUDY

## 3.1 Description of the Study Area

The study area is in Addis Ababa and Oromia in 45 KIM diameter of Addis Ababa which most of bottled water manufacturing companies have got head offices where they have the bulk of their consumers too as metropolitan capital of Ethiopia and consumer of every walk of life live, service companies like hospitality industry operate and huge constructions are carried out.

The location discussed above are selected for the convenience of the researcher in account of the available time and resource to finalize the study until the end of the thesis report submission calendar of Addis Ababa University school of commerce.

## 3.1 Research Approach

The research followed mixed approach of quantitative and qualitative data collected using structure questionnaire and interview & participatory observation checklist of the manufacturing, storage and distribution facilities respectively.

The quantitative data was obtained from the structured questionnaire where descriptive statistics and the significance of the study was carried out through computerized statistical analysis using SPSS. This was supported with the qualitative data obtained from the interview and the observation of the facilities of the bottling companies undertaken while collecting the questionnaires.

## 3.2 Research Design

The study is both descriptive that shows direct statistical data of the GSCM practices and explanatory to explain the correlation of sustainable development measurements with the GSCM practices of the bottled water manufacturing companies.

Secondary data through literature review on theory of GSCM and existing empirical knowledge was made from journals and other online sources for the development of conceptual framework of the study. This enabled to design structured questionnaires and interviews to collect primary data and investigate the GSCM application in bottled water manufacturing companies in Ethiopia.

Identification of key informants and interviewees from certification and regulatory bodies was undertaken including securing list of companies registered for bottling water from Ministry of Trade and industry, which greatly helped mapping of locations and to contact them during the data collection and participatory field observation. Primary data collection tools were developed and tested for validity and reliability during the start of the study data collection based on the conceptual framework of the study.

Structured questionnaire were filled physically in the bottled water factories premises and interview tools were distributed to key informants for online response which all refused to send. Certification and regulatory bodies of in the government offices were contacted to get full data of bottled water companies list in Ethiopia.

## 3.3 Population and Sample

Based on the list of Ministry of Trade and Industry-MoTI (2021), the study population was 175 bottled water manufacturing companies in Ethiopia, who are registered and are operational since 1999, which is when highland water brand first started but is out of market now, onwards till recent time in 2021 (Appendix-5).

Currently, the sector is flourishing that in 2018 there were more than 72 bottled water brands-that this trend was estimated to reach 90 in 2020 but exceeded 175 (MoTI, 2021), which the majority are located in Oromia Region close to Addis Ababa where they can access the biggest number of consumers in the country (Addis Fortune, 2018).

Using non-probability purposive/convenient sampling, 20 companies participated in the study out of the 70 water bottling manufacturers (table-3) who were supposed operational (office and or manufacturing and distribution facilities are found) and are located in and within 45 KM diameter of Addis Ababa will be included in the census study.

***Table 3: water bottling companies in and near Addis Ababa***

| Addis Ababa | Number | Addis Ababa-Near Oromia | Number |
|---|---|---|---|
| Lideta | 4 | Hollota | 2 |
| Kerkos | 4 | Legetafo-Legedadi | 2 |
| Bole | 9 | Sebeta&around | 8 |
| Nifas Silk Lafto | 6 | Sululta | 5 |
| Akaki Kaliti | 4 | Sebeta Hawas | 4 |
| Kolfe Keranio | 4 | Berek | 1 |
| Yeka | 2 | Burayu | 11 |
| Total | 33 | Bishoftu | 2 |
| | | Gefersa & Gelan | 2 |
| | | Total | 37 |

Next using non-probability purposive/convenient sampling, taking one person from the 20 factories, interviewees (owners, general and deputy, plant. Factory, operation, marketing and production managers) filled structured questionnaire who have the full knowledge of the factories supply, production, distribution and collaboration activities of the factories.

Moreover, while administering the questionnaire and interview, for triangulation purpose, the study sample bottling companies in and around Addis Ababa, were physically visited to see the technologies used for GSCM practice application in their manufacturing, warehouse and distribution units including excess/waste water management.

## 3.4 Data Sources and Types

Source of data will be secondary data from literature review and primary data from questionnaire, interview and participatory observations.

The datatype will be qualitative data from interview of certification, regulatory and financing bodies, making physical participatory observation in bottling companies manufacturing, warehouse and distribution units; and quantitative data through the structured data collection tools on GSCM practices and performance measurement application perspectives.

Nominal, ordinal and discrete data types were obtained from the questionnaires.

## 3.5 Data Collection tool

**Questionnaire:**

As per the population and sample data stated above, to assess the GSCM perspectives and practices in the bottled water manufacturing companies, structured questionnaire was prepared for the 20 factories respondents using 6-point Likert scale.

**Table 4: population and sample summery**

**Key to Measurement Scale:**

1= Not practiced/applied at; all and it means strongly disagree (SD)

2= satisfactorily practiced/applied but without the awareness of staff as part of the manufacturing set up- routine task, and means disagree (D)

3= Well practiced/applied with awareness of staff but as part of the manufacturing set up-routine task (average); and means neutral (N)

4= highly practiced/applied supported with Technology and training for staff; and means agree (A)

5= Very highly practiced/applied with the use of technology and training for staff with organizational culture and supported by strategy and policy; and means strongly agree (SA)

**Participatory observation**

For the purpose of triangulating the data collected by the questionnaire administration, participatory observation in the bottled water manufacturing companies facilities, together with concerned staff assigned by the responsible person.

## 3.6 Data Analysis

Using SPSS computer software, descriptive statistical data analysis is made that include tabulation based on the performance measurement perspectives, GSCM practices and challenges answered from the 20 bottling companies who filled the questionnaires.

Mean score descriptive statistics, reliability test of Cronbach alpha, correlation using multivariate analysis was made between practices used and performance measurement frameworks implemented and challenges faced in the bottling companies to implement GSCM and follow certification, regulatory and financing standards and specifications.

## 3.7 Reliability and validity test

### I. Reliability

To ensure the result finding internal consistency, Cronbach's alpha coefficient ($\alpha \geq 0.7$) (Taber, 2017), as measure of scale reliability, was tested using SPSS during the data analysis. Overall cronbach alpha is found to be 0.75.

### II. Validity and significance test

Statistical validity test of the data collection tools to measure what they claim and are intended to measure was made by during the analysis using non-parametric Chi square test. Bivariate correlation was made during analysis using Spearman and Pearson correlations tests.

## 3.8 Ethical Consideration

After design of data collection tools with the assistance of the research advisor and examiner, the research cooperation letter was obtained from AAU College of Logistics and Supply Chain management office.

Bottling companies' heads were contacted by phone first for introduction of the study objective and getting their participation consent to assign respondent.

As it was convenient for the respondents-with close talks, data collection tools were administered physically by the researcher/thesis candidate/; and couple of them required printed form by physical delivery in their offices and manufacturing facilities.

The introductory section of the questionnaire and interview & physical observation tools were made to have the required ethical detail and confidentiality of the companies and their respective interviewees' data.

Appointments were made for the questionnaire, interview and participatory physical observation visit in the manufacturing and office facilities of the companies..

# CHAPTER FOUR: RESULTS AND DISCUSSION

## 4.1. Introduction

Based on the data from Ministry of Trade and Industry (2021), 175 companies are registered for water bottling. Therefore, population of the research comprises 175 bottled water manufacturing companies in Ethiopia; where the sample companies were those in and around Addis Ababa with in 45km radius.

*Table 5: Registered water bottling companies in Ethiopia-(MOTI, 2021)*

| Nationality | Number | Nationality | Number | Remark |
|---|---|---|---|---|
| Ethiopian | 167 | Ethiopia-Africa | 167 | 95.4% are Ethiopians |
| Sudan | 1 | Other-Africa | 2 | Sudan & Djibouti |
| Spain | 1 | Europe | 5 | Italy, France, Spain, Turkish and Danish |
| Turkish | 1 | Australia | 1 | |
| Australia | 1 | Total | 175 | |
| Danish | 1 | | | |
| Djibouti | 1 | | | |
| Italy | 1 | | | |
| France | 1 | | | |
| Total | 175 | | | |

Again, the data from Ministry of Trade and Industry (2021) shows that they registered 70 water bottling companies whose factories and or offices are located in the metropolitan city Addis Ababa and around, in Oromia administrative locations.

*Table 6: water bottling companies in and near Addis Ababa*

| Addis Ababa | Number | Addis Ababa-Near Oromia | Number |
|---|---|---|---|
| Lideta | 4 | Hollota | 2 |
| Kerkos | 4 | Legetafo-Legedadi | 2 |
| Bole | 9 | Sebeta&around | 8 |
| Nifas Silk Lafto | 6 | Sululta | 5 |
| Akaki Kaliti | 4 | Sebeta Hawas | 4 |
| Kolfe Keranio | 4 | Berek | 1 |
| Yeka | 2 | Burayu | 11 |
| Total | 33 | Bishoftu | 2 |
| | | Gefersa & Gelan | 2 |
| | | Total | 37 |

Out of the above 70 companies that Ministry of Trade and Industry (2021) registered as located in Addis Ababa and around it, it was found out through mobile calls that 5 answered that they are not water bottling companies, 4 have got sameTIN number and company name, 2 are closed, 4 are new and yet to start production, 3 are located greater than 45 KM from the study sample location and more than 15 could not be verified whether their factories are located in and around Addis within 45 KM radius. Therefore, out of the 70 who have been claimed to have registered to operate in and around Addis Ababa, as the 33 companies were inaccessible for the study, those 37 bottled water manufacturing companies who were confirmed to have been located in and around Addis Ababa within 45 KM, have been contacted for the study. Consequently, from the accessible 37 bottled water manufacturing companies, using non-probability purposive sampling, 20 companies were willing and responded to the study quantitative questionnaire. Meanwhile, participatory observation was carried out by the researcher in the factories. The questionnaires were filled in the factory sites.

Therefore, the study result and discussion shows the finding of 20 water bottling manufacturing companies practices-reserve logistics (reuse, reduce, recycle, remanufacture, disposal), eco-design, green purchasing, green manufacturing and green distribution based on the independent factors of environmental, economic and social perspectives of sustainable development.

### 4.1.1. Respondents: Sex, Age and Position

The following tables show the data of the questionnaire respondents in the visited 20 BWMC.

***Table 7: Age distribution of respondents***

**Age**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 20-30 | 7 | 35.0 | 35.0 | 35.0 |
| | 31-40 | 10 | 50.0 | 50.0 | 85.0 |
| | 41-50 | 1 | 5.0 | 5.0 | 90.0 |
| | 51-60 | 2 | 10.0 | 10.0 | 100.0 |
| | Total | 20 | 100.0 | 100.0 | |

Out of them only 2 are female to the level of deputy manager and operation director. Educational level is equally divided to first degree to graduate level.

***Table 8: Sex Distribution of respondents***

| | | Frequency | Percent | Valid Percent | Cumulative Percent | Remark |
|---|---|---|---|---|---|---|
| Valid | Male | 18 | 90.0 | 90.0 | 90.0 | |

| | Frequency | Percent | Valid Percent | Cumulative Percent | Remark |
|---|---|---|---|---|---|
| Female | 2 | 10.0 | 10.0 | 100.0 | Deputy manager and operation director |
| Total | 20 | 100.0 | 100.0 | | |

The respondents have the following positions in the 20 BWMC who participated in the study. The majority of respondents (70%, N=20) are plan/factory and production mangers.

***Table 9: Position of respondents***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | General/Deputy Manager | 2 | 10.0 | 10.0 | 10 |
| | Plant/Factory Manager | 5 | 25.0 | 25.0 | 35 |
| | Finance/human resource/sales & marketing/ Property administration/manager | 4 | 20.0 | 20.0 | 55 |
| | Operation/quality Director | 2 | 10.0 | 10.0 | 65 |
| | Production manager/Head/supervisor | 7 | 35.0 | 35.0 | 100 |
| | Total | 20 | 100.0 | 100.0 | 100 |

***Table 10: Respondents' position and role in the factory***

| | |
|---|---|
| Applied Biology | Business Management |
| Applied Chemistry | Chemical engineering |
| Chemical Engineering | Industrial Engineering |
| Chemistry | Food science and Nutrition |
| Food technology & Process engineering | Internal Auditor certified |
| Industrial Chemistry | Renewable Energy |
| Industrial Engineering | |
| Industrial Microbiologist | |
| Management | |
| Marketing | |
| Mechanical Engineering | |

Therefore, the respondents are company managers, factory/plant managers, production heads and marketing managers. They are mainly of industry, chemistry and mechanical engineering professionals, who have got some exposure of GSCM practices like recycling and waste management due to their bachelor or post-graduation education and further training on job like ISO certification and environmental management and related courses.

***Table 11: Respondents' GSCM related training and experience***

| | | |
|---|---|---|
| Brewery Bottle Label and neck seal for recycling | Environmental | Environmental courses |
| HZCCP certified | Environmental Audit | Environmental Management & Food Safety |
| ISO | Food safety management system | Kaizen |
| ISO | Food safety-FSMS | QMS & Good manufacturing practice |
| ISO 2005 | FSMS | Supply chain management |
| Iso14001& QMS &HACCP | Kaizen | Waste management |
| ISO22000-2005 | QMS9001 | Waste management |
| ISO22000-2015 | Safety Trainer | Environmental courses |
| ISO9001-2015 | TQM | |
| Kaizen | | |
| QMS | | |

### 4.1.2. Respondents educational level and GSCM skill

It can be said that all the respondents have got appreciable skill and knowledge because of their education or and additional training in terms of environmental issues, waste management, recycling and reuse. Even few of the plant managers have got graduate level education in renewable energy and environmental management.

***Table 12: respondents' educational level***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | B.Sc/BA | 10 | 50.0 | 50.0 | 50.0 |
| | M.Sc/MA | 8 | 40.0 | 40.0 | 90.0 |
| | MBA | 2 | 10.0 | 10.0 | 100.0 |
| | Total | 20 | 100.0 | 100.0 | |

The respondents have got the combination of education in first degree and or graduate, specialization or advanced training level.

## 4.2. Profile and mapping of the sample companies

### 4.2.1. Location

***Table 13: List of water bottling factories that participated in the study***

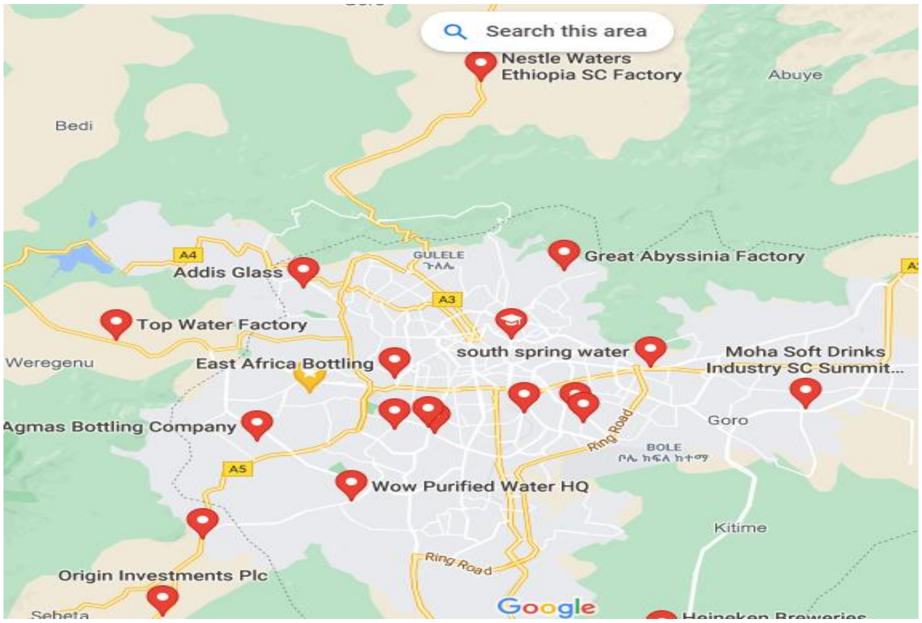
| Brand | Brand |
|---|---|
| Abyssinia Spring | Forest |
| Agmas | Gold |
| Alpha | Inn |
| Ambassador | Joy |
| Boss | Konjo |
| Care | Nova |
| Cheers | Sheger |
| Daily | Top |
| Delta | Unique |
| FHAM | Yes |
| Total | 20 |

The manufacturing factories are located in the following locations outside Addis Ababa in Oromia administrative Weredas. However, Agmas water is located in Addis Ababa, Ayer Tena surrounding, known as Kara Kore.

***Table 14: Location of water bottling factories that participated in the study***

| No. | Location | Frequency | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| 1 | Alemgena | 3 | 15.0 | 15.0 |
| 2 | Ayer Tena | 1 | 5.0 | 20.0 |
| 3 | Chacha | 1 | 5.0 | 25.0 |
| 4 | Menagesha | 2 | 10.0 | 35.0 |
| 5 | Menagesha Kolobo | 2 | 10.0 | 45.0 |
| 6 | Sebeta | 3 | 15.0 | 60.0 |
| 7 | Sululta | 2 | 10.0 | 70.0 |
| 8 | Tatek | 6 | 30.0 | 100.0 |
| | Total | 20 | 100.0 | |

***Figure 3: Map[1] showing the concentration of BWMC around Addis Ababa***



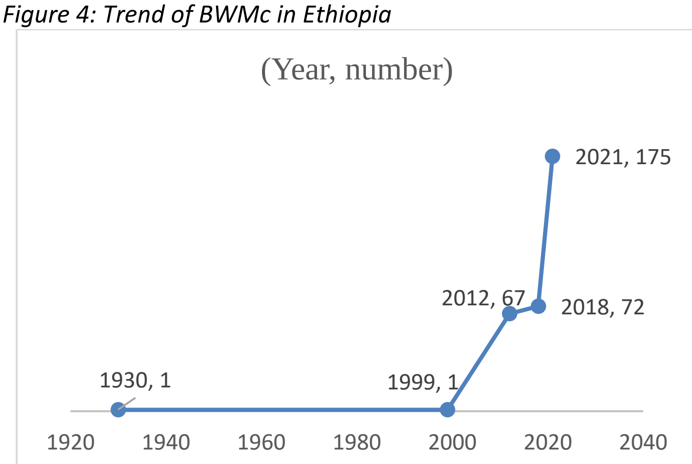

Except one in Ayer Tena vicinity, the factories under study are located in 8 different places in the four corners near Addis Ababa, in Oromia administrative region, with in 45 KM radius. The majority are concentrated around Tatek, Alem Gena and Seba .

