DEVELOPMENT OF A RESOURCE MODEL FOR GREENING ENVIRONMENTAL RESILIENCE: SOCIO - ECO EFFICIENCY FRAMEWORK ANALYSIS AT KOMBOLCHA INDUSTRIAL ZONE, ETHIOPIA.

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DEDICATION

This study dedicated to my children, who love and believe in me.

Declaration

I Tefera Eshete Kebede hereby declare that this thesis, which I hereby submit for the degree of Doctor of Philosophy in Environmental Management (98006) at the University of South Africa, is my own work and has not previously been submitted by me for a degree at this or any other institution.

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Abstract

This study used the socio-eco efficiency framework as an application tool to resilience the green environment at Kombolecha industrial zone by balancing the water consumption growth and green environmental tradeoffs. In addition, it aimed to determine the significant indicators, which associated with the water consumption and recycling efficiency. The consumers (factories and households) socio-eco efficiency practices were limited and then caused groundwater degradation and green environmental depletion. Previous studies, for instance, BASF (2009), ESCAP (2011) eco-efficiency, and Sailing *et al*., (2013) SEE balance (socio-eco efficiency) analysis targeted the company's product portfolio and quality improvement. This study, however, considered both factories and household's consumption activities that were proven to manifest in a complex water consumption compared to the production process. The study integrated social, economic and environmental indicators and determined the socio-eco efficiency effects on theresource consumption growth and green environment tradeoffs; water consumption and recycling efficiency. Subsequently, the study then developed a socio-eco efficiency model that used to balance the gaps between water consumption and recycling intensity inefficiency. The socio- eco efficiency indicators could, thus, be an applied tool that could be measured by employing the binary logistic regression, instrumental variable model, simultaneous equation model and the propensity score matching estimation.

Based on this, this study results indicated that the household's awareness, perception and consumption behaviours concerning the green mind adoption, product, market, technology and jobs use were strongly associated and influenced by the water resource consumption growth and green environment tradeoffs at the 5 percent significance level. Particularly, the household's social aspects, consumer's culture, behaviour and poverty; economic (monthly income) and environmental aspects (water quantity limit and waste recycle) were found to bestatistically significant and strongly altered the water resource consumption and recycling efficiency by 0.000 values at the 95 percent confidence level. This study implication was thesocio-eco efficiency framework, which was key the finding of the study that holds the three key indicators, did directly associate and significant determine the factories and household's groundwater consumption and recycling intensity differently by 0.000 values at the 95 percent confidence level.

The socio- eco efficiency model could thus be an analytical tool that could be applied into groundwater consumption and recycling process. The socio-eco efficiency resource model, which is a key tool to resilient the green environment, optimized the water consumption and recycling efficiency and could be incorporated into the groundwater and green environment protection policy of Ethiopia. This study, in a circular fashion, proved socio-eco efficiency application and resolved some of the consumption paradox in the factories and household's groundwater consumption and recycling processes. Thenon-integrated indicators and inapplicability of the socio-eco efficiency framework, nonetheless, made the green environment cautiously. So that a tactical integrative socio-eco efficiency resource model, particularly, green finances, such as green water tax, lease, paymenhave to be incorporated during the groundwater consumption that recovers the green environment attainments in Kombolecha and at large in Ethiopia.

Key words: Socio-Eco Efficiency indicators, Green Environment, Resource Model, Resilience, Tradeoffs and Green Industrial Zone

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Acronyms

EEPA	Ethiopia Environment Protection Agency
EIA	Eco efficiency Indicator Analysis
ESCAP	Economic and Social Commission for Asia and Europe
FDRE	Federal Democratic Republic of Ethiopia
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organisation
IVM	Instrumental Variables Model
LDCS	Least Developing Countries
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least square
REPI	Resource Efficiency Performance Index
SEE	Social Eco Efficiency
SEEF	Socio- Eco Efficiency Framework
SIA	Social Impact Analysis
SPSS	Statistical Package for Social Sciences
SWOT	Strength, Weaknesses, Opportunities and threats
TSLS	Two Stage Least Square
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Protection
UNIDO	United Nation Industrial Development Organizations
US-NEPA	United States National Environmental Policy Act
WBCS	World Business Council for Sustainable Development

CHAPTER ONE

1. INTRODUCTION AND BACKGROUND

1.1 BACKGROUND

The current resource consumption growth and green environmental tradeoffs of the earth are concerns of this study. Today's global environment faces some risky trends such as global warming, carbon emission, pollution, resources and energy problems, which result in people's life threatening environmental consequences (GTP, 2010 & UNEP, 2011). In response to this, various environmentally friendly solutions are implemented day by day to ensure the health of the environment and the overall well-being of the world around us (Rohini, 2012). Apart from that, household's resource consumption and recycles are not considered and integrated into the factory's consumption activities, which reduce green environmental problems, are coming out and neglected in a growing industrial zone. Indeed, greening growth is broad and varied across countries; it has emerged over increasingly evident resource constraints and environmental risk that threatens the continued stability and prosperity of the industrial region (UNIDO, 2011). Since countries are promoting industrial growth, and continues to do so, preventing its growth is neither possible nor desirable (UNIDO and Jacquelyn, 2011).