The concentration of the BWMC seem to concentrate following the water belt area of the West and south of Addis Ababa.

### 4.2.2. Year of establishment

The trend of water bottling manufacturing business after 2000 has been fast to reach 175 in 2021 (MoTI, 2021).

*Figure 4: Trend of BWMc in Ethiopia*




According to Mekuria (2016), Ambo mineral water was the first bottled water in Ethiopia since 1930. After Ambo, in 1999 plastic bottled water brand known as highland mineral water was famous until it went out of market in few years. Currently, the sector is flourishing that in 2018 there were more than 72 bottled water is Ethiopia-that this trend was estimated to reach 90 in 2020 (Addis Fortune, 2018) but exceeded 175 (Ethiopia's Ministry of Trade and Industry, 2021).

The majority of BWMC in the study were established between 2014 and 2018.

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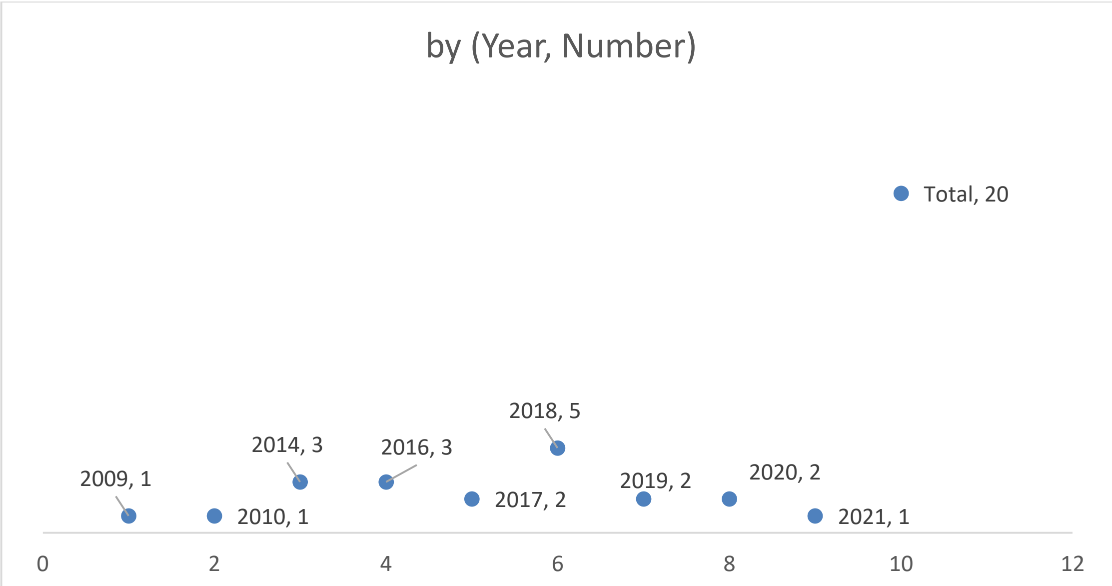
1 https://www.google.com/maps/search/map+location+of+water+bottling+manufacturing+factories+around+addis+ababa/@8.9857866,38.6633358,12z/data=!3m1!4b1

**Figure 5: year establishment bottled water companies in the study**




### 4.2.3. Bottling Capacity

The BWMC under the study produce 365515 bottles per hour (BPH) (using standrad halfliter measurement of capacity), while the have got design capaciy of 502300 bottles per hour. As the majority work more atleast 8 hours per day, they actually produce over all 2,924,120 bottles per day; which is 58,482,400 bottles per month and 701,788,800 bottles per year supplied to the market.

***Figure 6: Design production capacity of 20 BWMC (standard half litre bottle per hour), N=20***

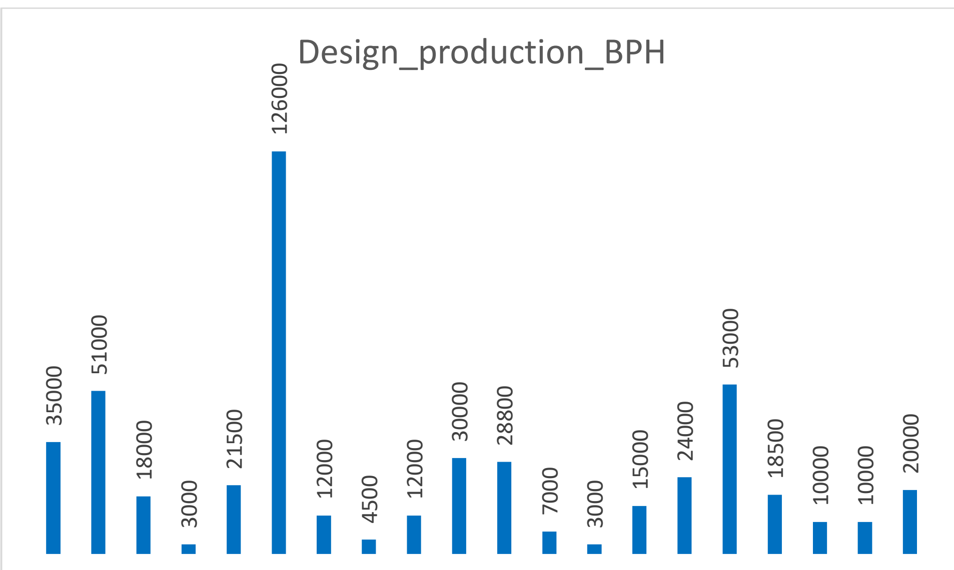
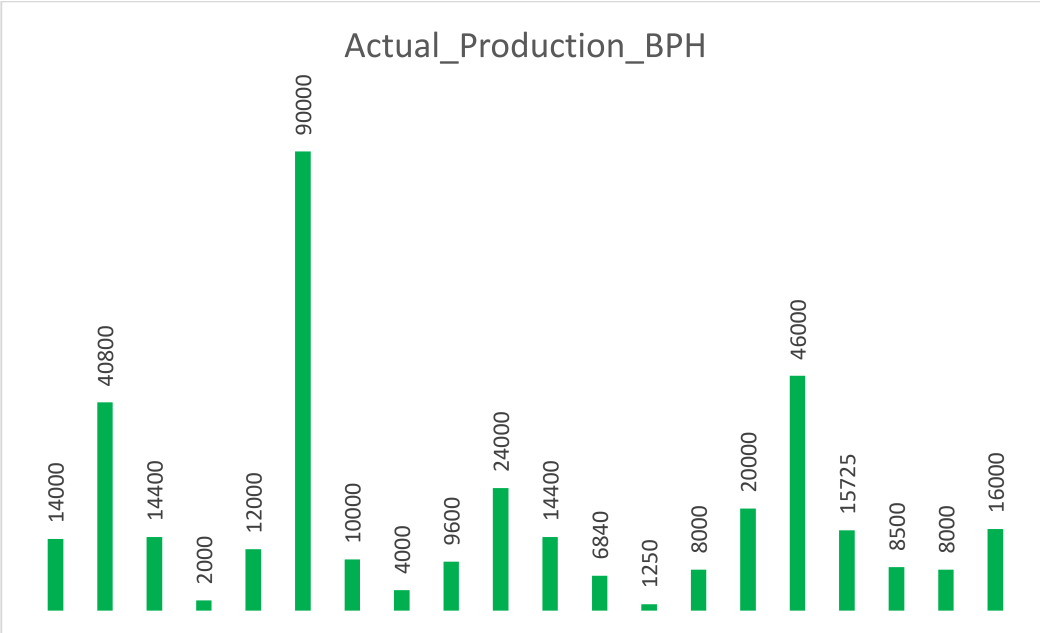


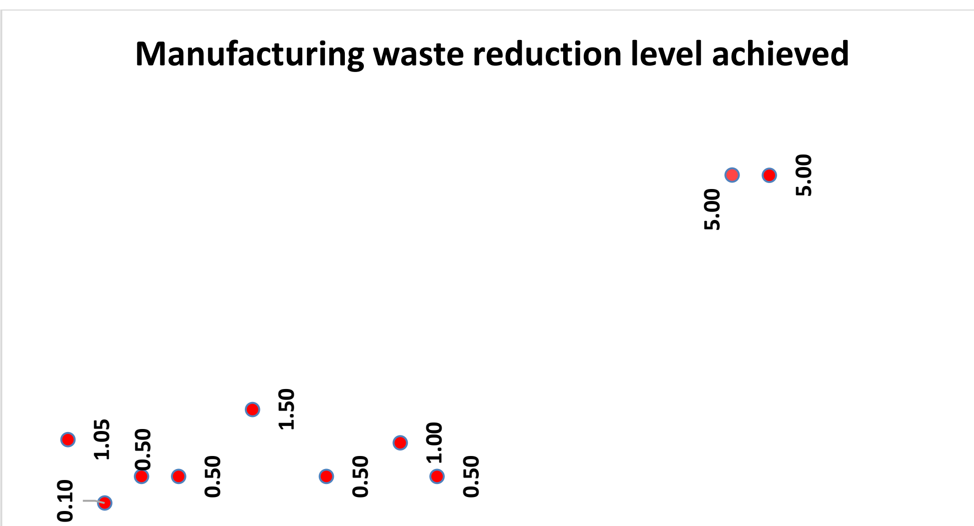
*Figure 7: Design production capacity of 20 BWMC (standard half litre bottle per hour), N=20*[2]




### 4.2.4. Waste reduction %

Out of the 20 BWMC who filled the questionnaire, the 10 of them reported their bottling materials waste reduction level achieved in percentage during production. Thus, the majority are between 1 to 1.5%, while the highest are two companies 5% level.

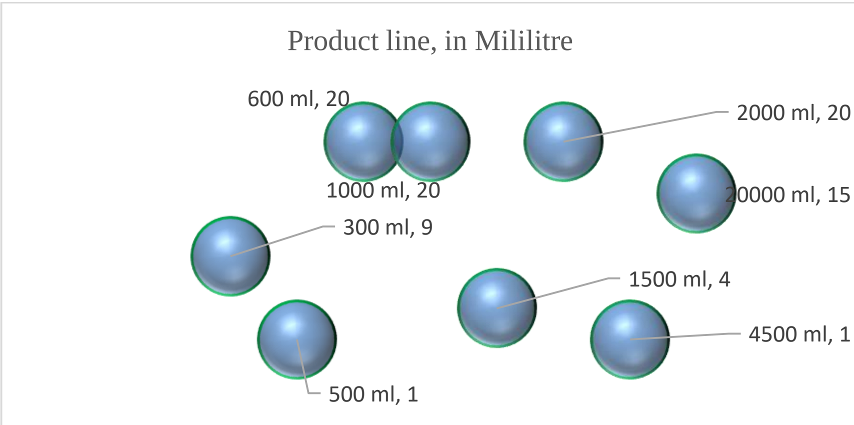
*Figure 8: bottling materials waste reduction level achieved during production, N=10*




[2] Given the iron door of the water companies to get permission to the fill the questionnaires, the figure even can be significantly much higher than the reported during the study.

### 4.2.5. Product line

***Figure 9: Product Line of BWMC, N=20***




### 4.2.6. ISO certification

The 20 companies who willingly participated in the study, only 2 are ISO certified. The certifications are ISO 9000, ISO9001-2015, ISO2004-18, ISO10000 and ISO22000.

However, no one company has got environmental related ISO certifications like ISO14000 and ISO31001.

***Table 15: ISO certification of respondent companies, N=20***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 2 | 10.0 | 10.5 | 10.5 |
| | No | 17 | 85.0 | 89.5 | 100.0 |
| | Total | 19 | 95.0 | 100.0 | |
| Missing | System | 1 | 5.0 | | |
| Total | | 20 | 100.0 | | |

### 4.2.7. Other alternative GSCM measurement practice

Though all factories have got quality control in terms of the raw material procurement and traditional production process, few factories claim that they implement TQM and BSC. However, majority has no performance measurement practice of the traditional supply chain and GSCM.

Thus, quality measurement of raw material procurement, production and distribution including waste treatment follow routine process that is installed together with the product line.

### 4.2.8. Challenges

Policy, regulatory bodies' capacity, sectoral and standard challenges and skilled labour were mentioned as significant ones. Apart from these major other challenges were forwarded by the respondents include frequent electric black out that oblige them to use fossil fuel generator for production, foreign currency that posed very high raw material and spare part shortage which again brought about production interruption, excise tax, unstable labour because of competition and quality standard and testing technology challenges.

***Table 16: Finance and raw material Challenges reported by BWMC***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 8 | 40.0 | 40.0 | 40.0 |
| | Foreign currency | 4 | 20.0 | 20.0 | 60.0 |
| | Foreign Currency | 8 | 40.0 | 40.0 | 100.0 |
| | Total | 20 | 100.0 | 100.0 | |
| Valid | | 11 | 55.0 | 55.0 | 55.0 |
| | Raw material | 9 | 45.0 | 45.0 | 100.0 |
| | Total | 20 | 100.0 | 100.0 | |

***Table 17: Electric and other challenges reported by BWMC***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | | 9 | 45.0 | 45.0 | 45.0 |
| | Collaboration | 1 | 5.0 | 5.0 | 50.0 |
| | Electric | 7 | 35.0 | 35.0 | 85.0 |
| | Labour unstable | 1 | 5.0 | 5.0 | 90.0 |
| | Quality Control Technology | 1 | 5.0 | 5.0 | 95.0 |
| | Spare parts | 1 | 5.0 | 5.0 | 100.0 |
| | Total | 20 | 100.0 | 100.0 | |

The BWMC have got association that also recently established recycling and green economy development association. And respondents indicated that they have collaboration in the sector from lobbying together to information sharing and capacity building.

***Table 18: Collaboration in the sector of the BWMC***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 18 | 90.0 | 94.7 | 94.7 |
| | No | 1 | 5.0 | 5.3 | 100.0 |
| | Total | 19 | 95.0 | 100.0 | |
| Missing | System | 1 | 5.0 | | |
| Total | | 20 | 100.0 | | |

However, all admitted that they have got problem of collaboration outside the sector including with local and foreign suppliers of raw materials, machines and spare parts, except during procurement and installation of machines and production units during introduction phase.

***Table 19: Collaboration outside the sector challenge of the BWMC***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 4 | 20.0 | 22.2 | 22.2 |
| | No | 14 | 70.0 | 77.8 | 100.0 |
| | Total | 18 | 90.0 | 100.0 | |
| Missing | System | 2 | 10.0 | | |
| Total | | 20 | 100.0 | | |

***Table 20: Collaboration of BWMC with regulatory bodies***

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 2 | 10.0 | 11.1 | 11.1 |
| | No | 16 | 80.0 | 88.9 | 100.0 |
| | Total | 18 | 90.0 | 100.0 | |
| Missing | System | 2 | 10.0 | | |
| Total | | 20 | 100.0 | | |

## 4.3. Reliability

According to Taber (2017), Cronbach's alpha is commonly used in studies as an indicator of instrument or scale reliability or internal consistency. Alpha became widely used after being discussed by Cronbach (1951) who reasonably suggested that using the label α was more convenient than repeatedly referring to the "Kuder-Richardson Formula 20". It is common to see the reliability of instruments used in published science education studies framed in terms of a statistic known as Cronbach's alpha (Cronbach, 1951). Cronbach's alpha has been described as 'one of the most important and pervasive statistics in research involving test construction and use' (Cortina, 1993, p. 98) to the extent that its use in research with multiple-item measurements is considered routine (Schmitt, 1996, p. 350). Cronbach wrote that "if all the splits for a test were made, the mean of the coefficients obtained would be alpha value. So, alpha reflects the extent to which different subsets of test items would produce similar measures. Cronbach suggested that alpha reports how much the test score depends upon general and group, rather than item specific, factors. Cronbach alpha statistic is most valuable in relation to single-construct scales and less informative when reported for instruments measuring several constructs at once (Adams & Wieman, 2010). The practice of reporting only an overall alpha value when an instrument is comprised of several discrete scales is less useful to readers.

Therefore, for testing the reliability and consistency of the measurement outcome in this study, the factors were split to calculate their alpha value and then the average is taken for the overall measurement as seen the table-21.

***Table 21: Reliability test summery, average of Cronbach alpha of measurement tool***

| *No.* | **Main Variables** | **Chronbach Alpha (α)[3]** |
|---|---|---|
| *1* | Economic perspective | 0.815 |
| *2* | Environmental perspective | 0.984 |
| *3* | Social perspective | 0.771 |
| *4.1* | GSCM practices: Green purchasing, manufacturing, distribution and eco-design | 0.810 |
| *4.4* | Reverse logistics | 0.706 |
| *5* | Application Challenges | 0.387 |
| *6* | Regulatory, certification, standard and other policy challenges | 0.690 |
| | Instrument overall Chronbach Alpha (α) | 0.738 |

In this study, therefore, Cronbach alpha was calculated using SPSS for independent variables-economic, environmental and social factors; and dependent variables-GSCM practices of Reverse logistics, eco-design, green manufacturing, green purchasing and green distribution.