Mounting evidence indicates that the transition to a green economy has sound economic and social as well as environmental justification which resting on the systemic interplay between environmental, economic and socio-cultural sometimes here together referred to as "green" factors (UNEP and Uno, 2011). This transition, however, varied considerably between nations as it depends on the specifics of each country's natural and human capital on the relative level of development (UNEP, 2011). However, one very important key strategic aspect has to do with sustainability considerations that should be explained in environmental, economy and social challenges which are now inextricably linked (Judith, 2012). However, within a realm of industrialisation, the social economy develops in an unparalleled speed while it inevitably increases the consumption of natural resources (Shaofeng *et al.*, 1975). This immense industrial activity and growth create massive exploitation of land, water and air, which lead to degradation of the environmental quality (Peng, 2006).

To address environmental degradation, approach towards eco-efficiency has been at the center of attention during the past decade. The concept of eco-efficiency was disseminated by Stephan Schmidheiny, who was the founding member of the World Business Council for Sustainable Development (WBCSD) in 1992. The simple idea of producing more but with less environmental impact was taken up by many scientists, counselors and companies, eventually leading to a large number of derived concepts and managing tools. For example, the concept of 'MIPS' by Schmidt-Bleek (1994), 'factor four' by Weizsäcker *et al*. (1997), the 'eco-compass' by Fussler (1996), and the 'eco-efficiency analysis' by Schaltegger and Sturm (1998). On top of these, WBCSD (1992 & 1996) portrays that the eco efficiency indicators have only been concerned the economic and environmental aspects that intended for private enterprises (ESCAP, 2009). Nonetheless, Sailing, *et al.* (2013) incorporated ecological aspects into eco efficiency and built the socio-eco efficiency (SEE balance).

Authors such as Holling, *et al*. (1989), McDonough and Braungart (1998) evaluated the eco-efficiency indictors for sustainable development and the environment was criticised that the use of eco efficiency alone is not efficient because it left the household's social costs outside its embrace. In other word, the eco efficiency concept has not incorporated the social indicators, including people social progress, who act and react differently on the water resource consumption and environmental conservation. That is people's perception and behaviour of adopting a green mind, technology used during water consumption and waste recycling processes were found different along with the distinct economic, social and environmental benefits and costs. This was due to some people who may be more environmentally were anxious than others and others may not at all (Lorenzo, 2013). The household's green perception and behavioural inequality was importantly embracing the water resource consumption and recycling inefficiency at the growing industrial city in Ethiopia.

Since in 1996, the government of the Federal Democratic Republic of Ethiopia (FDRE) confirmed that Kombolcha city becomes the center of industrial zone (Kombolcha Municipality, 2012). Currently, in addition to fourteen existing factories, there are 220 licensed investors who received land and start to construct firm in Kombolcha Industrial Zone (Kombolcha City municipality office, 2013). This industrial growth makes the city over urbanized and populated through increasing the resource consumption demand. As a result, the environment is crowded by dense population and factory's production and consumption process. Hence, building resilience is, particularly, crucial in cities, agricultural land and industrial zones which are often the most impacted by humans and upon which society often depends (Guy and Xuemei, 2007). In World Business Council Sustainable Development (WBCSD, 1996), ESCAP (2009), Bruce *et al*. (2010) and Lorenzo (2013) eco-efficiency and Sailing, *et al*. (2013) socio-eco efficiency were not considered water consumption growth and resilient the depleted green environment in the rapidly growing cities in Ethiopia and the rest of the world.

Resource use, particularly, the consumption and recycle efficiency impact on the environmental problem was considering in the factory's production process (eco efficiency) in Kombolecha and elsewhere. This study, thus, attempted to integrate both household and factory's water consumption and recycling efficiency. In addition to this, household's social aspects, such as the green perception, behaviours, poverty status and cultures were incorporated to economic and environmental indicators, which are at most closely interlinked to recover the defining trends of green environment. To commence this investigation, this study shared the general interest of eco efficiency concept and indicator principles by WBCSD (1996), ESCAP (2009) and Sailing, *et al*. (2013) socio-eco efficiency and Tatari, *et al*. (2016). The household's perception and behavioural inequality to adopt the green consumption and environment protection were measured followed by Kuznets (1955). This study proposed indicators and the socio-eco efficiency framework would be affected the water consumption and recycling efficiency at altering social, economic, and environmental reasons inKombolecha.

1.2 PROBLEM STATEMENT

Environmental deterioration is currently increased due to over-consumption and growth of natural resources utilization that result a depletion of stratospheric ozone layer, pollution of sea and rivers, noise and light pollution, acid rain and desertification (McDonagh & Ramlogan, 1997 and Chen, 2010). Studies, for instance, by Grunert (1993) indicated that 40 percent of environmental degradation is caused by private household's consumption activities (Chen, 2010). According to Ashraf *et al.* (2009); JingJing *et al*. (2008); McDonagh & Prothero (1997), deforestation; the extinction of certain fauna and flora as well as the surfacing of new illnesses and diseases are current phenomenon but a few manifestations on the natural environment. This wide spread myth is a result of an inescapable tradeoffs between industry's growth, which boost resource degradation, and environmental sustainability (UNIDO, 2009). In addition to this, population density; water consumption growth; pollution emitted by industrial activities, poor management of water catchment areas and groundwater overuse are partly responsible for this situation (ESCAP,2012).