[3] See appendix six for the detailed measurement factors

Thus, the overall Cronbach alpha of the measurement instrument reliability and internal consistency is 0.738, which is greater than the arbitrarily agreed alpha threshold of 0.7 for high reliability and internal consistency test of the measurement outcome of the questionnaire.

## 4.4. Validity

Quality may traditionally be understood in terms of such notions as validity (the extent to which an instrument measures what it claims to measure, rather than something else) (Taber, 2017)

In this study, this is confirmed by Non-parametric test of goodness of fit using chi square for the independent variables-economic, environmental and social factors; and dependent variables-GSCM practices of Reverse logistics, eco-design, green manufacturing, green purchasing and green distribution.

The analysis is presented below.

## 4.5. Analysis of the quantitative data

For the assessment made in 20 WBMC located within 45 Km radius of Addis Ababa, the study used structured questionnaire of Likert five scale to assess the GSCM practices, based on the following criteria which have weight of 1(the lowest/very low and means strongly disagree) to 5 (the highest/very high and means strongly agree).

**Key to Measurement Scale:**

1= Not practiced/applied at; all and it means strongly disagree (SD)

2= satisfactorily practiced/applied but without the awareness of staff as part of the manufacturing set up- routine task, and means disagree (D)

3= Well practiced/applied with awareness of staff but as part of the manufacturing set up-routine task (average); and means neutral (N)

4= highly practiced/applied supported with Technology and training for staff; and means agree (A)

5= Very highly practiced/applied with the use of technology and training for staff with organizational culture and supported by strategy and policy; and means strongly agree (SA)

Apart from the five scale likert to assess the variables, dichotomy questions and question that have five scale measurement of low/absent, below average, average, high and very high were applied for the respondents to rate their answers.

Adapting the GSCM measurement factors and practices of Kafa, Hani and Mhamedi (2013), the assessment tool used three independent variables, economic, environmental and social perspective of sustainable development; which in themselves have been divided in other factors and sub-factors. Likewise, the dependent variables, which are the GSCM practices, namely, reverse logistics, eco-design, green manufacturing, green purchasing and green distribution. These practices also were divided into other assessment variables and sub-variables.

Therefore, the economic perspective factors assessed availability of environmental costs associated with GSCM for environmental compliance of national policy, ISO certification like ISO14000 and ISO 31000, cost associated with consumption of clean energy during manufacturing and distribution of bottled water, recycling cost, excess and demineralized water and others wastes management and disposal cost and cost purchasing environmentally friendly materials. Presence of costs of GSCM related to information sharing, ordering, inventory and delivery were also assessed. Moreover, the economic perspective factor addressed greening related quality issues associated with customer compliance like packaging, green product certification and green product warranty in the BWMC.

The environmental perspective factors tried to observe and assess in the respondent BWMC issues associated with process management practices in light of process optimization for waste reduction, pollution level control during production and distribution, practices to reduce amount of energy consumption like fossil fuel. Product features like use of recycled materials in products, eco-labelling, recycling efficiency related to waste reduction, recycling time and amount of recycling energy were seen. Environmental technology that includes clean technology use-electric forklift, solar and wind energy and number of new product and process available in terms of GSCM were also assessed.

The social perspective factor of sustainable development assessment addressed management commitment and effort to motivate staff, take environmental initiative and effort to raise customer awareness and satisfaction including satisfying customer interest in greening through packaging and other materials use, employee development and training in GSCM and practice of participating and or organizing such forums.

With respect to the dependent variables of GSCM practices green purchasing issues like selection of green suppliers, environmental collaboration with suppliers and availability of the 3Rs (reduce, reuse and recycle) were discussed. Eco-design activities presence seen include reducing material/energy consumption, the 3Rs and use of hazardous materials were assessed. In the green manufacturing part, environmental friendly technology use in factory during water extraction and packaging, warehouse, distribution related to fossil fuel use in transportation versus renewable energy in factories including g green packaging were assessed. Moreover, the reverse logistics activities like collection, recycling, disposal, reuse and remanufacturing were raised in the assessment.

Moreover, the study partly addressed assessment of policy, certification, regulatory, standard, control and other challenges to apply GSCM in water bottling companies, the presence of other alternative GSCM measurement practices (TQM, green SCOR and BSC) in BWMC supply chain measurement and finally presence of ISO certification and corporate social responsibility (CSR) in terms of environmental initiative effort and investing in the community for the community.

Finally, the GSCM collaboration was also assessed and described as follows. The validity of the measurement and presence of relationship between the variables used to assess collaboration is analysed using non-parametric test of Chi Square and correlation using bivariate analysis is made. Apart from the five scale likert to assess the above assessment variables dichotomy questions and question that have five scale measurement of low/absent, below average, average, high and very high were applied for the respondents to rate their answers.

Eventually, the analysis is made based on the above assessment factors and variables detail and presented as descriptive statistics of mean and standard deviation; and inferential statistics of non-parametric test for validity of the measurement using chi square and bivariate analysis is used for significance of correlation presence between them which helped to interpret the acceptance or rejection of the null hypothesis.

### 4.5.1. Independent factors: GSCM perspectives

#### 4.5.1.1. Economic perspective factors

Based on the assessment made in 20 WBMC located within 45 Km radius of Addis Ababa, the economic perspective factors assessed availability of environmental costs associated with GSCM for environmental compliance of national policy, ISO certification like ISO14000 and ISO 31000, cost associated with consumption of clean energy during manufacturing and distribution of bottled water, recycling cost, excess and demineralized water and others wastes management and disposal cost and cost purchasing environmentally friendly materials. Presence of costs of GSCM related to information sharing, ordering, inventory and delivery were also assessed. Moreover, the economic perspective factor addressed greening related quality issues associated with customer compliance like packaging, green product certification and green product warranty in the BWMC.

Therefore, the result of descriptive statistics, mean and standard deviation, and the non-parametric test using Pearson and Spearman for the measurement tool used using chi square and the bivariate analysis using correlation for significance of relationship among the variables is presented next.

The result of the mean values show that the BWMC who participated in the study have no costs related to GSCM, though some reported that they invested in battery/electric forklifts used in the production plan. The mean score of 1.95 seen for recycling and disposal cost is somewhat higher than others due to some of them who responded and were observed using recycling machines for damaged bottles and investment in the treatment and disposal of excess/demineralized water.

***Table 22: Mean and std. on environmental cost associated with GSCM***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Compliance Cost | 20 | 1.35 | .933 | 1 | 4 |
| Recycling Cost | 20 | 1.95 | 1.395 | 1 | 4 |
| Clean Energy Cost | 20 | 1.55 | 1.099 | 1 | 4 |
| Disposal Cost | 20 | 1.80 | 1.281 | 1 | 4 |
| EFM Cost | 20 | 1.50 | 1.051 | 1 | 4 |

The Chi square non-parametric validity test shows more than 95% significance for all environmental cost related variables.

***Table 23: Chi square test statistics of variables-environmental cost associated with GSCM***

| | Compliance Cost | Recycling Cost | Clean Energy Cost | Disposal _Cost | EFM |
|---|---|---|---|---|---|
| Chi-Square | 24.100[a] | 10.900[a] | 15.700[a] | 12.400[a] | 19.600[a] |
| df | 2 | 2 | 2 | 2 | 2 |
| Asymp. Sig. | .000 | .004 | .000 | .002 | .000 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.7.

Based on the correlation bivariate analysis, clean energy cost versus environmental friendly materials use cost have registered very high significance of relationship at 0.01 level.

**Table 24: Bivariate correlation-environmental cost associated with GSCM**

| | | Compliance Cost | Recycling Cost | Clean Energy Cost | Disposal Cost | EFM Cost |
|---|---|---|---|---|---|---|
| Compliance Cost | Pearson Correlation | 1 | .216 | -.044 | -.114 | -.080 |
| | Sig. (2-tailed) | | .360 | .855 | .631 | .736 |
| | N | | 20 | 20 | 20 | 20 |
| Recycling Cost | Pearson Correlation | | 1 | .156 | -.094 | .305 |
| | Sig. (2-tailed) | | | .511 | .693 | .191 |
| | N | | | 20 | 20 | 20 |
| Clean Energy Cost | Pearson Correlation | | | 1 | .344 | .660** |
| | Sig. (2-tailed) | | | | .138 | .002 |
| | N | | | | 20 | 20 |
| Disposal Cost | Pearson Correlation | | | | 1 | .273 |
| | Sig. (2-tailed) | | | | | .243 |
| | N | | | | | 20 |
| Environmental friendly Material (EFM) Cost | Pearson Correlation | | | | | 1 |
| | Sig. (2-tailed) | | | | | |
| | N | | | | | |

**. Correlation is significant at the 0.01 level (2-tailed).

The response for traditional supply chain cost as applied to GSCM (not the cost of normal activities) shows that factory cost has high mean score of 2.30 the max being 4 for the BWMC use high technology which has no environmental effect for production. The others-delivery, ordering, inventory, information sharing and ordering has shown lowest mean score for GSCM is not constituted in the supply chain, except undertaking business as usual routine installed activities.

***Table 25: Mean and Std.-traditional supply chain cost as applied to GSCM***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Factory Cost | 20 | 2.30 | 1.490 | 1 | 4 |
| Delivery Cost | 20 | 1.10 | .447 | 1 | 3 |
| Inventory Cost | 20 | 1.25 | .786 | 1 | 4 |
| Information Sharing Cost | 20 | 1.10 | .447 | 1 | 3 |
| Ordering Cost | 20 | 1.10 | .447 | 1 | 3 |

The Chi square non-parametric validity test shows more than 95% significance for all traditional supply chain cost related variables as applied to GSCM.

***Table 26: Chi square test of stat traditional supply chain cost as applied to GSCM***

| | Factory Cost | Delivery Cost | inventory Cost | Information Sharing Cost | Ordering Cost |
|---|---|---|---|---|---|
| Chi-Square | 7.900[a] | 16.200[b] | 28.900[a] | 16.200[b] | 16.200[b] |
| df | 2 | 1 | 2 | 1 | 1 |
| Asymp. Sig. | .019 | .000 | .000 | .000 | .000 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.7.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

The bivariate correlation of significance of relationship between traditional supply chain costs delivery with inventory, and inventory with information sharing and ordering costs as applied to GSCM has shown high significance 0.05 level of relationship. And delivery with information sharing and ordering costs, information sharing with ordering cost have significant relationship at 0.01 level

***Table 27: Bivariate correlation- traditional supply chain cost as applied to GSCM***

| | | Factory Cost | Delivery Cost | Inventory Cost | Information Sharing Cost | Ordering Cost |
|---|---|---|---|---|---|---|
| Factory Cost | Pearson Correlation | 1 | .111 | .292 | .111 | .111 |
| | Sig. (2-tailed) | | .643 | .212 | .643 | .643 |
| | N | | 20 | 20 | 20 | 20 |
| Delivery Cost | Pearson Correlation | | 1 | .524* | 1.000** | 1.000** |
| | Sig. (2-tailed) | | | .018 | .000 | .000 |
| | N | | | 20 | 20 | 20 |
| inventory Cost | Pearson Correlation | | | 1 | .524* | .524* |
| | Sig. (2-tailed) | | | | .018 | .018 |
| | N | | | | 20 | 20 |
| Information Sharing Cost | Pearson Correlation | | | | 1 | 1.000** |
| | Sig. (2-tailed) | | | | | .000 |
| | N | | | | | 20 |
| Ordering Cost | Pearson Correlation | | | | | 1 |
| | Sig. (2-tailed) | | | | | |
| | N | | | | | |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

In terms of GSCM quality, the dichotomy questions, yes or no, for assurance for customer compliance in addressing their complaints and using greening activities, the mean square show low mean but it is because of the response of the WBMC that they have no almost complaint from customers except few admitted packaging problems of cap and shrink wrap of bottles; but on the other hand all of them responded no, which is absence of green certification and green warranty costs related to GDCM in their factories, which is related to the low mean score value.

***Table 28: Mean and Std. of GSCM related quality assurance***

| | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Quality Green Certification cost | 2.00 | .000 | 2 | 2 |
| Quality Green warranty Cost | 2.00 | .000 | 2 | 2 |
| Environmental Factor Measured | 1.95 | .224 | 1 | 2 |

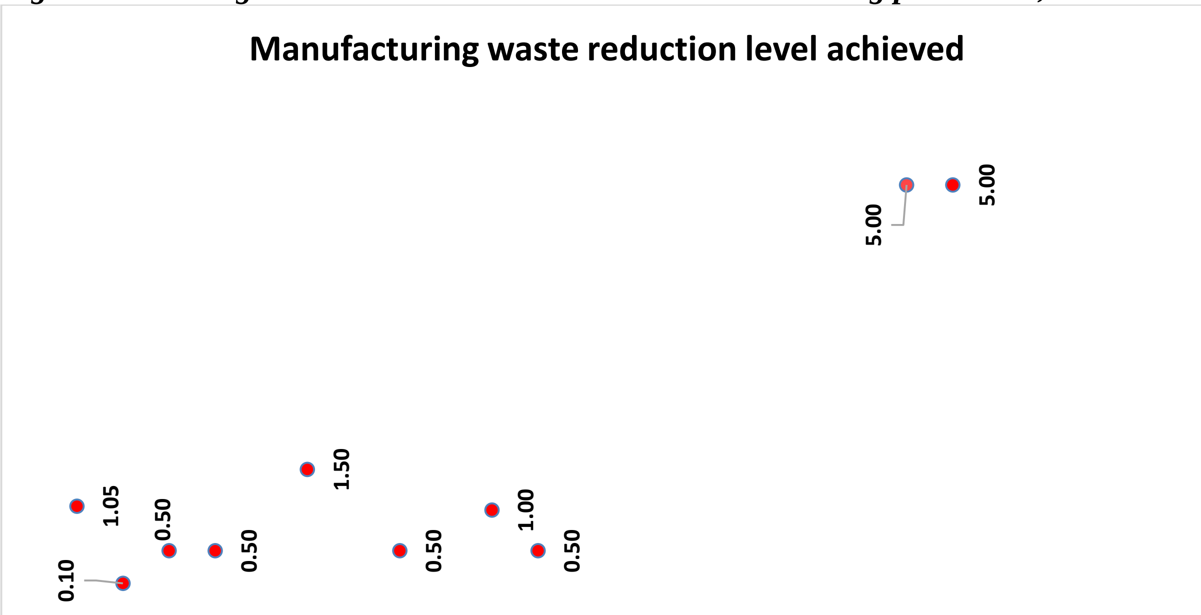
### 4.5.1.2. Environmental Perspective factors

The environmental perspective factors tried to observe and assess in the respondent BWMC issues associated with process management practices in light of process optimization for waste reduction, pollution level control during production and distribution, practices to reduce amount of energy consumption like fossil fuel.

Product features like use of recycled materials in products, eco-labelling, recycling efficiency related to waste reduction, recycling time and amount of recycling energy were seen. Environmental technology that includes clean technology use-electric forklift, solar and wind energy and number of new product and process available in terms of GSCM were also assessed.

In the process management practices GSCM related responses of the BWMC, in factory optimization of waste reduction has got high mean score for they exhibit high technology use that is free from pollution and very low wastage of raw materials, ranging from 0.1% to 0.5% and 1.5% for the majority and few reported maximum of 5% (Figure 10), for using raw materials of preforms used for bottle making, caps, shrink wrap and labelling.

***Figure 10: bottling materials waste reduction level achieved during production, N=20***




Still the practice of clean energy use for distribution has lowest mean score, for all use massive number of truck-fossil fuel to distribute their products of bottled water. The high mean score of 3.8 and 3.7 for waste reduction and pollution level control is due to the response that there is high pollution control and waste reduction level in the factory because of the technology used for bottling; on the contrary outside the factory during distribution, there is high level use of massive fossil fuel for transportation.

***Table 29: Mean and Std. for process management practices***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Waste Reduction Optimized | 20 | 3.80 | .616 | 2 | 4 |
| Pollution Level Control | 20 | 3.70 | .733 | 2 | 4 |
| Reduced Energy consumption | 20 | 1.15 | .671 | 1 | 4 |

The validity test using non parametric chi square test shows highest significance

***Table 30: Chi square test for process management practices***

| | Waste Reduction Optimized | Pollution Level Control | Reduced Energy consumption |
|---|---|---|---|
| Chi-Square | 12.800[a] | 9.800[a] | 16.200[a] |
| df | 1 | 1 | 1 |
| Asymp. Sig. | .000 | .002 | .000 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

There is significance relationship between the Waste Reduction Optimized and Pollution Level Control at level of 0.01.

***Table 31: Bivariate Correlation GSCM for process management practices***

| | | Waste Reduction Optimized | Pollution Level Control | Reduced Energy consumption |
|---|---|---|---|---|
| Waste Reduction Optimized | Pearson Correlation | 1 | .793** | .076 |
| | Sig. (2-tailed) | | .000 | .749 |
| | N | | 20 | 20 |
| Pollution Level Control | Pearson Correlation | | 1 | .096 |
| | Sig. (2-tailed) | | | .686 |
| | N | | | 20 |
| Reduced Energy consumption | Pearson Correlation | | | 1 |
| | Sig. (2-tailed) | | | |
| | N | | | |

**. Correlation is significant at the 0.01 level (2-tailed).

The mean scores for product feature, recycling efficiency, use of environmental technology variables used for assessment of GSCM, show very low mean scores for use of recycled material for they don't use recycled materials for packaging water, as it is not allowed by regulation-policy. In the meantime the eco-labelling practice has also low mean score for the BWMC use plastic labels which are not environmental friendly. The clean technology use of mean score 3 is due to the in factory value, which doesn't use fuel except during electric supply black out-that they also reported happens frequently these days and are obliged to use fossil fuel diesel generator, again out bound activities of transporting their products does not use clean technology, as they use massive number of trucks that use fossil fuel for transportation.