These problems are not new but they were varied between the household's and factory's consumption and recycling activities. The accumulation of a number of bad habits and "unsustainable" practices seems to have led to critical stresses on societies and the environment. As a consequence, the world has been on a course leading to resource depletion and serious social crises and old ways of problem-solving have proven inadequate (Tracey and Anne, 2008). However, many of the "green" types of challenges are found general phenomena and not necessarily specifically connected to urban space (Uno, 2011). In particular, processes of an industrialisation affect 'cities' risk profiles with serious consequences (Abigail, 2012). Among many challenges, for instance, the brown environmental problems, pollution and disease multiplying are prevalent in cities (UNEP, 2011). Smith (2013) argued that there is no time like the present for all the stakeholders to go green. This argument is opposed to what distinguish today's environmental threats from the past is the incredible interconnection of individual activities and life sustainability with in social, environment and economical interactions (Elkington, 2004).

Compared to these three dimensions, social aspects present special problems due to their highly diverse and weight differently across interest groups and regions (Anna, 2006). Hence, Freeman (1984), Beckenstein (1996) and Elkington (2004) set the base indicators on social impact assessment, which relate to resource extraction, processing, use, recycling, disposal and others (Rainer, 2005 & 2006). However, in least developing countries (LDCs), firm and people are uniquely in a hurry to buy technology during production and consumption process while they are poor (WBCSD, 1996, ESCAP & UNIDO, 2009). Ethiopia wants to avoid the traps of business-as-usual development to ensure the green economy growth andenvironmental resilience. In this study, environment resilience is describing in the context of restoring the green nature via balancing the water resource consumption growth and environmental problems. As like other developing countries, Ethiopia, nonetheless, faced a dual challenge in achieving its development goals and recovering the depleted environment (GTP, 2010).

Factories and households have lacked resources or expertise to adopt new green technologies despite the long term economic and environmental advantages in doing so (UNIDO, 2009 & Kombolecha municipal, 2014). Consequently, the factory's resource consumption growth erodes the green nature and thereby resulta brown environment, which takes a large economic, social and environmental tollthat lead people to struggle under vast and potentially fatal illusion without integrity of their living environment (UNEP, 2011). In this study, the brown environment was contextually characterizedas over water consumption but less recycle and excess waste discharges and etc., which resulted negative externalities on the household's living and working condition.

To resolve green environment problems, scholars, academician and international institutions have investigated a broad gauge study of the complex and dynamic interplay amongst the firm's production process and its impact on environment abroad Ethiopian cities. For example, Schaltegger and Sturm (1990) introduced an eco- efficiency concept to reduce environmental pollution; WBCSD (1992&1996) applied an eco-efficiency for sustainability of business and environment quality; ESCAP (2008 & 2009) evaluated eco efficiency indicators and principles with regard to environmental pollution; Bruce, *et al.* (2010) and BASF (2009) measured eco efficiency for sustainable development and environment. On top of this, WBCSD's (1996), BAZF (2009) eco efficiency and Sailing, *et al*. (2013) socio-eco efficiency are very much a part of this base ground picture, which interprets as "achieving more value with less impact" on environment, and focused on factory's product lifecycle.

However, there has been some critique against the concept of eco efficiency. For instance, Holling *et al.* (1989) argued that eco efficiency only considers the economic and ecological aspects while it left the social progress, which is among major pillars for sustainable development. In other words, eco efficiency only focused on economic benefits and costs with respect to environmental quality ratio for a defined level of output production (ESCAP, 2009). Nonetheless, McDonough & Braungart (1998) called "eco efficiency as the current industrial buzzword, which will neither save the environment nor foster ingenuity and productivity" (Braungart, 1998). This indicates that "eco-efficiency" is insufficient by itself as a basis for policy making (OECD, 1998). This might be the case that a few individuals consider only apportion of product's life cycle that does not address environmental problem (Judith, 2012). Moreover, one identified product which is found eco efficient in one analysis may be less eco efficient in another alternative product analysis and vice versa (Bruce *et al.*, 2010).

This indicates that previous studies, such as WBCSD (1996); Isabell, *et al.* (2002); ESCAP (2009); Bruce, *et al.* (2010); UNEP (2011); Lorenzo (2013) and etc. eco efficiency analysis could not build a unified social, economic and environmental indicator on resource consumption patterns. Besides, none of these studies has clearly shown the path to interlink people social aspects with industrial water resource consumption and recycling patterns, which is a key ingredient to keep the green environment. This shows that there is a need of wider studies about water consumption and recycling processes to recover the green environment, which merges the social aspects into economic activity and environmental damage, with a drive force of perception change, consumption behaviour and ethical motives of people (Fussler, 1996). Protecting ecosystems and biodiversity is, therefore, central to building the resilience of the world's poorest people, in both rural and urban areas, and to ensuring the provision of clean water, productive soils for food, and protection from natural hazards (MDG, 2015). However, Ethiopia economy, which relied on the vast agriculture sector, is depending on variable rainfall and triggered by continuous drought.

This study, therefore, extended eco efficiency concepts into socio-eco efficiency framework by integrating the household's social indicators (water consumption culture, behaviours, poverty and etc.) into an economic (monthly income) and environmental indicators (water quantity limits and waste recycles) in the water resource consumption and recycling processes. Moreover, this study aimed to build a unified socio-eco efficiency framework and evaluated its impact on the water consumption and recycling process that met the green environmental problems. The main contribution of the study is a socio-eco efficiency framework and it also developed consistent socio- eco efficiency resource model on the groundwater consumption and recycling process in the body of knowledge. Moreover, it identified the significant household's social indicators (poverty, consumption culture and behaviours), economic (monthly income) and environmental indicators (groundwater consumption and waste recycles) by using a triangulated methodology (qualitative and quantitative methods). This study employed quantitative methods by applying different econometric models including a binary logistic regression, instrumental variable, simultaneous equation, and propensity score matching model.

1.3 RATIONAL AND JUSTIFICATION

Greening industry is a cross-cutting exercise of governments. However, social and economic conditions in LDCs make the facilitation of greening industries a challenge undertaking (ESCAP, 2008 & UNIDO, 2011). Today, industry growth and green environment sustainability is confronted by the complex interplay of environment, economic and social factors in cities (UNIDO, 2011). There is the realisation that economic growth alone is not enough: the economic, social and environmental aspects of any action are interconnected. Considering only one of these at a time leads to errors in judgment and "unsustainable" outcomes (Tracey and Anne, 2008). According to Lockwood (2007), greening has gained much respect lately by businesses because it has proven to lower overhead costs, improve productivity and strengthen the bottom line.

Fast industrial growth is not necessarily by itself a problem. However, the unplanned growth can result many environmental problems such as waste emission, air and water pollution (Troschinetz & Mihelcic, 2009). As like other cities in Ethiopia, in Kombolcha, consumers had challenges of limited water resources but shamelessly consumed groundwater resources which was not sufficient for their production activity. Since Ethiopia is amongst rainfall dependent and drought affected in eastern Africa, consumers used the groundwater sources inefficiently without recycling and consequently plundered the nature of green environment. Hence, the department of environmental health of the city went well beyond local environmental problems that affect issues of the national or global relevance like climate variability (ESCAP, 2009). Though ESCAP (2009) eco-efficiency application can be done at different levels of the economy such as macro, micro and regional level, it was not yet adopted on the water consumption and waste recycling process.

This study, thus, began from an eco-efficiency rationality, which is, in fact, not a panacea to practice static means used to improve resource intensity on fixed pin point lifecycle but it's dynamic process that encourage the new way of creative and innovative skill in finding new insights and results (ESCAP, 2011). It is an open ended approach to foster infant industry's product innovation and creativity (WBCSD, 1996). Furthermore, this study, considered eco-efficiency, complexity and less applicability on resource consumption (ESCAP, 2009); factories and household's inefficient consumption growth and environmental problems (Kombolecha Municipality report, 2012); importance of green environment issues at national and global perspectives (GTP, 2010). Sailing, *et al. (*2013) SEE balance, which improved company's product portfolio and manufacturing performance, focused society, economy and ecology integration to sustain development.

This study, however, justified that social, economic and environment indicators integration and the socio-eco efficiency formulation was complex and has a paradox to sustain development by recovering the eroded environment. This study, thus, applied a socio-eco efficiency framework and developed a socio- eco efficiency model on both household and factory's water resource consumption process in Kombolecha. Against this background rationality, GTP-1 (2010-15) and the current GTP2 (2015-2020) important strategic focus is building a climate resilient green economy in Ethiopia. In line with this, intervention targets are set for the sector. However, it gives a green emission reduction instead of narrowing the tradeoffs between the groundwater consumption growth and green environment problems. Exceptional to this tradeoff, groundwater consumption and recycling efficiency were not measured by factories and households. This makes the study necessary to conduct in Kombolecha industrial zone where water consumption and recycling inefficiency was alarmingly increasing without payment and in turn eroding the green environment.

1.4 AIM AND OBJECTIVES

1.4.1 AIM OF THE STUDY

The study aimed to assess the social, economic and environmental indicators and built the socio-eco efficiency framework on the resource consumption and recycling processes in meeting the green environmental problems in Kombolecha.

1.4.2 OBJECTIVES OF THE STUDY

This study main objective was developing a resource model that is applied in a green environment through applying the socio-eco efficiency framework at Kombolecha industrial zone, Ethiopia.