***Table 32: mean score and Std. for product features recycling efficiency, use of environmental technology related to GSCM***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Use Recycled Materials | 20 | 1.15 | .671 | 1 | 4 |
| Eco-Labelling practiced | 20 | 1.25 | .786 | 1 | 4 |
| Recycling Time | 5 | 1.40 | .894 | 1 | 3 |
| Recycling Energy | 4 | 1.50 | 1.000 | 1 | 3 |
| Clean Technology Non-Fuel | 20 | 3.00 | 1.522 | 1 | 5 |
| New Product Process | 20 | 1.15 | .671 | 1 | 4 |

The test of validity using chi square shows highest significance.

***Table 33: Test of Chi square for product features recycling efficiency, use of environmental technology related to GSCM***

| | Use Recycled Materials | Eco-Labelling practiced | Recycling Time | Recycling Energy | Clean Technology Non-Fuel | New Product Process |
|---|---|---|---|---|---|---|
| Chi-Square | 16.200[a] | 28.900[b] | 1.800[c] | 1.000[d] | 9.100[b] | 16.200[a] |
| df | 1 | 2 | 1 | 1 | 2 | 1 |
| Asymp. Sig. | .000 | .000 | .180 | .317 | .011 | .000 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.7.
c. 2 cells (100.0%) have expected frequencies less than 5. The minimum expected cell frequency is 2.5.
d. 2 cells (100.0%) have expected frequencies less than 5. The minimum expected cell frequency is 2.0.

In terms of product features recycling efficiency, use of environmental technology related to GSCM, use of recycled materials versus recycling energy, eco-labelling practiced with recycling time and new product process have shown high significance of relationship at 0.01 level.

***Table 34: Bivariate correlation for product features recycling efficiency, use of environmental technology related to GSCM***

| | | Use Recycled Materials | Eco-Labelling practiced | Recycling Time | Recycling Energy | Clean Technology Non Fuel | New Product Process |
|---|---|---|---|---|---|---|---|
| Use Recycled Materials | Pearson Correlation | 1 | -.075 | -.250 | 1.000** | .155 | -.053 |
| | Sig. (2-tailed) | | .754 | .685 | .000 | .515 | .826 |
| | N | | 20 | 5 | 4 | 20 | 20 |
| Eco-Labelling practiced | Pearson Correlation | | 1 | 1.000** | .[b] | .308 | .823** |
| | Sig. (2-tailed) | | | .000 | .000 | .187 | .000 |
| | N | | | 5 | 4 | 20 | 20 |
| Recycling Time | Pearson Correlation | | | 1 | .[b] | 1.000** | .[b] |
| | Sig. (2-tailed) | | | | .000 | .000 | .000 |
| | N | | | | 4 | 5 | 5 |
| Recycling Energy | Pearson Correlation | | | | 1 | .[b] | .[b] |
| | Sig. (2-tailed) | | | | | .000 | .000 |
| | N | | | | | 4 | 4 |
| Clean Technology Non Fuel | Pearson Correlation | | | | | 1 | .155 |
| | Sig. (2-tailed) | | | | | | .515 |
| | N | | | | | | 20 |
| NewProduct_ Process | Pearson Correlation | | | | | | 1 |
| | Sig. (2-tailed) | | | | | | |
| | N | | | | | | |

**. Correlation is significant at the 0.01 level (2-tailed).
b. Cannot be computed because at least one of the variables is constant.

#### 4.5.1.3. Social perspective factors

The social perspective factor of sustainable development assessment addressed management commitment and effort to motivate staff, take environmental initiative and effort to raise customer awareness and satisfaction including satisfying customer interest in greening through packaging and other materials use, employee development and training in GSCM and practice of participating and or organizing such forums.

As seen in the table below, though it is still low mean score except some insisting that they have environmental policy for highest mean score of 5, the claim of managements' staff motivation, environmental initiative and development of staff in terms of GSCM practice has also lowest mean score like other factors with in this category; all are below average because almost all have no GSCM concept when asked what it means in supply chain.

***Table 35: Mean score and Std. of management commitment, customer satisfaction and employee development***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Management Staff Motivation | 20 | 1.70 | 1.218 | 1 | 5 |
| Management Environment Initiative | 19 | 1.84 | 1.425 | 1 | 5 |
| Management Consumer Awareness | 20 | 1.15 | .671 | 1 | 4 |
| Effort Customer Interest | 20 | 1.70 | 1.129 | 1 | 4 |
| Employee Development | 20 | 2.00 | .000 | 2 | 2 |
| GSCM Training | 20 | 1.35 | .745 | 1 | 3 |
| Conference GSCM | 20 | 1.35 | .745 | 1 | 4 |

The validity test of management commitment, customer satisfaction and employee development using chi square shows high significance level.

***Table 36: Chi square test for management commitment, customer satisfaction and employee development***

| | Management Motivation | Management Environment Initiative | Management Consumer Awareness | Effort Customer Interest | GSCM Training | Conference GSCM |
|---|---|---|---|---|---|---|
| Chi-Square | 32.000[a] | 28.105[b] | 16.200[c] | 12.400[d] | 19.900[d] | 16.300[d] |
| df | 4 | 4 | 1 | 2 | 2 | 2 |
| Asymp. Sig. | .000 | .000 | .000 | .002 | .000 | .000 |

c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.
d. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.7.

Management motivation has significant relationship with their initiative of environment and Management Consumer Awareness and Effort Customer Interest at 0.05 level. Management environmental initiative has significant relationship with management customer awareness at 0.05 level, and management consumer awareness has got significant relationship with their effort of customer interest at 0.05 level. And effort of management effort to customer interest is significantly related with GSCM training at 0.05 level and finally the participation in conference or other GSCM forums has significant relationship with GSCM training at 0.01.

***Table 37: Bivariate correlation of management commitment, customer satisfaction and employee development***

| | | Management Motivation | Management Environment Initiative | Management Consumer Awareness | Effort Customer Interest | GSCM training | Conference GSCM |
|---|---|---|---|---|---|---|---|
| Management Staff Motivation | Pearson Correlation | 1 | .509* | .444* | .505* | .006 | .296 |
| | Sig. (2-tailed) | | .026 | .050 | .023 | .981 | .206 |
| | N | | 19 | 20 | 20 | 20 | 20 |
| Management Environment Initiative | Pearson Correlation | | 1 | .537* | .347 | .005 | .101 |
| | Sig. (2-tailed) | | | .018 | .145 | .983 | .680 |
| | N | | | 19 | 19 | 19 | 19 |
| Management Consumer Awareness | Pearson Correlation | | | 1 | .480* | .205 | .205 |
| | Sig. (2-tailed) | | | | .032 | .385 | .385 |
| | N | | | | 20 | 20 | 20 |
| Effort Customer Interest | Pearson Correlation | | | | 1 | .131 | .257 |
| | Sig. (2-tailed) | | | | | .581 | .275 |
| | N | | | | | 20 | 20 |
| Employee Development | Pearson Correlation | | | | | .b | .b |
| | Sig. (2-tailed) | | | | | . | . |
| | N | | | | | 20 | 20 |
| GSCM Training | Pearson Correlation | | | | | 1 | .810** |
| | Sig. (2-tailed) | | | | | | .000 |
| | N | | | | | | 20 |
| Conference GSCM | Pearson Correlation | | | | | | 1 |
| | Sig. (2-tailed) | | | | | | |
| | N | | | | | | |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

### 4.5.2. Dependent factors: GSCM practices

With respect to the dependent variables of GSCM practices green purchasing issues like selection of green suppliers, environmental collaboration with suppliers and availability of the 3Rs (reduce, reuse and recycle) were discussed. Eco-design activities presence was assessed include reducing material/energy consumption, the 3Rs and use of hazardous materials. In the green manufacturing part, environmental friendly technology use in factory during water extraction and packaging, warehouse, distribution related to fossil fuel use in transportation versus renewable energy in factories including g green packaging were assessed. Moreover, the reverse logistics activities like collection, recycling, disposal, reuse and remanufacturing were discussed with respondents during the assessment; and the finding is presented below with descriptive analysis, non-parametric test using chi square and correlation of relationships among the variables using bivariate analysis.

#### 4.5.2.1. Green purchasing

In green purchasing assessment of the BWMC eco suppliers selection and GSCM collaboration with suppliers, has got lowest mean value. The respondents replied that these does not exist in water bottling supply chain activities, especially with respect to the application of green supply chain practices. The three Rs (Reuse, reduce & recycle) have above average got highest mean score of 2.80 because of the response of the application of reuse of 20 litre Jar water bottle which the factories collect from customers through their distributers.

***Table 38: Mean score and Std. of green purchasing GSCM practice***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Eco-suppliers selection | 20 | 1.00 | .000 | 1 | 1 |
| GSCM Collaboration Suppliers | 20 | 1.10 | .447 | 1 | 3 |
| Three Rs Reuse reduce recycle | 20 | 2.80 | 1.361 | 1 | 4 |

The Chi square validity test is significant.

***Table 39: Validity test with chi square of green purchasing GSCM practice***

| | GSCM Collaboration Suppliers | Three Rs Reuse reduce recycle |
|---|---|---|
| Chi-Square | 16.200[a] | 8.800[b] |
| df | 1 | 3 |
| Asymp. Sig. | .000 | .032 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 5.0.

However, the bivariate correlation test of these practices of GSCM in the BWMC has no significant relationship among themselves.

### 4.5.2.2. Eco-design

In eco-design, use of hazardous materials have got highest mean score of 4.80 because from its nature the water bottling manufacturing business is required to be stringently free of such materials. Reuse and Reduce material and energy consumption have also high mean score of 3.1 and 2.85 respectively for these are practiced in the sector at least using the 20 litre jar water bottle. But recycling is of lowest mean score for almost all have no such practice except few who recycle damaged bottle during production process including caps and pressing used bottles for sale to recyclers.

***Table 40: Mean score and Std. of Eco-design variables***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Reduce Material Energy Consumption | 20 | 2.85 | 1.424 | 1 | 4 |
| Recycle | 19 | 1.79 | 1.357 | 1 | 4 |
| Reuse | 20 | 3.10 | 1.410 | 1 | 4 |
| Avoid Hazardous materials | 20 | 4.80 | .894 | 1 | 5 |

The validity test of the variables of eco design register highest significance except that of reduced material and energy consumption.

***Table 41: Chi square test of Eco-design variables***

| | Reduce Material Energy Consumption | Recycle | Reuse | Avoid Hazardous materials |
|---|---|---|---|---|
| Chi-Square | 6.100[a] | 4.263[b] | 3.200[c] | 16.200[c] |
| df | 2 | 1 | 1 | 1 |
| Asymp. Sig. | .047 | .039 | .074 | .000 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.7.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 9.5.

c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

The significance correlation of bivariate analysis shows that Reduce Material and Energy Consumption has got significance of relationship with reuse at 0.01 level.

***Table 42: Bivariate correlation of significance of eco design variables***

| | | Reduce Material Energy Consumption | Recycle | Reuse | Avoid Hazardous materials |
|---|---|---|---|---|---|
| Reduce Material Energy Consumption | Pearson Correlation | 1 | .432 | .872** | -.190 |
| | Sig. (2-tailed) | | .065 | .000 | .422 |
| | N | | 19 | 20 | 20 |

| | | Reduce Material Energy Consumption | Recycle | Reuse | Avoid Hazardous materials |
|---|---|---|---|---|---|
| Recycle | Pearson Correlation | | 1 | .406 | .141 |
| | Sig. (2-tailed) | | | .085 | .565 |
| | N | | | 19 | 19 |
| Reuse | Pearson Correlation | | | 1 | -.150 |
| | Sig. (2-tailed) | | | | .527 |
| | N | | | | 20 |
| Avoid Hazardous materials | Pearson Correlation | | | | 1 |
| | Sig. (2-tailed) | | | | |
| | N | | | | |

**. Correlation is significant at the 0.01 level (2-tailed).

### 4.5.2.3. Green manufacturing and distribution

In the assessment of SCM related to green manufacturing practices, the 3Rs of reuse, recycle and reduce have high means score of 2.90 because of the reuse of 20 lire water jar c collection from customers for reuse. However, environmental technology use, except the machines of production, green packaging and green transportation has got lowest mean score of 1.

The bottle raw materials called PET, cap raw material called HDP and plastic materials use for labelling and shirk wrap packages are not environmental friendly and are not also recycled by the companies, other than another tier of recyclers in the supply chain.

These materials are pollutants of environment these days known for taking hundred years for decomposition unless recycled and used for other purpose. They also use massive number of fossil fuel trucks for distribution of bottled waters to customers.

***Table 43: Mean score and Std. of bottled water Green manufacturing and distribution variable***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Manufacture Reduce Reuse Recycle | 20 | 2.90 | 1.447 | 1 | 4 |
| Environmental technology | 20 | 2.20 | 1.508 | 1 | 4 |
| Green Packaging | 20 | 1.00 | .000 | 1 | 1 |
| Green Transportation | 20 | 1.00 | .000 | 1 | 1 |

The validity test is significant for Manufacture Reduce Reuse Recycle.

***Table 44: validity test of bottled water Green manufacturing and distribution variable***

| | Manufacture Reduce Reuse Recycle | Environmental technology |
|---|---|---|
| Chi-Square | 9.100[a] | .800[b] |
| df | 2 | 1 |
| Asymp. Sig. | .011 | .371 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.7.
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

No significant correlation among the green manufacturing an green distribution variables. Where green manufacturing and green distribution are not practiced in the companies for they still use non-recycled materials and the companies don't recycle them neither.

#### 4.5.2.4. Reverse logistics

Basically the mean score of remanufacturing, recycling in the BWMC as exhibited the lowest mean score. Disposal mean score of 4.75 is the highest due to the response of excess water removal at least in to nearby drainages and river sides, which still is observed not supported by appropriate technology and use like for horticulture, water supply of community and other sectors. Collection and reuse have equal mean score of 3.25 due to the 20 Litre jar collected and reused by the factories. Other bottles made of PET and caps made of HDP material including plastic labels are still disposed in hundreds millions every year in the environment after customers used them.

***Table 45: Mean score and Std. of bottled water green manufacturing reverse logistics***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Collection | 20 | 3.25 | 1.333 | 1 | 4 |
| Remanufacturing | 20 | 1.30 | .923 | 1 | 4 |
| Recycling | 20 | 1.45 | 1.099 | 1 | 4 |
| Reuse Reverse | 20 | 3.25 | 1.333 | 1 | 4 |
| Disposal | 20 | 4.75 | .910 | 1 | 5 |

The validity test of chi square shows high significance for the measurement instrument goodness of fit to assess GSCM practices in BWMC.

***Table 46: Chi square test of bottled water green manufacturing reverse logistics***

| | Collection | Remanufacturing | Recycling | Reuse Reverse | Disposal |
|---|---|---|---|---|---|
| Chi-Square | 5.000[a] | 12.800[a] | 9.800[a] | 5.000[a] | 28.900[b] |
| df | 1 | 1 | 1 | 1 | 2 |
| Asymp. Sig. | .025 | .000 | .002 | .025 | .000 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 6.7.

The bivariate correlation of reverse logistics assessment for GSCM practices assessment shows that collection versus reuse because and remanufacturing versus recycling has got high significance level of relationship at the level of 0.01.

***Table 47: Bivariate correlation of bottled water green manufacturing reverse logistics***

| | | Collection | Remanufacturing | Recycling | Reuse Reverse | Disposal |
|---|---|---|---|---|---|---|
| Collection | Pearson Correlation | 1 | .192 | .243 | 1.000** | .358 |
| | Sig. (2-tailed) | | .416 | .303 | .000 | .121 |
| | N | | 20 | 20 | 20 | 20 |
| Remanufacturing | Pearson Correlation | | 1 | .793** | .192 | -.094 |
| | Sig. (2-tailed) | | | .000 | .416 | .694 |
| | N | | | 20 | 20 | 20 |
| Recycling | Pearson Correlation | | | 1 | .243 | -.039 |
| | Sig. (2-tailed) | | | | .303 | .869 |
| | N | | | | 20 | 20 |
| Reuse Reverse | Pearson Correlation | | | | 1 | .358 |
| | Sig. (2-tailed) | | | | | .121 |
| | N | | | | | 20 |
| Disposal | Pearson Correlation | | | | | 1 |
| | Sig. (2-tailed) | | | | | |
| | N | | | | | |

**. Correlation is significant at the 0.01 level (2-tailed).

### 4.5.3. GSCM practices Application challenge

The study partly addressed assessment of policy, certification, regulatory, standard, control and other challenges to apply GSCM in water bottling companies, where the descriptive analysis and correlation for relationship significance using bivariate analysis is presented hereunder.

The mean score indicates that the BWMC responded that they have little challenge of policy, skilled, Social (Customer and community) challenge. Financial and technology challenge were reported with high mean score of 2.82 and 2.69 respectively due to the recent shortage and constrain of foreign currency to import raw materials and spare parts-which even challenged many to reduce and stop production.