In addition, these study specific objectives were:

1. To assess household's behaviour and perceptions of balancing the resource consumption and green environmental tradeoffs
2. To determine major significant indicators in the course of resource consumption and recycle Efficiency
3. To evaluate the extent to which indicators of water consumption and recycling intensity would impact on green environment
4. To develop a conceptual resource model for identifying indicator gaps between water resource consumption and recycling processes

1.5 RESEARCH QUESTIONS

This study major research question: Does a socio- eco efficiency framework resilient the green environment in Kombolecha though balancing the tradeoffs between consumption growth and green environment problems?

The study also attempted to address the following specific questions:

1. What are the local residents' perception and behaviour with regards to the resource consumption activities?
2. Which indicators would be significantly determined to reduce green environmental problems during resource consumption and recycling?
3. What is the impact of indicators on water consumption and recycling intensity at altering social, economic and environmental aspects?
4. What type of resource model would be required for identifying indicators to balance water resource consumption and recycling gaps?

1.6 SIGNIFICANCE

The primary outcome of this study was socio-eco efficiency framework application and the socio eco efficiency resource model formulation in the period of water consumption and recycling processes. This resource model were integrating statistically significant economic, social and environmental indicators, which provide a useful basis, for further exploration and application at Kombolecha industrial level and at large drought affected cities in Ethiopia. It would present the need to develop a more comprehensive set of a socio- eco efficiency indicator for policy and infant industry growth; water consumption and waste recycling sustainable packages.

In the short run, this study contributed and integrated the household's social, economic and environmental indicators into factory's consumption and recycling processes and then built a socio–eco efficiency framework that are used for policy, strategy input and builds comparative advantage of recovering the greening environment. In the long run, stakeholders such as municipal, factory, and experts and researchers would use socio- eco-efficiency framework for green economy growth and environmental resilience programs.International, government and nongovernmental institutions would employ the socio-eco efficiency resource model as a strategy tool for the green initiative's purpose, green tax policies and groundwater rehabilitation program accomplishments relate to the green environmental resilience in Kombolecha and other cities.

1.7 Chapter Summary

This chapter introduced the resource consumption growth and green environment tradeoffs at the global, continental and national level and put some theoretical justification and methodology gaps in the problem statement. In doing so, it defined objectives and the research questions that address the green environment resilience by integrating the social, economic and environmental indicators. However, consumer's water consumption and recycling efficiency were different because of the diverse consumption awareness, behaviours, culture and level of poverty. On the other side, cities are considered to be a center of innovation and the challenges in building resilient environment. In cities, the role of different actors comes into view as these actors' act as leaders to deal with climate change, environmental degradation and social-economic turmoil, and can be considered as potential drivers for urban resilience (Loorbach, 2007).In rural Ethiopia, particularly around Kombolecha, agriculture production faced water shortage due to its dependence on variable rainfall.

Against this fact, liquid waste, however, is an asset but can be a problem in an urbanized world (Drechsel *et al*., 2015a). Though Ethiopia has abundant river water sources such as Nile, Awash, Baro, Tekeze and etc, people, who engaged in the agriculture sectors and factories faced water shortage and triggered by a continuous drought. Groundwater consumptions were not, yet, measured to equate the economic, social, and environmental benefits and costs. Consumers were focused to optimise the economic benefits but disregarded the water consumption and recycling efficiency. The various indicators were assessed in ESCAP (2009) and WBSCD (2006), BASF (2005&2009), Sailing, *et al.* (2013) and Tatari, *et al.* (2016). Nonetheless, these studies were not integrated the household's social aspects into eco-efficiency (economic and environmental aspects) and built the socio-eco efficiency framework on the resource consumption.

This study, thus, aimed at recovering the green environment by applying a socio-eco efficiency framework at Kombolecha industrial zone. To achieve the specific objectives, different econometric models would be employed to assess the household's perception and consumption behaviours; identify and evaluate significant key indicators on water consumption and recycling efficiency, and finally developed the socio-eco efficiency resource model. This proposition was supported by reviewing the various literature in chapter two.

CHAPTER TWO

2. LITERATURE REVIEW

2.0 Introduction

This chapter reviewed literature in three parts in the study. First, it defined key concepts of the green environment; urbanization and economic growth payoff on the green environment. Second, it revised pertinent theories of green environment tradeoffs with regards to resource consumption growth and resultant impacts on the green environment. Third, it reviewed indicators such as environment, economic and social indicators to build the eco efficiency frameworks that would pinpoint the company's production process. In sum, related articles, issues at the stack and scholarly literatures, which are pertinent to the study, were discussed.

This study rationality stemmed from the fact that development not based on green growth may lead to prosperity, but only in the short term, and will soon be undermined by insecurity and vulnerability of the natural resources like groundwater. This was due to developing economies, particularly, the Ethiopia economy, which takes 46 percent of the GDP from the agriculture sector, tend to be sensitive to environmental challenges, as the economies often rely upon the intensive use of natural resources and are dependent on rainfall for development. Natural capital comprises 25% of total per capita wealth in low-income countries, compared to 2 percent in OECD countries (World Bank, 2006; OECD, 2008). The links between environmental performance, equity and poverty are more direct and significant in developing countries than in developed countries. The environment protection, water resource depletion and poverty were similarly intertwined with the Ethiopia economy. The nature of the green environment was, nevertheless, affected by factories and household's over-consumption of the groundwater sources at the Kombolecha industrial zone.