***Table 48: Mean score and Std. of GSCM Application challenges***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Policy | 16 | 1.625 | 1.0247 | 1.0 | 4.0 |
| Social Customer community | 17 | 1.88 | 1.111 | 1 | 4 |
| Financial | 11 | 2.82 | 1.601 | 1 | 5 |
| Technology | 16 | 2.69 | 1.852 | 1 | 5 |
| Skilled labour | 15 | 2.13 | 1.506 | 1 | 5 |
| Other Challenges | 16 | 1.13 | .342 | 1 | 2 |

The validity test of chi square shows high significance for challenges of application of GSCM in terms of policy, financial, social, technology. Skilled labour and other challenges.

***Table 49: Chi square validity test of GSCM Application challenges***

| | Policy | Social Customer community | Financial | Technology | Skilled labour | Other Challenges |
|---|---|---|---|---|---|---|
| Chi-Square | 17.000 | 7.235 | 1.000 | 7.500 | 10.333 | 9.000a |
| df | 3 | 3 | 3 | 3 | 3 | 1 |
| Asymp. Sig. | .001 | .065 | .801 | .058 | .016 | .003 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 8.0.

Social (Customer & community) with technology and skilled labour at 0.05 level.

***Table 50: Bivariate correlation of significance of GSCM Application challenges***

| | | Policy | Social Customer community | Financial | Technology | Skilled labour |
|---|---|---|---|---|---|---|
| Policy | Pearson Correlation | 1 | .081 | -.395 | -.171 | .121 |
| | Sig. (2-tailed) | | .775 | .230 | .526 | .668 |
| | N | | 15 | 11 | 16 | 15 |
| Social Customer community | Pearson Correlation | | 1 | .144 | .599* | .451 |
| | Sig. (2-tailed) | | | .672 | .018 | .106 |
| | N | | | 11 | 15 | 14 |
| Financial | Pearson Correlation | | | 1 | -.228 | .050 |
| | Sig. (2-tailed) | | | | .500 | .891 |
| | N | | | | 11 | 10 |
| Technology | Pearson Correlation | | | | 1 | .339 |
| | Sig. (2-tailed) | | | | | .216 |
| | N | | | | | 15 |

*. Correlation is significant at the 0.05 level (2-tailed).

The low mean score shows that the BWMCs responded that they have no as such challenge related to regulatory, standard, specification and certification. Very few indicated problem of certification, regulatory bodies capacity and some bureaucratic challenges including excise tax that they mentioned to have influenced cost of selling bottled water.

***Table 51: Mean score and Std. of regulatory, certification and other challenges/policy***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Challenge Regulatory procedure rule | 16 | 1.75 | 1.000 | 1 | 3 |
| Challenge Standard sectoral | 14 | 1.64 | .929 | 1 | 3 |
| Challenge Specification Sectoral | 14 | 1.43 | .852 | 1 | 3 |
| Challenge Regulatory Capacity | 19 | 1.63 | 1.300 | 1 | 5 |
| Challenge Certification | 13 | 2.00 | 1.414 | 1 | 5 |

The chi square statistics test of the variables of challenges in policy, standard, regulation and specification is significant.

***Table 52: Chi square validity test of regulatory, certification and other challenges/policy***

| | Challenge Regulatory procedure rule | Challenge Standard sectoral | Challenge Specification Sectoral | Challenge Regulatory Capacity | Challenge Certification |
|---|---|---|---|---|---|
| Chi-Square | 1.000[a] | 7.000 | 4.571[b] | 29.632 | 10.077 |
| df | 1 | 2 | 1 | 3 | 3 |
| Asymp. Sig. | .317 | .030 | .033 | .000 | .018 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 8.0.
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 7.0.

Challenge of sectoral Standard with Challenge of specification, regulatory Capacity with certification has got significance correlation at 0.01 level.

***Table 53: Bivariate correlation of regulatory, certification and other challenges/policy***

| | | Challenge Regulatory procedure rule | Challenge Standard sectoral | Challenge Specification Sectoral | Challenge Regulatory Capacity | Challenge Certification |
|---|---|---|---|---|---|---|
| Challenge Regulatory procedure rule | Pearson Correlation | 1 | .297 | -.026 | .152 | .438 |
| | Sig. (2-tailed) | | .302 | .930 | .589 | .154 |
| | N | | 14 | 14 | 15 | 12 |

| | | Challenge Regulatory procedure rule | Challenge Standard sectoral | Challenge Specification Sectoral | Challenge Regulatory Capacity | Challenge Certification |
|---|---|---|---|---|---|---|
| Challenge Standard sectoral | Pearson Correlation | | 1 | .792** | .149 | .239 |
| | Sig. (2-tailed) | | | .001 | .628 | .454 |
| | N | | | 14 | 13 | 12 |
| Challenge Specification Sectoral | Pearson Correlation | | | 1 | .099 | -.027 |
| | Sig. (2-tailed) | | | | .747 | .934 |
| | N | | | | 13 | 12 |
| Challenge Regulatory Capacity | Pearson Correlation | | | | 1 | .856** |
| | Sig. (2-tailed) | | | | | .000 |
| | N | | | | | 13 |
| Challenge Certification | Pearson Correlation | | | | | 1 |
| | Sig. (2-tailed) | | | | | |
| | N | | | | | |

**. Correlation is significant at the 0.01 level (2-tailed).

All in all, the factories responded to the question of challenge to implement the GSCM practices as attributed mainly to the following issues.

Using recycled materials for water packaging is not permitted as it is related to health. However, recycling and GSCM is not also encouraged by policy of the companies themselves and regulatory bodies; which could be due to the low or hardly prevalent exposure and knowledge of GSCM concept, advantage and benefit in the water bottling sector.

Technology exposure, investment capital and market for GSCM practices like excess/demineralized water management, recycling and related market chain for the reverse logistics are not familiarized in the sector by the regulatory bodies and owners.

The finance problem due to foreign currency problem is also a challenge to implement GSCM technologies. GSCM Collaboration absence with in the sector, with supplier, regulatory bodies and other similar sectors is not familiar.

### 4.5.4. GSCM measurement alternative practices

The presence of other alternative GSCM measurement practices ( e.g. TQM, green SCOR and BSC) in BWMC supply chain measurement; and presence of ISO certification and corporate social responsibility (CSR) in terms of environmental initiative effort and investing in the community for the community were assessed and the result shows absence of such supply chain performance including GSCM.

The descriptive statistics, validity test using non-parametric test of Chi Square and correlation for relationship significance using bivariate analysis is made hereunder.

There is low mean score of all alterative supply chain measurement including GSCM performance like using TQM, green SCOR, and green BSC during product and operational life cycle is barely present. Some claim use of TQM and JIT is applied for 20 lire jar water production as per customer order. The CSR practice itself is not that much significant except few community initiatives in tap water supply because it is not in their company policy.

***Table 54: Mean score of other alternative GSCM measurement practices***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| PDCA | 20 | 1.70 | .470 | 1 | 2 |
| Green SCOR | 20 | 1.90 | .308 | 1 | 2 |
| Green BSC | 20 | 1.90 | .308 | 1 | 2 |
| JIT | 20 | 1.60 | .503 | 1 | 2 |
| TQM | 20 | 1.60 | .503 | 1 | 2 |
| Product Life Cycle | 20 | 1.90 | .308 | 1 | 2 |
| Operation Life Cycle | 20 | 1.90 | .308 | 1 | 2 |

The validity chi square test of statistics is significant for all variables except TQM.

***Table 55: Chi square statistics of other alternative GSCM measurement practices***

| | PDCA | Green SCOR | Green BSC | JIT | TQM | Product Life Cycle | Operation Life Cycle |
|---|---|---|---|---|---|---|---|
| Chi-Square | 3.200[a] | 12.800[a] | 12.800[a] | .800[a] | .800[a] | 12.800[a] | 12.800[a] |
| df | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Asymp. Sig. | .074 | .000 | .000 | .371 | .371 | .000 | .000 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

The correlation of bivariate analysis shows presence of high significant correlation among the variables of alternative GSCM measurement variables assessed in the BWMC. At the level of 0.05 PDCA vs Green SCOR, Product life cycle and operation life cycle, Green SCOR with green BSC, green BSC with Product life cycle and operation life cycle. At 0.01 level green SCOR with Product life cycle and operation life cycle; also product life cycle with operation life cycle with 0.01 level of significant relationship.

***Table 56: Bivariate correlation of other alternative GSCM measurement practices***

| Spearman's rho | | PDCA | Green SCOR | Green BSC | JIT | TQM | Product Life Cycle | Operation Life Cycle |
|---|---|---|---|---|---|---|---|---|
| PDCA | Correlation Coefficient | 1.000 | .509* | .145 | -.089 | .134 | .509* | .509* |
| | Sig. (2-tailed) | | .022 | .541 | .709 | .574 | .022 | .022 |
| | N | | 20 | 20 | 20 | 20 | 20 | 20 |
| Green SCOR | Correlation Coefficient | | 1.000 | .444* | .068 | .068 | 1.000** | 1.000** |
| | Sig. (2-tailed) | | | .050 | .776 | .776 | . | . |
| | N | | | 20 | 20 | 20 | 20 | 20 |
| Green BSC | Correlation Coefficient | | | 1.000 | .408 | .408 | .444* | .444* |
| | Sig. (2-tailed) | | | | .074 | .074 | .050 | .050 |
| | N | | | | 20 | 20 | 20 | 20 |
| Other JIT | Correlation Coefficient | | | | 1.000 | .375 | .068 | .068 |
| | Sig. (2-tailed) | | | | | .103 | .776 | .776 |
| | N | | | | | 20 | 20 | 20 |
| TQM | Correlation Coefficient | | | | | 1.000 | .068 | .068 |
| | Sig. (2-tailed) | | | | | | .776 | .776 |
| | N | | | | | | 20 | 20 |
| Product Life Cycle | Correlation Coefficient | | | | | | 1.000 | 1.000** |
| | Sig. (2-tailed) | | | | | | | . |
| | N | | | | | | | 20 |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

### 4.5.5. GSCM Collaboration

The GSCM collaboration was also assessed and described as follows. The validity of the measurement and presence of relationship between the variables used to assess collaboration is analysed using non-parametric test of Chi Square for statistics validity and correlation using bivariate analysis is made.

The mean square indicates that collaboration with in the sector, outside, with regulatory bodies including ISO certification is very low. Almost all responded that there is no as such significant collaboration except the membership of the majority manufacturers in the Ethiopia bottled Water and Beverage, Fruit and Vegetable Manufacturing Industry Association (EBWFMIA).

This was observed during the study data collection that there is high resistance for accepting participation in research and development. During visiting the 20 BWMC, except exceptional few cooperative factory managers and owners, many refused to participate ad those participated opened their iron doors after repeated appointment by phone and 10s of KMs travel to the far factory sites.

***Table 57: Mean score and Std. of collaboration in BWMC***

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| GSCM Incentive | 19 | 2.00 | .000 | 2 | 2 |
| Collaboration sector | 19 | 1.05 | .229 | 1 | 2 |
| Collaboration outside | 18 | 1.78 | .428 | 1 | 2 |
| Collaboration regulatory | 18 | 1.89 | .323 | 1 | 2 |

The statistics validity test proved significant for assessment of the collaboration aspect of BWMC.

***Table 58: statistics validity test-chi square of collaboration in BWMC***

| | Collaboration sector | Collaboration outside | Collaboration regulatory |
|---|---|---|---|
| Chi-Square | 15.211[a] | 5.556[b] | 10.889[b] |
| df | 1 | 1 | 1 |
| Asymp. Sig. | .000 | .018 | .001 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 9.5.
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 9.0.

Collaboration outside BWMC with Collaboration with regulatory has shown significant correlation from the bivariate analysis at 0.01 level.

***Table 59: Bivariate correlation of collaboration in BWMC***

| | | Collaboration sector | Collaboration outside | Collaboration regulatory |
|---|---|---|---|---|
| Collaboration sector | Correlation Coefficient | 1.000 | .130 | .086 |
| | Sig. (2-tailed) | | .608 | .735 |
| | N | | 18 | 18 |
| Collaboration outside | Correlation Coefficient | | 1.000 | .661** |
| | Sig. (2-tailed) | | | .003 |
| | N | | | 18 |
| Collaboration regulatory | Correlation Coefficient | | | 1.000 |
| | Sig. (2-tailed) | | | |
| | N | | | |

## 4.5.6. Conclusion of discussion and analysis

### 4.5.6.1. Hypothesis

According to the aforementioned research analysis outcome using descriptive statistics mean score and Std., non-parametric chi square test of statistics and significance of correlation using bivariate analysis with Pearson and Spearman tests, the null hypothesis ($H_0$): Social, economic and environmental perspectives significantly affect GSCM practice of bottled water manufacturing companies in Ethiopia is acceptable at 95% and 99% except for few variables as mentioned below.

In economic perspective, among GSCM quality measurement category of variables:

No significant relationship in terms of GSCM quality assurance for customer compliance in addressing their complaints and using greening activities, and the mean square show low mean but it is because of the response of the WBMC who said that they have no almost complaint from customers except few admitted packaging problems of cap and shrink wrap of bottles, but on the other way they responded absence of green certification and green warranty costs related to GSCM in their factories, which is related to the low mean score value.

In environmental perspective, among level of process measurement category variables:

There is no significance relationship between the factories reduced waste level during production and reduced energy level use during product distribution. Because they are in bound and out bound activities in their supply chain. There is high pollution control and waste reduction level in the factory because of the technology used for bottling; on the contrary outside the factory during distribution, there is high level use of massive fossil fuel for transportation.

And among the dependent variables of GSCM practices of reverse logistics, eco-design, green purchasing, green manufacturing and green distribution, the following variables among green purchasing and manufacturing and distribution has no significant relationship.

Green purchasing variable category has no significance, but the three Rs (Reuse, reduce & recycle) have highest mean score of 2.85 because of the response of the application of reuse of 20 litre Jar water bottle which the factories collect from customers through their distributers.

In the assessment of SCM related to green manufacturing practices, the 3Rs of reuse, recycle and reduce have high means score of 2.90 because of the reuse of 20 lire water jar c collection from customers for reuse. However, environmental technology use, except the machines of production, green packaging and green transportation has got lowest mean score of 1. The bottle raw materials called PET, cap raw material called HDP and plastic materials use for labelling and shirk wrap packages are not environmental friendly and are not also recycled by the companies, other than another tier of recyclers outside the supply chain. These materials are pollutants of environment these days known for taking hundred years for decomposition unless recycled and used for other purpose. They also use massive number of fossil fuel trucks for distribution of bottled waters to customers.

### 4.5.6.2. Challenges

Policy, regulatory bodies' capacity, sectoral and standard challenges and skilled labour were mentioned as significant ones. Apart from these major other challenges were forwarded by the respondents include frequent electric black out that oblige them to use fossil fuel generator for production, foreign currency that posed very high raw material and spare part shortage which again brought about production interruption, excise tax, unstable labour because of competition and quality standard and testing technology challenges.

**i. GSCM application**

Social (Customer & community) with technology and skilled labour at 0.01 level, financial with technology at 0.05 level and technology with skilled labour at 0.01 level show significant correlation among the application challenge of the BWMC who responded to the quantitative data collection.

**ii. Regulatory, certification and standard**

Challenge of regulatory procedure with regulatory bodies' capacity and certification, sectoral standard with regulatory Capacity and regulatory bodies' capacity with certification has got significance correlation at 0.01 level.

### 4.5.6.3. GSCM collaboration

Collaboration outside BWMC with Collaboration with regulatory has shown significant correlation from the bivariate analysis at 0.01 level.

The BWMC have got association that also recently established recycling and green economy development association. And respondents indicated that they have collaboration in the sector from lobbying together to information sharing and capacity building.

However, all admitted that they have got problem of collaboration outside the sector including with local and foreign suppliers of raw materials, machines and spare parts, except during procurement and installation of machines and production units during introduction phase.

It was observed during the painstaking communication with bottling companies representatives and owners that the water manufacturing sector seems to have an iron gate and they seems closed for Research and development and communication. They also seem so suspicious and instigate suspicion on the mind of the researcher in return as why their doors are so closed so tightly. In the meantime, this may show the low awareness of the companies on the importance of research and development for growth and creation of competitive advantage. Such mistrust and suspicion are hindrance for collaboration, which intern become hindrance for the growth of the sector to create competitive and alternative advantage.

Eventually, as an instance of collaboration, the sector could have done much and could have created high competitive advantage from recycling of the bottles that remain disposed at the customers end. This could have achieved by strong collaboration with in the sector or by forming partnership collaboration with recyclers-which are flourishing these days and are even exporting recycled raw materials.

#### 4.5.6.4. Other GSCM measurement alternatives application

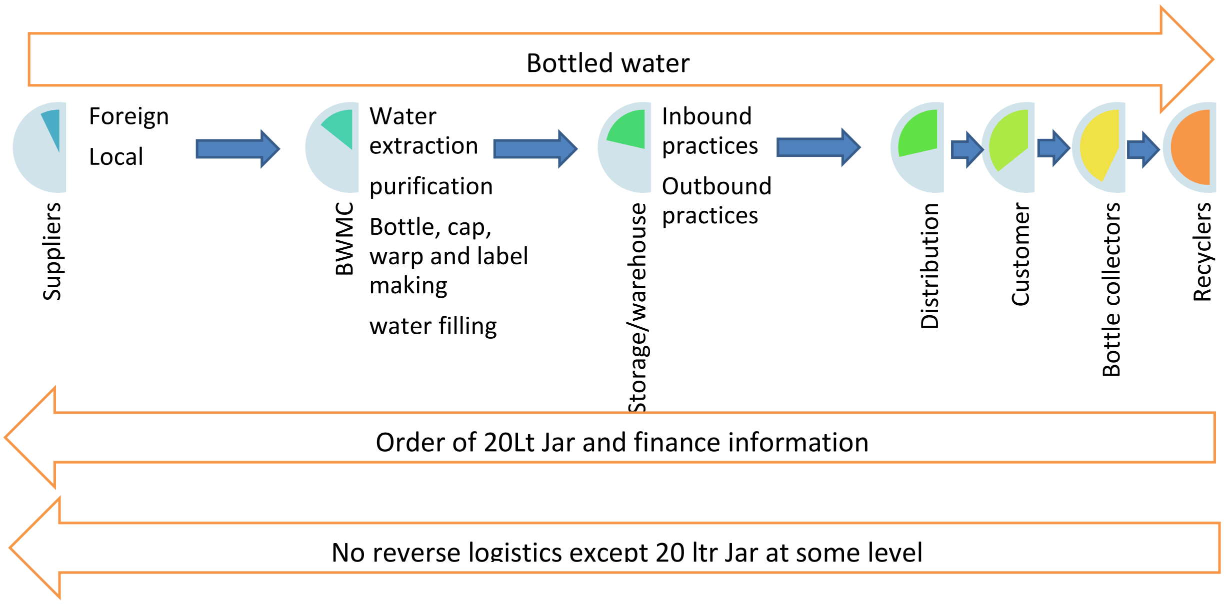
The correlation of bivariate analysis shows presence of high significant correlation among the variables of alternative GSCM measurement variables assessed in the BWMC. At the level of 0.01 PDCA vs Green SCOR, Green BSC, Product life cycle and operation life cycle and Green SCOR with operation and product life cycle, Green BSC with JIT, TQM, product and product life cycle with operation life cycle. Finally, operation life cycle, and at 0.05 level JIT with TQM

## 4.6. Participatory observation

### 4.6.1. SC of water bottling companies

Though the supply chain mapping is not clearly mapped by the sector and the water bottling companies, the following SC is practically existent in water bottling business including GSCM.

***Figure 11: Observed components of SC of the 20 BWMC***




### 4.6.2. Concept of GSM in the water bottling sector

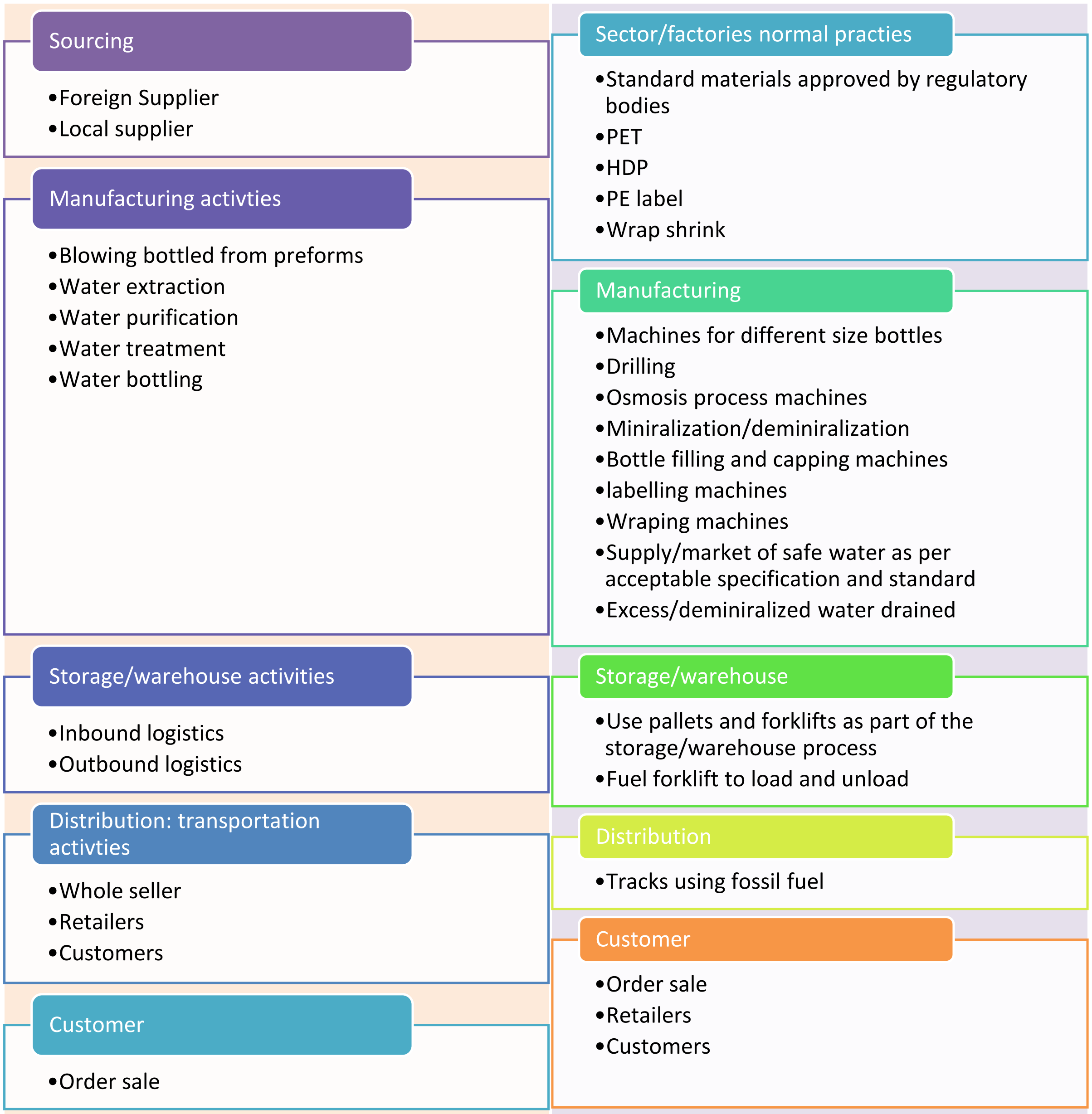
Concept of GSCM is hardly existent in the water bottling industry, when there is many that has to be dealt with in light of it; like recycling, eco-design, Eco labeling, waste management of excess water/demineralized water, distribution, reduction of raw material by collecting and reusing like Jar.

One experience done in the water industry related to the removal of neck seal from bottled waters, which was decided with in the water and beverage association. This helped reduce waste, which was hard to decompose, and this reduced raw material which has high implication in cost, time and energy use of factories-which ultimately increase revenue and bring about competitive advantage.

### 4.6.3. Traditional and green logistics and supply chain in Bottled water manufacturing sector

It was found out that the supply chain with in the sector is not well defined and studied, that almost every factory employ the same sourcing, production and distribution strategy, and much competition is prevalent in the sector that hardly there is one that tries to create competitive advantage like by using GSCM which has such benefit if implemented and well exploited. From the data collection, observation and discussion with respondents figure-12 depicts the supply chain and the activities performed in the factories.

***Figure 12: The SC and related activities in BWMC***



# CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

## 5.1. Conclusions

The study used structured questionnaire based on Likert five scale to assess the GSCM practices in BWMC in and around Addis Ababa, which are located within 45 KM radius, based on then following criteria from which have weight of 1(the lowest/very low and means strongly disagree) to 5 (the highest/very high and means strongly agree).

Adapting the GSCM measurement factors and practices of Kafa, Hani and Mhamedi (2013), the assessment tool used three independent variables, economic, environmental and social perspective of sustainable development; which in themselves have been divided in other factors and sub-factors. Likewise, the dependent variables, which are the GSCM practices, namely, reverse logistics, eco-design, green manufacturing, green purchasing and green distribution. These practices also were divided into other assessment variables and sub-variables.

Therefore, the economic perspective factors assessed availability of environmental costs associated with GSCM for environmental compliance of national policy, ISO certification like ISO14000 and ISO 31000, cost associated with consumption of clean energy during manufacturing and distribution of bottled water, recycling cost, excess and demineralized water and others wastes management and disposal cost and cost purchasing environmentally friendly materials. Presence of costs of GSCM related to information sharing, ordering, inventory and delivery were also assessed. Moreover, the economic perspective factor addressed greening related quality issues associated with customer compliance like packaging, green product certification and green product warranty in the BWMC.

The environmental perspective factors tried to observe and assess in the respondent BWMC issues associated with process management practices in light of process optimization for waste reduction, pollution level control during production and distribution, practices to reduce amount of energy consumption like fossil fuel. Product features like use of recycled materials in products, eco-labelling, recycling efficiency related to waste reduction, recycling time and amount of recycling energy were seen. Environmental technology that includes clean technology use-electric forklift, solar and wind energy and number of new product and process available in terms of GSCM were also assessed.

The social perspective factor of sustainable development assessment addressed management commitment and effort to motivate staff, take environmental initiative and effort to raise customer awareness and satisfaction including satisfying customer interest in greening through packaging and other materials use, employee development and training in GSCM and practice of participating and or organizing such forums.

With respect to the dependent variables of GSCM practices green purchasing issues like selection of green suppliers, environmental collaboration with suppliers and availability of the 3Rs (reduce, reuse and recycle) were discussed. Eco-design activities presence seen include reducing material/energy consumption, the 3Rs and use of hazardous materials were assessed. In the green manufacturing part, environmental friendly technology use in factory during water extraction and packaging, warehouse, distribution related to fossil fuel use in transportation versus renewable energy in factories including g green packaging were assessed. Moreover, the reverse logistics activities like collection, recycling, disposal, reuse and remanufacturing were raised in the assessment.

Moreover, the study partly addressed assessment of policy, certification, regulatory, standard, control and other challenges to apply GSCM in water bottling companies, the presence of other alternative GSCM measurement practices (TQM, green SCOR and BSC) in BWMC supply chain measurement and finally presence of ISO certification and corporate social responsibility (CSR) in terms of environmental initiative effort and investing in the community for the community.

Finally, the GSCM collaboration was also assessed and described as follows. The validity of the measurement and presence of relationship between the variables used to assess collaboration is analysed using non-parametric test of Chi Square and correlation using bivariate analysis is made. Apart from the five scale likert to assess the above assessment variables dichotomy questions and question that have five scale measurement of low/absent, below average, average, high and very high were applied for the respondents to rate their answers.

Eventually, the analysis is made based on the above assessment factors and variables detail and presented as descriptive statistics of mean and standard deviation; and inferential statistics of non-parametric test for validity of the measurement using chi square and bivariate analysis is used for significance of correlation presence between them which helped to interpret the acceptance or rejection of the null hypothesis.

Therefore, the practice of GSCM is few like electric forklifts used because of the regulatory obligation, collection of jar for reuse; otherwise, the sourcing does not take into account environmental friendly and easily recyclable materials, the production does not consider the use of eco labelling, use of bottles like glasses that are easily reusable. Rather, the sstandard materials approved by regulatory bodies, but are not environmentally friendly if not recycled and reused, which is the day to day phenomena in our environment, are used. They are disposed everywhere and are observed from land to water bodies including oceans.

The factories responded to the question of challenge to implement the GSCM practices that it is attributed to mainly using recycled materials is not permitted. However, recycling and GSCM is not also encouraged by policy of the companies themselves and regulatory bodies. This could be due to the low or hardly prevalent exposure and knowledge of GSCM concept, advantage and benefit in the water bottling sector and certification and regulatory bodies.

Technology exposure, investment capital and market for GSCM practices like excess/demineralized water management, recycling and related market chain for the reverse are not familiarized in the sector by the regulatory bodies and owners. The finance problem due to foreign currency problem is also a challenge to implement GSCM technologies. GSCM Collaboration with in the sector, with supplier, regulatory bodies and other similar sectors is not familiar.

All in all, it was found out that 100s of millions of bottles are disposed at the customer end. The practice of GSCM is almost non-existent in concept and practice except with few traditional signs like battery forklifts used because of the regulatory obligation and collection of jar for reuse; otherwise, the sourcing does not take into account environmental friendly like recyclable materials, the production does not consider the use of eco labelling, use of reusable bottles like glasses, paper labels and packaging materials. Excess, demineralized, waste water is simply disposed to the surrounding drainage or rive. Moreover, tens of 100s trucks are used to distribute bottled water to customers using fossil fuel. The sector has got collaboration challenges with in itself and suppliers, regulatory bodies, recyclers and customers

## 5.2. Recommendation

It can be concluded that the GSCM practices observed in the sector are because of the system itself and obligation imposed by regulatory bodies like using battery forklift in the warehouse and factory inbound logistics. Some treat the excess water and release it to sewerage or drainage or river steams for reuse by the community for horticulture and construction works.

Therefore, the practice of GSCM is few like electric forklifts used because of the regulatory obligation, collection of jar for reuse.

Otherwise, the sourcing does not take into account environmental friendly and easily recyclable materials, the production does not consider the use of eco labelling, use of bottles like glasses that are easily reusable.

Therefore, based on the exposure during the assessment in the factories, and seeing available alternatives, the following chart is prepared to be taken into account by the companies.

***Figure 13: existing. Used materials and suggested materials.***

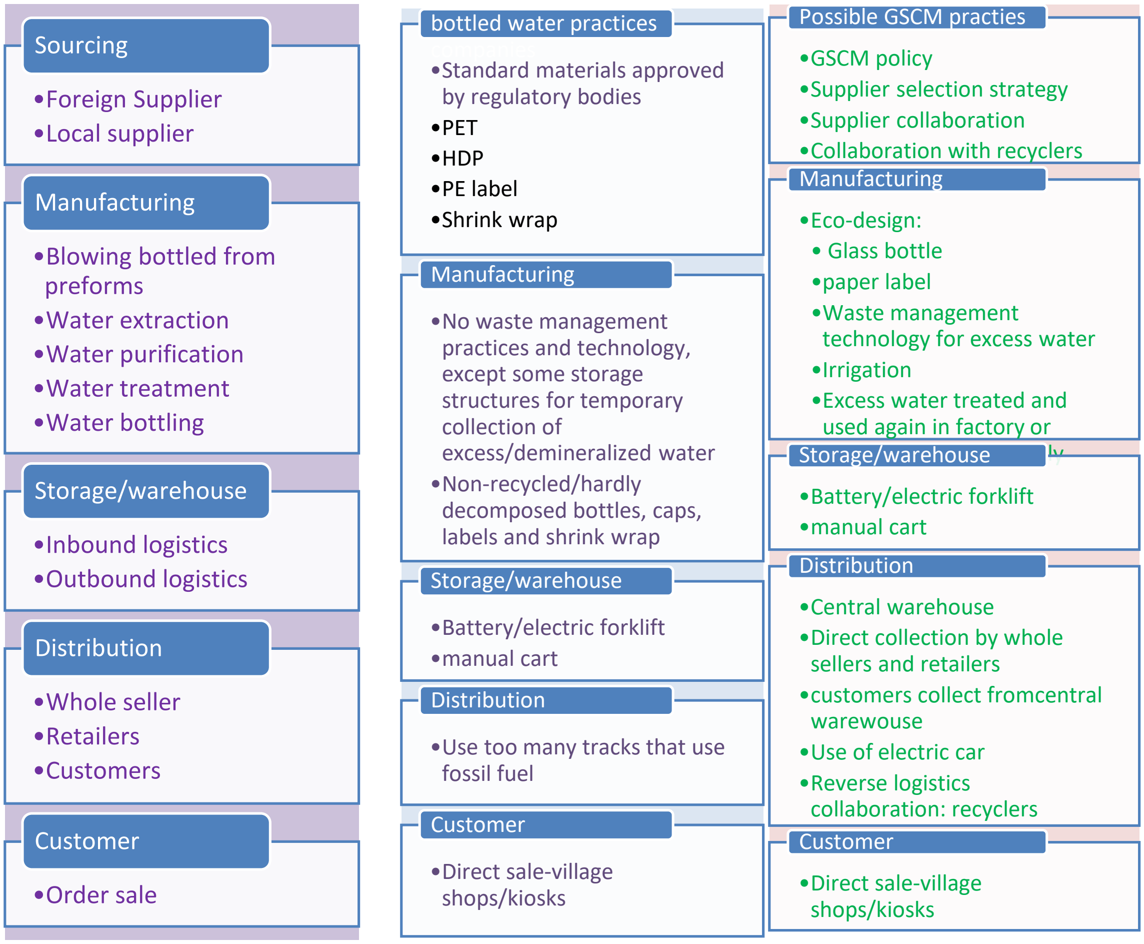
| Used materials | Suggested materials |
|---|---|
| • **PET**<br>• **HDP**<br>• **PE label**<br>• **Shrink wrap** | • Glasses<br>• Stainless steel caps<br>• Paper label<br>• Cartoon wraps |

The excess/demineralized water is disposed to the nearby stream, drainage even wetting roads which some factories have been challenged by the surrounding community. This could have been supported by water treatment technology like to reuse the excess water, treat and dispose for irrigation by community or to be integrated with the community water supply.

Eventually, as an instance of collaboration, the sector could have done much and could have created high competitive advantage from recycling of the bottles that remain disposed at the customers end. This could have achieved by strong collaboration with in the sector or by forming partnership collaboration with recyclers-which are flourishing these days and are even exporting recycled raw materials.

All, in all the sector needs to be clearly accountable to its customers and community where water is extracted.

***Figure 14: existing and recommended GSCM practices and materials***




## 5.3. Gaps for Future Studies

The study addressed the green supply chain practices in the four corners of the bottled water manufacturing companies' factory setting. It was also limited in and around Addis Ababa in 20 companies, where the MoTI (2021) data showing that 195 companies have been registered to produce bottled water in Ethiopia. Moreover, policy and related certification and regulatory and standard issues in terms of GSCM are not investigated except they are included in identification of collaboration and challenges of the sector.