2.1 Definitions of Green Environment

This study green environment definition stood from the notion that households are pursuing knowledge, behaviour and practices that can lead to more environmentally friendly and ecologically responsible and sustain decisions and life styles, which can help to protect the environment and sustain water resources for current use and future generation. In this regard, resilience is not a new concept but it is used with precision in engineering, materials science, psychology, and more recently, ecology and the new field of socio-ecology (Rockefeller Foundation, 2012). These words give a full sense to express non-eroded environment that suits for human living and working areas, particularly, where the water resource consumption growth balances with the green environment problems. It was summarised that greening is very broad and can be applied in almost every industry such as service, construction and retailing. However, Makower (2009) put standards that determine whether the business can be called “green” in terms of how the business should operate and the environmental commitments that the business should make.

Like all words in circulation for so long, there are variations in its usage. However, across the academic disciplines and indeed in common parlance, there is a universal meaning of resilience that includes the ability to respond to or bounce back from stress and shocks in a healthy and functional way, and indeed, at times to be transformed into something or someone better adapted to their new circumstances. Of course, resilience has a dark side. For example, poverty has proven to be an incredibly resilient or persistent, a fact of life through the centuries and across most societies and cultures, as has disease, conflict, and human exploitation (Rockefeller Foundation, 2012). However, what distinguishes today’s threats from the past is the incredible interconnectedness of our planet and human dependence on natural resources. This is a fact of life that revealed the environment, economy, and social challenges are inextricably linked in everyday activities.

In the context of resilienting the stressed green environment in this century, professionals in different disciplines forward definitions and concepts differently. For instance, Alex (2007) describes contemporary environmentalists as being split into three groups, "dark", "light", and "bright" greens. Accordingly, "Light greens" is described as seeing and protecting the environment first and foremost as a personal responsibility. They fall in on the transformational activist end of the spectrum, but light greens do not emphasize environmentalism as a distinct political ideology, or even seek fundamental reform. Instead, they often focus on environmentalism as a lifestyle choice (Alex, 2007). Lovins, and Hawken (2011) agreed and further noted that greening is sustainability or rather ecological concerns are permeated throughout the business activities.

The motto "green is the new black" sum up of thinking for many which is quite different from the term "light green"(Alex, 2009). Some environmentalists use it to describe products or practices for which their believing is green washing. In contrast, "dark greens" believe that environmental problems are an inherent part of industrialized capitalism. Dark greens claim that this is caused by the emphasis on economic growth that exists within all existing ideologies, a tendency referred to as "growth mania". According to Robertson (2007), the dark green brand of environmentalism is associated with ideas of supporting for a reduction in human numbers and/or a relinquishment of technology to reduce humanity's impact on the biosphere. However, Makower (2009) argued that consumers might be interested in greening, but could not identify it. According to Smith (2013), consumers are often not willing to pay more for green products compared to non-green products.

The term "bright green", first coined in 2003 by writer Alex (2004), refers to the fast-growing new wing of environmentalism, distinct from traditional forms. More recently, they emerged as a group of environmentalists who believe that radical changes are needed in the economic and political operation of society in order to make it sustainable, but that better designs, new technologies and more widely distributed social innovations are the means to make those changes and that society can neither shop nor protest its way to sustainability (Alex, 2004). "Bright green'' environmentalism is less about the problems and limitations we need to overcome than the tools, models, and ideas" that already exist for overcoming them. It forgoes the bleakness of protest and dissent for the energizing confidence of constructive solutions" (Robertson, 2007).

Pertinent with the greening concepts, environment literally means surrounding and everything that affect an organism during its lifetime. In other words, environment is defined as sum total of water, air and land interrelationships among themselves and also with the human being, other living organisms and property. Moreover, Oxford Advanced Learner Dictionary (2009) defined environment is the conditions that affect the behaviour and development of something or somebody; the physical condition that somebody or something exists in. Consistent to this definition, environment is the source of all human civilizations and its sustainability is a crucial factor for the perpetuation of this civilization (Tesfanesh, 2010). This revealed that people's livelihood and firm's profitability are interconnected to the natural environment and the green economy achievements.

However, there are various definitions for a green economy and that these are uniquely tailored to the specific context of each country. For instance, UNEP (2011) described the green economy for which it results an improved human well-being and social equity, while significantly reduced environmental risks and ecological scarcities. With this respect, the green economy presents an attempt to guide countries towards the adoption of action oriented pathways to sustainable development (UNEP, 2014). Along with this line, a resilient green environment is a condition for which eroded natural resources rehabilitate and bounce back from depleted status to create suitable situation for living and working activities. The green resilience environment can provide warranty for people's living and working condition in Kombolecha city.

It was found that in every aspect, environmental problems are never strictly linear, even though some cause and effect relationships can be shown, but are a part of a complex web of interactions (WCED, 1987). The public good called 'environment' is a complex phenomenon that lies at the heart of the cultural, political and economic contexts of people's livelihoods (Najuguna, 2010). The general idea is to integrate an environmental concern into all aspects of the social and economic life that keenly plays important role for people wellbeing (Andrew, 2004). The valuation of environment found out only the physical aspects of the environment that determined human existence on this planet. However, environment non-price valuation showed that how life intertwined under the umbrella qualitative characters between living and non-living things (Kwashirai, 2012).