Therefore, the study can be carried out to address the whole supply chain stages from supplier to customers and recyclers. The massive fossil fuel use by tens of hundreds bottled water distribution trucks can also be an area of further study of GSCM in the sector. There are hundreds of distributers who work with BWMC who use high number of fossil fuel trucks which is not environmental friendly. There is good collection practice 20 litre jar for reuse, but still as billions of bottles remain in the customer environment that may be of interest for studying the reverse legists aspect of the bottled water manufacturing business.

It was also observed during the study that the use of environmentally friendly materials is poor; and this area can be of research interest to be addressed in finding alternative environmentally materials other than the currently used PET, HDP, PE packaging materials and the likes. The study can also be extended to recyclers outside and inside the sector, if any.

Excess water management can be another research area. Because there is abundant excess/demineralized/water waste observed flowing out of the factories that has high potential of reuse for the factories themselves or for the supply of water for the nearby towns and villages some of whom crave for potable water access; or for the use of other sectors like construction works-as reported by some BWMC, irrigation for horticulture production and the likes that couple of the factories claim that they have been addressing.

The GSCM performance measurement for the sector can also be studied to identify relevant and appropriate methods and tools for improving the GSCM practices of the factories in particular and the bottled water manufacturing industry in general.

Moreover, the policy, regulation, certification and standard issues with respect to GSCM application in the sector can be one area of research interest.

Finally, the collaboration problem of the sector can also be another research gap in terms of addressing GSCM practice and implementation in the sector. In addition the CSR aspect can be of interesting area of research for the surrounding community and the sector to benefit each other.

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## Appendix-1: Quantitative data collection instrument

**Addis Ababa University, School of Commerce**
**Logistics and Supply Chain Department, Graduate program**
**Masters' Thesis Research**

Date: ____________________

### I Introduction:

The interview is prepared for Master's Thesis Research in partial fulfilment of Logistics and Supply Chain Management graduate program in Addis Ababa University School of Commerce.

The study is intended to assess the application of **Green Supply Chain management (GSCM**) in Bottled water manufacturing companies in Ethiopia, under the title "**Assessment of Green Supply Chain Management Practices in Bottled Water Manufacturing Companies In and around Addis Ababa-Ethiopia**" within 45 km radius.

Thus, I kindly request the consent of your company to participate in the interview assigning concerned lead staff from factory manager, purchasing/sourcing, manufacturing, and marketing and distribution who have the experience and skill in your supply chain/value chain activities.

Your company and lead staff confidentiality is kept throughout data collection and analysis and reporting.

Please take your time and contribute your part to this study that may also serve the interest of your manufacturing sector in GSCM.

Therefore, I the undersigned respondent read/heard the above introduction about the research and have agreed to participate filling this questionnaire and give my consent willingly.

Respondent:

Name: ________________________________

Sign: _________________________________

Date: _________________________________

Place: ________________________________

I, the researcher also give my assurance to the respondent that the information/data of the respondent will not be used for other purpose other than the thesis report and publication; and in doing so the name and specific information of the respondent and the company will not be mentioned in the report/publication, but analysis and reporting will be made as part of the whole study and finding in aggregate.

**Name: Menberu Adane**

**Sign: ____________________________**

**Date: _____________________________**

**Place: ____________________________**

## II Company data

Organogram of the bottling company: departments/functions

1 Company name:

2 Location:

3 Year of Establishment:

4 Bottled water brand/name:

5 Bottling material used (plastic/glass):

6 Total production capacity/hr: Bottles

7 Total actual production/hr: bottles

8 Investment in Green Supply Chain management (GSCM practices: technology (In Birr) e.g. recycle, electric forklift, excess water treatment/waste management

9 Investment in Green Supply Chain management (GSCM measurement (In Birr) e.g. ISO certification, impact assessment…

10 Tick the bottles size you use for bottling water:

300ml

500ml

1000ml

1500ml

2000ml

2500ml

Jar, 20 liter

Other size (please state)

11 Do you use battery/electric forklift in the factory? Yes ☐ No ☐

12 Do you use fuel forklift for loading unloading? Yes ☐ No ☐

13 What is percent of waste reduction on average for using bottling raw materials including preforms?

(e,g 0.5%, 1%, 2% etc)

14 Do you have Green Supply Chain management (GSCM) in your corporate, business, production and distribution policy etc. Yes ☐ No ☐

## III Respondent data:

1 Name

2 Position/job:

3 Sex:

4 Age:

5 Qualification/education:

6 Green Supply Chain management (GSCM) Training/exposure/experience like: recycle, reuse, ISO certification, environmental training, waste management etch Yes ☐ No ☐

## IV Interview on GSCM in the company

**Key to Measurement Scale:**

1= Not practiced/applied at; all and it means strongly disagree (SD)

2= satisfactorily practiced/applied but without the awareness of staff as part of the manufacturing set up- routine task, and means disagree (D)

3= Well practiced/applied with awareness of staff but as part of the manufacturing set up-routine task (average); and means neutral (N)

4= highly practiced/applied supported with Technology and training for staff; and means agree (A)

5= Very highly practiced/applied with the use of technology and training for staff with organizational culture and supported by strategy and policy; and means strongly agree (SA)

## Note: GSCM is Acronym for Green supply Chain Management

Please rate your company in the following table as per the above key to the measurement scale. Tick or put X mark under the scale numbered from 1 to 6 as per the above Key.

| No. | GSCM application description | Measurement scale | |
|---|---|---|---|
| **1** | **GSCM skill or knowledge** | | |
| 1.1 | Do you have GSCM training, experience/exposure?<br>(please put X mark in the next box) | **Yes** | **No** |
| 1.2 | Mention the training you have got related to GSCM | | |
| 1.3 | Do you think you apply GSCM in your company? | **Yes** | **No** |

| No. | GSCM application description | Measurement scale | | | | |
|---|---|---|---|---|---|---|
| | (please put X mark in the next box) | | | | | |
| **I.** | **GSCM Sustainable Development performance measurement perspectives/factors** | | | | | |
| 2 | Do you think you have environmental performance measurement in your company? (please put X mark in the next box) | **Yes** | | **No** | | |
| 3 | How do you rate, using 1 to 5 scale measure seen in the key above, environmental performance measurement in your company in terms of the following economic, environmental and social perspective factors? | | | | | |
| **3.1** | **Economic perspective/factors to apply GSCM practices** | | | | | |
| I | Availability of environmental cost associated with: | **1** | **2** | **3** | **4** | **5** |
| A | Environmental compliance, e.g. associated with national/certification/regulatory policy, ISO 14000 | | | | | |
| B | Recycling cost | | | | | |
| C | Cost associated with the consumption of clean energy, e.g. solar other than hydro-electric grid supply, non-fossil transport/distribution | | | | | |
| D | Disposal costs-e.g. waste management | | | | | |
| E | Cost for purchasing environmentally friendly materials | | | | | |
| II | Availability of traditional supply chain cost as applied to GSCM (not the cost of normal activities) | **1** | **2** | **3** | **4** | **5** |
| A | Delivery cost | | | | | |
| B | Inventory cost | | | | | |
| C | Information sharing cost | | | | | |
| D | Ordering cost | | | | | |
| III | Availability of GSCM quality measures<br>(please put X mark in the next box) | | | | | |
| A | Customer complaints-e.g. packaging | **Yes** | | **No** | | |
| B | Availability of green product certification give to company | **Yes** | | **No** | | |
| C | Availability of green product warranty | **Yes** | | **No** | | |
| **3.2** | **Environmental perspective factors to apply GSCM practices** | | | | | |

| No. | GSCM application description | Measurement scale | | | | |
|---|---|---|---|---|---|---|
| I | Availability of GSCM process management practices | **1** | **2** | **3** | **4** | **5** |
| A | Process optimization for waste reduction in % | | | | | |
| B | Pollution level control: waste and emissions during production and distribution of products | | | | | |
| C | Practice to reduce amount of energy consumption like fuel for distribution of products | | | | | |
| II | Product features | **1** | **2** | **3** | **4** | **5** |
| A | Use of recycled material in products | | | | | |
| B | Practice/Availability of eco-labelling | | | | | |
| III | Recycling efficiency | **1= low** | **2= below average** | **3=average** | **4= high** | **5 = Very high** |
| A | Recycling time | | | | | |
| B | Amount of energy consumption during the recycling<br>(how much_________________) | | | | | |
| C | Waste reduction | | | | | |
| IV | Environmental technology | **1** | **2** | **3** | **4** | **5** |
| A | Use of clean technologies | | | | | |
| B | Number of new products and process | | | | | |
| **3.3** | **Social Perspective factors to apply GSCM practices** | | | | | |
| I | Management Commitment | **1** | **2** | **3** | **4** | **5** |
| A | Effort to motivate employees | | | | | |
| B | Environmental management initiatives | | | | | |
| C | Effort to raise consumer awareness of sustainability-GSCM | | | | | |
| II | Customer satisfaction | **1** | **2** | **3** | **4** | **5** |
| A | Effort to address customer interest in green products, e.g. green packaging, recycling | | | | | |
| II | Employee development | **1** | **2** | **3** | **4** | **5** |

| No. | GSCM application description | Measurement scale | | | | |
|---|---|---|---|---|---|---|
| B | Special green training programs (GSCM) | | | | | |
| C | Participation in conference /fairs related to SD | | | | | |
| **II.** | **GSCM practices and technologies used** | | | | | |
| 4 | Do you think that you use/have/invested technologies that adhere GSCM practices? (please put X mark in the next box) | **Yes** | | **No** | | |
| 4 | If yes to the above, how do you rate it in terms of the availability of the following GSCM practices in your company? | | | | | |
| 4.1 | Green purchasing | **1** | **2** | **3** | **4** | **5** |
| A | Selection of eco-suppliers | | | | | |
| B | Environmental collaboration with suppliers. | | | | | |
| C | The 3Rs (reduce, reuse & recycle) | | | | | |
| 4.2 | Eco-design, Design of product to: | **1** | **2** | **3** | **4** | **5** |
| A | Reduce material/energy consumption | | | | | |
| B | The 3Rs (Reduce, Reuse and recycle) | | | | | |
| C | Avoid use of hazardous materials | | | | | |
| 4.3 | Green manufacturing | **1** | **2** | **3** | **4** | **5** |
| A | The 3Rs (Reduce, Reuse and recycle) | | | | | |
| B | Advanced environmental technology, e.g. warehouse, water extraction, packaging, distribution | | | | | |
| 4.4 | Green distribution, e.g. free of fossil fuel and use of renewable energy | **1** | **2** | **3** | **4** | **5** |
| A | Green packaging practice | | | | | |
| B | Green transportation practice | | | | | |
| 4.5 | Reverse Logistics | **1** | **2** | **3** | **4** | **5** |
| A | Collection | | | | | |
| B | Remanufacturing | | | | | |
| C | Recycling | | | | | |
| D | Reuse | | | | | |
| **III.** | **GSCM application challenges** | | | | | |

| No. | GSCM application description | Measurement scale | | | | |
|---|---|---|---|---|---|---|
| 5 | How do you rate your challenges to apply GSCM in terms of the following perspective/factors | **1= low/absent** | **2= below average** | **3=average** | **4= high** | **5 = Very high** |
| 5.1 | Policy:(Mention___________________________ _______________________________) | | | | | |
| 5.2 | Social like customer, community etc (Mention__________________________________ ________) | | | | | |
| 5.3 | Financial (what?____________________) | | | | | |
| 5.4 | Technology availability | | | | | |
| 5.6 | Technology skilled labour | | | | | |
| 5.6 | Other---------------------------------technical factors | | | | | |

**IV. Regulatory and standard/specification challenges**

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | How do you rate ***regulatory, standard and specification*** challenges to apply GSCM in terms of the following perspective/factors | **1= low/absent** | **2= below average** | **3=average** | **4= high** | **5 = Very high** |
| 6.1 | Certification, Regulatory/standard and other procedure/rule challenges | | | | | |
| 6.2 | Standard challenges: sectors related | | | | | |
| 6.3 | Specification challenges: detail product specifics | | | | | |
| 6.4 | Certification, Regulatory/standard and other bodies capacities | | | | | |
| 6.5 | Certification bodies challenges | | | | | |
| 6.6 | Other bodies like finance-------------------------------- challenges | | | | | |
| 6.7 | Do you get GSCM support-incentive (policy, technology, finance, capacity building)? (please put X mark in the next box) | **Yes** | | **No** | | |
| 6.8 | Do you have collaboration/network/forum in the sector? (please put X mark in the next box) | **Yes** | | **No** | | |
| 6.9 | Do you have GSCM collaboration/network/forum in and outside the sector? (please put X mark in the next box) | **Yes** | | **No** | | |

| No. | GSCM application description | Measurement scale | |
|---|---|---|---|
| 6.10 | Do you have GSCM collaboration/network/forum with certification/ regulatory/standard and others bodies? (please put X mark in the next box) | **Yes** | **No** |

## V. Other GSCM alternatives/practices

| | | | |
|---|---|---|---|
| 7 | Is your organization ISO certified? (please put X mark in the next box) | **Yes** | **No** |
| 8 | If yes to the above, Rate them. (please put X mark in the next box) | | |
| 8.1 | ISO 9000 is a series, or family, of quality management standards<br>ISO 9001:2015: Quality Management Systems - Requirements<br>ISO 9000:2015: Quality Management Systems - Fundamentals and Vocabulary (definitions)<br>ISO 9004:2018: Quality Management - Quality of an Organization - Guidance to Achieve Sustained Success (continuous improvement)<br>ISO 19011:2018: Guidelines for Auditing Management Systems | **Yes** | **No** |
| 8.2 | ISO 10000 total quality management programs<br>**Standards support the ISO 9000 quality family**<br>Provides guidance for planning, designing, developing, implementing, maintaining and improving customer satisfaction codes of conduct. It applies to an organization's promises to its customers regarding its behavior to improve customer satisfaction. | **Yes** | **No** |
| 8.3 | ISO 14000 environmental management system requirements typically associated with one organization, focuses on trends and changes in environmental-set of rules and standards created to help companies reduce industrial waste and environmental damage. | **Yes** | **No** |
| 8.4 | ISO 14001 is the international standard that specifies requirements for an effective environmental management system (EMS), for organization to follow not setting requirement | **Yes** | **No** |
| 8.5 | ISO 14010: green principles of environmental auditing | **Yes** | **No** |

| No. | GSCM application description | Measurement scale | | | | |
|---|---|---|---|---|---|---|
| 8.6 | ISO 14031 environmental performance management guidelines, focuses on evaluation of environmental performance | **Yes** | | **No** | | |
| **VI.** | **Other GSCM alternative applied in the bottled water manufacturing company** | | | | | |
| 8 | Do you have GSCM goal?<br>Example: Plan-Do-Check-Act (PDCA) model for implementing an environmental management system | **Yes** | | **No** | | |
| 9 | Apply green Supply Chain Operation Reference (SCOR) to measure your performance (please put X mark in the next box) | **Yes** | | **No** | | |
| 10 | Apply Green Balance Score Card (Green BSC) (please put X mark in the next box) | **Yes** | | **No** | | |
| 11 | Apply Just in time (JIT) for production like jar<br>(please put X mark in the next box) | **Yes** | | **No** | | |
| 12 | Apply Total Quality Management (TQM)<br>(please put X mark in the next box) | **Yes** | | **No** | | |
| 13 | Do your company apply GSCM in Product life cycle | **Yes** | | **No** | | |
| 14 | If yes to the above, rate each phase where applicable (please put X mark in the next box) | **Yes** | | **No** | | |
| 14.1 | Introduction | **Yes** | | **No** | | |
| 14.2 | Growth | **Yes** | | **No** | | |
| 14.3 | Maturity | **Yes** | | **No** | | |
| 14.4 | Decline | **Yes** | | **No** | | |
| 15 | Do your company apply GSCM in Operation life cycle | **Yes** | | **No** | | |
| 16 | If yes to the above, rate each phase where applicable | **1** | **2** | **3** | **4** | **5** |
| 16.1 | Design | | | | | |
| 16.2 | Production | | | | | |
| 16.3 | Distribution | | | | | |
| 16.4 | Transportation | | | | | |

| No. | GSCM application description | Measurement scale | | | | |
|---|---|---|---|---|---|---|
| 17 | Are there environmentally influential organizational practices, in the perspective of reverse logistics | | | | | |
| 18 | If yes to the above, rate each phase where applicable | **1** | **2** | **3** | **4** | **5** |
| 18.1 | Reduction/reduce waste | | | | | |
| 18.2 | Reuse | | | | | |
| 18.3 | Remanufacture | | | | | |
| 18.4 | Recycle | | | | | |
| 18.5 | Disposal | | | | | |
| 19 | Do your company apply **Corporate Social Responsibilities (CSR)** | **Yes** | | **No** | | |
| 20 | If yes to the above, rate each phase where applicable | **1** | **2** | **3** | **4** | **5** |
| 20.1 | Invest back in environmental initiatives (afforestation, waste treatment, training/capacity building)---------------------------------------------- | | | | | |
| 20.2 | Invest in community initiatives like potable water supply, health, education, other social service------ ----------------------------------------------------- | | | | | |

Comment:________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

**Thank you.**

# Appendix-2: Qualitative Data collection instrument

***Table 60: Participatory observation: qualitative data collection checklist***

| Observation facilities/units & Technologies used in: | Observation checklist (Hervani, Helms and Sarkis, 2005) |
|---|---|
| a. Production location<br>b. Production facility<br>c. Warehouse/storage facility<br>d. Distribution facility<br>e. Transportation means | • Fossil fuel emissions- transport, production, diesel generator<br>• Discharges to receiving streams and water bodies;<br>• Releases to land on-site;<br>• Discharges to publicly owned treatment works;<br>• On-site and off-site energy recovery;<br>• On-site and off-site recycling;<br>• On-site or off-site treatment;<br>spill and leak prevention;<br>• Inventory control;<br>• Raw material modification;<br>• Process modifications;<br>• Cleaning and decreasing waste; |

**Table 61: Key informants interview: certification, regulatory and financing bodies**

1. What are the criteria, specifications and standards for certification, regulation and financing?
2. What are the tools used for the above?
3. How often is the monitoring undertaken? By whom?
4. What policies, guidelines, procedures and frameworks are available and applied in relation to water bottling?
5. How is the awareness of the certification, regulatory and financing bodies related to the GSCM practices in bottled water companies?
6. Are there incentives or any form of encouragement for applying GSCM?
7. What collaboration measures and means are used to strengthen companies and certification, regulatory and financing bodies?
8. Other comments:_______________________________________________________________

**Key informants interview: EBWMIA**

| |
|---|
| 1. What is the aim of your association (EBWMIA)?<br>2. What are the criteria and procedure/process of membership in the case of EBWMIA? |

3. How many bottled water manufacturing companies are there is Ethiopia? In and around Addis Ababa?
4. How many members do EBWMIA have?
5. What are the services given to EBWMIA members and others?
6. To the knowledge of EBWMIA, what policies, guidelines, procedures and frameworks are available and applied in relation to bottled water manufacturing in Ethiopia?
7. How is the awareness of the certification, regulatory and financing bodies and EBWMIA related to the GSCM[4](see footnote) practices in bottled water companies?
8. Are there incentives or any form of encouragement for applying GSCM?
9. What collaboration measures and means are used to strengthen companies and certification, regulatory and financing bodies with EBWMIA and its members?
10. What EBWMIA thinks about its members challenges to apply GSCM (see footnote)
11. Other like GSCM(see footnote) activities of EBWMIA?

comments:___________________________________________________________

[4] GSCM means Green Supply Chain Management, Like revers logistics of recycling, reuse, reduce like raw materials, green distribution, green purchasing including sustainable development with environmental considerations.

# Appendix-3: Research Schedule and budget

## Appendix-3:1-Schedule

*Table 62: schedule of thesis research activities*

| No. | Activities | Nov. 2020 | Dec. 2020 | Jan. 2021 | Feb. 2021 | Mar. 2021 | Apr. 2021 | May 2021 | Jun. 2021 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Finalizing the partial proposal and submit to advisor | | | | | | | | |
| 2 | Finalizing the Review of Related Literature | | | | | | | | |
| 3 | Finalizing the Research Methodology | | | | | | | | |
| 4 | Development of the research instrument | | | | | | | | |
| 5 | Submit final proposal to advisor & program coordinator | | | | | | | | |
| 6 | Proposal Defense | | | | | | | | |
| 7 | Train in SPSS | | | | | | | | |
| 8 | Select and train data collectors | | | | | | | | |
| 9 | Finalize Proposal and send to advisor & get feedback | | | | | | | | |
| 10 | Pretesting data collection instrument | | | | | | | | |
| 11 | Full scale data collection and data cleaning | | | | | | | | |
| 12 | Report write up: findings and analysis, interpretation and discussion of results | | | | | | | | |
| 13 | Report write up: summary, conclusion and recommendation, research limitation and areas of future research | | | | | | | | |
| 14 | Submit report to advisor | | | | | | | | |
| 15 | Finalize final write up and submit report to Program coordinator | | | | | | | | |
| 16 | Thesis Defense | | | | | | | | |
| 17 | Submission of final report booklet to School of Commerce Library in hard and soft copy | | | | | | | | |

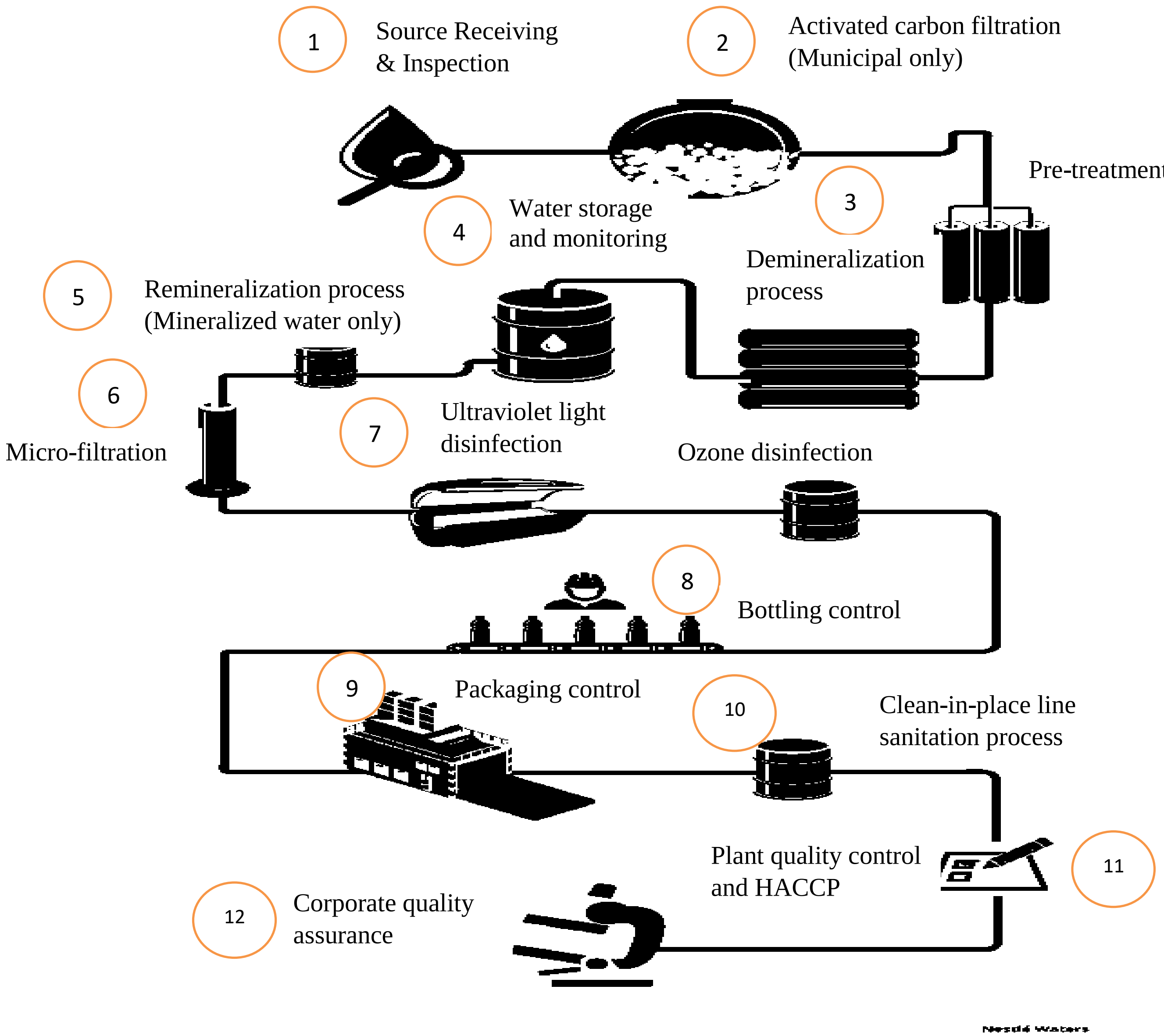
# Appendix-3:2-Budget

*Table 63: Budget estimate of the thesis research*

| No. | Activities | Unit of Measure | Quantity | Unit cost | Total Cost ( in Birr) | Remark |
|---|---|---|---|---|---|---|
| 1 | Stationery materials | Lump sum | | | 1000 | |
| 2 | Internet and communication | Lump sum | | | 7000 | |
| 3 | Copy and printing & binding | Lump sum | | | 1500 | |
| 4 | Transport/fuel: January to March 2021 | Lump sum | | | 5000 | |
| 5 | SPSS training | Lump sum | 40 hours | | 2000 | In AAU-school of commerce |
| 5 | Data collectors training, transportation and fee | Number | 5 | 4500 | 22500 | |
| | **Sub Total** | | | | **39000** | |
| | **Contingency of 10%** | | | | **3900** | |
| | **Thesis research total cost** | | | | **42900** | Researcher is self-paid & train data collectors, also collects data, make observation, make analysis and report write up |

## Appendix-4: Water bottling process

**Figure 15: The 12 steps of Water Bottling Process-nestle-water, 2020**




The process aims to guarantee the highest safety standards for drinking water and ensure a taste that is in accordance with consumer preference.

1. **Source receiving and inspection: water is carefully collected** and received through stainless steel pipes from either a local well or municipal water supply. Quality testing of the original source is conducted regularly to monitor for abnormalities.
2. **Activated carbon filtration:** This step is taken when the water originates from a municipal or public drinking water system. It consists of **removing chlorines and THMs** (trihalomethanes) through a daily-monitored activated carbon filtration process. A water softener is used to reduce water hardness.
3. **Demineralisation**: removes unwanted minerals (through reverse osmosis or distillation).
4. **Water storage and Monitoring:** Water received in storage tanks is monitored on a daily basis.
5. **Remineralization**: selected minerals are added to cater to consumer taste preferences.
6. **Micro-filtration:** pharmaceutical grade micro-filtration **removes particles as small as 0.2 microns**. It is also capable of removing potential microbiological contaminants. This is monitored on an hourly basis.
7. **Ultra-violet filtration**: provides additional product disinfection. This is monitored on an hourly basis.

   **Ozonization: Ozone disinfection** is the third disinfection step (steps 7-9), using a highly reactive form of oxygen. This is monitored on an hourly basis.
8. **Bottling control:** The filling room is highly sanitary to ensure bottling is conducted in a microbiologically controlled environment. **It is continuously monitored and controlled**.
9. **Packaging control:** packaging quality assurance is conducted by human inspection and the latest in modern equipment designed to ensure the removal of any packaging defects.
10. **Clean-in-Line sanitation:** includes automated cleaning equipment to ensure maximum cleanliness, effectiveness and control.
11. **Plant quality control and HACCP:** Overall bottling plan quality control following certain specification and standards
12. **Corporate quality assurance:** monitoring quality at corporate level to meet standards.

# Appendix-4: BSC categories for environmental based performance

**Table 64: Environmentally based performance measures by the balanced scorecard categories (Hervani, Helms and Sarkis, 2005)**

| No. | Green BSC measures | Measures |
|---|---|---|
| 1 | Learning and growth | Percentage of Employees trained |
| | | number of Community complaints |
| | | Percentage of renewable resource use |
| | | number of Violations reported by employees |
| | | number of Employees with incentives related to environmental goals |
| | | number of Functions with environmental responsibilities |
| | | Emergency response programs |
| 2 | Business Process perspective | Percentage of production and office materials recycled |
| | | number of Certified suppliers |
| | | number of Accidents and spills |
| | | Internal audit scores |
| | | Energy consumption |
| | | Percentage of facilities certified |
| | | Percentage of product remanufactured |
| | | Energy use |
| | | Greenhouse gas emissions |
| | | Hazardous material output |
| 3 | Customer perspective | number of Green products |
| | | Product safety |
| | | number of Recalls |
| | | Customer returns |
| | | Unfavourable press coverage |
| | | Percentage of products reclaimed after use |
| | | Functional product eco-efficiency |

| No. | Green BSC measures | Measures |
|---|---|---|
| | | Percentage of products reclaimed after use |
| | | Functional product eco-efficiency |
| 4 | Financial Internal process | Percentage of proactive vs reactive expenditures |
| | | Capital investments |
| | | Operating expenditures |
| | | Disposal costs |
| | | Recycling revenues |
| | | Revenues from “green” products |
| | | Fines and penalties |
| | | Cost avoidance from environmental actions |

## Appendix-5: Bottled Water manufacturing Companies in Ethiopia

*Table 65: Bottled water manufacturing companies in Ethiopia*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Addis Ababa | number | Tigray | number | Other Oromia | Number | Afar | number |
| Lideta | 4 | Mekele&Kwiha | 3 | Awadai | 1 | Asaita | 2 |
| Kerkos | 4 | Adwa | 1 | Sinan/Bale | 1 | Mille | 1 |
| Bole | 9 | Adigrat | 2 | Adama city and around | 6 | Total | 3 |
| Nifas Silk Lafto | 6 | Saesie/Tsada Amba | 2 | Mojo | 1 | | |
| Akaki Kaliti | 4 | Aleje-S.Tigray | 1 | Jima | 1 | Somali | number |
| Kolfe Keranio | 4 | Asgede Tsimbla | 1 | Adaba, Gedeb & Shashemene | 3 | Shebele/ Gode | 1 |
| Yeka | 2 | Total | 10 | Arsi | 7 | Jigjiga | 1 |
| Total | 33 | | | Total | 20 | Fefan | 1 |
| | | Sidama | number | Oromia Total | 57 | Total | 3 |
| Addis Ababa-Near Oromia | number | Arbegona | 1 | | | | |
| Holota | 2 | Aleta-wendo | 1 | Amhara | Number | Dire Dawa | number |
| Legetafo-Legedadi | 2 | Hawassa | 9 | Armacho | 1 | Dire Dawa | 11 |
| Sebeta&around | 8 | Total | 11 | Gojam/Sinan | 2 | Total | 11 |
| Sululta | 5 | | | Angolela/N.Shewa | 3 | | |
| Sebeta Hawas | 4 | SNNPRS | number | Wolo-Dessie | 5 | Harari | number |
| Berek | 1 | Hadiya | 1 | Bahir Dar | 4 | Harar | 2 |
| Burayu | 11 | Gurage | 6 | Dangla/Waghemra | 2 | Total | 2 |
| Bishoftu | 2 | Silte | 2 | Guna/Laygaynt | 2 | | |
| Gefersa & Gelan | 2 | Sheka | 1 | Gondar town | 1 | | |
| Total | 37 | Welayita | 10 | Total | 20 | | |
| | | Gamogoffa | 5 | | | | |
| | | Total | 25 | | | | |
| | | Grand total | 175 | | | | |

## Appendix-6: Reliability test and internal consistency of the measurement outcome (SPSS)

**Economic factor:**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .752 | .815 | 10 |

**Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Complaince_Cost | 1.35 | .933 | 20 |
| Recycling_Cost | 1.95 | 1.395 | 20 |
| CleanEnergy_Cost | 1.55 | 1.099 | 20 |
| Disaposal_Cost | 1.80 | 1.281 | 20 |
| Env_friendly_Mat_Cost | 1.50 | 1.051 | 20 |
| Factory_Cost | 2.30 | 1.490 | 20 |
| Delivery_Cost | 1.10 | .447 | 20 |
| Inventrot_Cost | 1.25 | .786 | 20 |
| Information_Sharing_Cost | 1.10 | .447 | 20 |
| Oredering_Cost | 1.10 | .447 | 20 |

**Environmental factor:**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .984 | 1.000 | 3 |

**Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Reduced_Energy_consuption | 1.75 | 1.500 | 4 |
| Use_Recycled_Materials | 1.75 | 1.500 | 4 |
| Recycling_Energy | 1.50 | 1.000 | 4 |

**Social factor:**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .747 | .771 | 6 |

**Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Management_Staff_Motivation | 1.53 | .964 | 19 |
| Management_Environment_Initiative | 1.84 | 1.425 | 19 |
| Management_Consumer_Awareness | 1.16 | .688 | 19 |
| Effort_Customer_Interest | 1.74 | 1.147 | 19 |
| GSCM_Training | 1.37 | .761 | 19 |
| Conference_GSCM | 1.32 | .749 | 19 |

**GSCM practices:**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .840 | .810 | 7 |

**Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Three_Rs_Reuse_reduce_recycle | 2.74 | 1.368 | 19 |
| Reduce_Material_Energy_Consumption | 2.79 | 1.437 | 19 |
| Recycle | 1.79 | 1.357 | 19 |
| Reuse | 3.05 | 1.433 | 19 |
| Avoid_Hazaradous_materials | 4.79 | .918 | 19 |
| manufactire_Reduce_Reuse_Recycle | 2.84 | 1.463 | 19 |
| Environmnetal_technology | 2.11 | 1.487 | 19 |

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .730 | .706 | 5 |

**Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Collection | 3.25 | 1.333 | 20 |
| Remanufacturing | 1.30 | .923 | 20 |
| Recycleing | 1.45 | 1.099 | 20 |
| Reuse_Reverse | 3.25 | 1.333 | 20 |
| Disposal | 4.75 | .910 | 20 |

**Application Challenges:**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .460 | .387 | 6 |

**Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Policy | 2.000 | 1.1952 | 8 |
| Social_Customer_community | 1.875 | 1.1260 | 8 |
| Financail | 2.750 | 1.5811 | 8 |
| Technology | 2.500 | 1.7728 | 8 |
| Skilled_lbour | 2.250 | 1.3887 | 8 |
| Other_Challenges | 1.125 | .3536 | 8 |

**Regulatory, certification, standard and other policy challenges:**

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .694 | .690 | 5 |

**Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Challenge_Regulatory_procedure_rule | 1.83 | 1.030 | 12 |
| Challenenge_Standard_sectoral | 1.58 | .900 | 12 |
| Challenge_Specification_Sectoral | 1.33 | .778 | 12 |
| Challenge_Regulatory_Capacity | 1.75 | 1.422 | 12 |
| Challenge_Certification | 2.08 | 1.443 | 12 |