This indicates that environment comprises of both tangible and intangible, human and non-human activity, and the resulting phenomenon (Kwashirai, 2012). Indeed, Ethiopia is endowed with abundant water sources; there is reversal rainfall variability and drought persistently continuing in affecting agriculture production. This reviewed, in sum, revealed that there is much common ground between the green concepts employed by governments, businesses and international organisations globally. When all's said and done, a green economy implies a departure from the 'business as usual' economic paradigm, to one with regulatory measures and strong financial incentives for innovation, investments, sustainable consumption behaviour, and information-sharing (EEA, 2013). Natural resources are best able to support people livelihoods when they are healthy, diverse and resilient (MDG,2015). However, environment philosophy in the modern world determined the country's green growth policies and programs that attempt to realise the green living and working condition.

2.2 Green Environment Philosophy

The environmental philosophy in its modern form developed in the late 1960s, the product of concerns arising from diverse quarters: naturalists, scientists and other academics, journalists, and politicians (Baird, and Robert, 2008). In 1968, the Tragedy of the Commons by Garrett Hardin, who argued that human self-interest and a growing population, would inevitably combine to deplete resources and degrade the environment. In the same year, another best-seller, Paul Ehrlich's Population Bomb, anticipated hundreds of millions of deaths in the coming decades because of the failure of food supply to keep pace with an ever-expanding global population (Meadows *et al*., 1974). The rising urbanization worldwide brings challenging problems to governments and stakeholders thus societies due to the fact that more and more people migrate to urban areas and projections indicate that more than 60% of world population will be living in the urban areas by 2030 (Shcherbakova, 2010).

It was only in the 1970s that philosophers began to rediscover and mine ideas about nature found in Rousseau, Kant, Hegel, Hölderlin, Nietzsche, Benjamin, and Heidegger; thinkers who regard themselves as belonging to the continental tradition have been at the forefront of this development (Foltz, 1995; Foltz and Frodeman, 2004). Some have argued for the relevance of phenomenology to environmental consciousness and the understanding of the human condition (Evernden, 1985; Seamon and Mugerauer, 1985; Abram, 1996; vine and Brown, 2002). A phenomenological approach, which was applied in this study, takes the subject's own awareness and experiences as the starting point for philosophical, aesthetic, and moral reflection. Ralston (1975) explored the implications of this view by looking for ways in which to make sense of the idea that humans have duties not only to individual humans and animals but also to larger wholes species and ecosystems.

Through the 1970s and 1980s these themes of atomism, human-centeredness, and the scope of what is intrinsically valuable set much of the agenda for further theorizing. With the introduction of the idea of animal liberation in 1973 (Singer, 2003), there was a swell of support for the idea that the capacity to feel pleasures or pains might be a significant criterion of moral value, or at least of moral considerability. On this view, although things that are morally valuable ought to be protected, things that are morally considerable ought to figure directly in human thinking and planning but need not necessarily be protected (Callicott, 1989 and Frodeman, 2004).This shows environmental philosophy has explored new criteria of such considerability, including being alive (Goodpaster, 1978); being a community or a holistic entity of a certain kind (Callicott, 1980, 1987; Rolston, 1994); being an entity or organism that has an end in itself (Taylor 1981, 1986, Rolston,1994); being a subject of a life (Regan 1983); lacking intrinsic function (Brennan 1984); being a product of natural processes (Elliott,1982;Rolston,1989); or being naturally autonomous (Katz, 1997 and Frodeman, 2004).

The issue really was need for a new ethic for the environment dominated much of the philosophical discussion for the next decade (Rodman, 1977&1983; Attfield, 1983; Callicott, 1986; Rolston, 1986). Continuing into the 1980s, the debate expanded beyond questions of value and ethics and extended to meta ethical issues (the meaning of moral terms and the objectivity of value), metaphysical issues (the nature of the cosmos and the place of humans within it), and wider questions about human consciousness, identification and awareness. The appearance of a number of systematic single-author books and collections of essays (Bookchin, 1980, Elliot and Gare, 1983, van de Veer, 1986, Attfield, 1983; Rolston, 1988; Brennan, 1988; Callicott, 1989; Hargrove, 1989; Norton, 1991) helped to solidify and clarify the main currents of thought in environmental philosophy (Callicott, 1989 cited in Frodeman, 2004 and ESCAP, 2011). This study shared these environmental philosophies, especially underlined the household's phenomenology, such as culture, perception, behaviours, habits etc., that were keenly intertwined with the green environment in growing industrial sites.

By the early 1990s, the field of environmental philosophy was well established, as evidenced in the appearance of new societies and journals. As feminists and political and literary theorists increasingly turned their attention to environmental issues, more debates and schisms arose from the 1980s onward. The ways in which the environment and nature have been construed in philosophical, political, and a new area of literary theory: eco-criticism or eco-critique (Meeker, 1972; Buell, 1995; Glotfelty and Fromm, 1996; Luke, 1997; Morton, 2007). The wilderness was the focus of many of the writings in the 1970s and 1980s. However, the following decades saw an increasing concern with issues such as restoration, urban environments, pollution, and resource depletion and their connections with poverty, dispossession, housing, environmental policy, social justice, economics, and sustainability (Wenz, 1988, Sagoff, 1990; Guha and Allier, 1997; Light, 2001, Norton, 2003, Frechette, 2005).

By the turn of the twenty-first century, contemporary environmental philosophy had ramified into nearly all areas of philosophical, social, cultural and political theory. The most environmental philosophies often borrow their overall orientation from the author's implicit philosophical, political, and religious identifications. Interpreters of Islamic traditions, for example, echo the ideas of some followers of deep ecology in arguing that environmental destruction is an aspect of a wider cultural and moral corruption associated with materialism and spiritual bankruptcy (Wersal, 1995). Whether conservation is a politically conservative position and what scope there is for developing green forms of socialism and marxism have been hotly debated (Dobson, 1995 and Barry, 1999). The green credentials of many religious and cultural traditions have been scrutinized (Callicott and Ames, 1989; Callicott, 1994), and some thinkers proposed that traditional medicine can provide some support for an ethics of place (Brennan, 2002).

This showed that there is a growing interest in comparative studies of environment, religion, and culture, a trend evidenced on two fronts: in the recent publication of a major reference work (Taylor, 2005) containing numerous entries on diverse traditions and their environmental beliefs (Forum on Religion and Ecology, 2008). However, the politics of the environment the talk and the action, the rhetoric and the reality, the theory and the practice have changed in fundamental ways (Connelly and Smith, 1999). The general emphasis among politicians and policy makers as well as for most of the experts who advise them and the activists who goad them on has tended to shift from the protection of an external realm of non-human nature to the greening of our own human societies (Dobson, 2000). This diverse process of greening, and of green knowledge making, are filled with ambiguities that paved to give due attention and find out the dynamic multifaceted green growth and vice versa challenges on resource degradation that continuously confront citizen’s wellbeing.

2.3 The Notion of Green Resilience

Greening is very broad and can be applied in almost every industry (Makower, 2009). The notion of "greening" is, of course, multifaceted and can be thought of as an application of the concept of sustainable development to the economic or corporate sphere. "Greening of industry" is a processual term; it focuses on the dynamic elements of change rather than on what might be termed the substantial elements, and it was thus no easy matter to carve out the particular discursive space in which the network could operate (Andrew, 2004). There are many areas in which a business can green itself, in terms of producing the green products, purchase the green logistics, green staff training, and green buildings and green information technology (Jenkins & Yakovleva, 2006).

Back in the 1960s, trying to lead an environmentally conscious lifestyle especially integrating green into one's shopping was a very fringe phenomenon. After 1990s, the greening concept has been identified as the adoption of "environmental management systems, waste minimisation and the integration of environmental issues into all organisational activities" (Polonsky, 1994). Most recently, it is described as the strategy whereby businesses engage in environmental education to reduce solid waste and make use of recyclable packaging for their product offerings (Orsato, 2009). In the case of a greener footprint for industry it is depicted as a two-pronged endeavour to decouple resource use and pollution from industrial development and promote growth of productive sectors and entrepreneurships in developing countries (UNIDO, 2009 &Annika, 2012).

In the 1970s a range of "new social movements" emerged throughout the world (Dickson, 1974). Among other things, the new movements of feminism and environmentalism articulated an alternative approach to science and technology. The new movements involved both a rejection of modern science's exploitative attitude to nature, as well as an alternative organizational ideal a democratic, and participatory ideal for the development of knowledge (Eyerman and Andrew, 1991). However, the 1980s were not kind to environmentalism. The 1980s witnessed the widespread entrance of environmentalism into the parliamentary arena as green parties were formed across Europe and North America as well as in several Asian countries. The formation of green parties, nevertheless, was controversial and perhaps the main factor that led to splits and conflicts within most national environmental movements. In the late 1980s, environmental concern emerged once again into the broader public sphere, but now in a new more "global" and professional guise (Andrew, 2004).

However, the resilience perspective was revived in the early 1990s through research programs of the Beijer Institute, where it came across as essential in interdisciplinary studies on biodiversity (Perrings *et al.*, 1995 and Folke *et al.*,1996), complex systems (Costanza *et al.*, 1993), property rights regimes (Hanna *et al.,* 1996; Berkes and Folke, 1998) cross-level interactions and the problem of fit between ecosystems and institutions (Folke *et al.,*1998 and Costanza *et al*., 2001) and in relation to economic growth and socio economic systems (Arrow *et al.*, 1995 and Levin *et al.*, 1998). With this respect, resilience is defined as "a measure of the persistence of systems and of their ability to absorb change, disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973). Resilience seeks to enhance the capacity and ability of a social or ecological system to absorb disturbances for self organisation to adapt to stress and change (IPCC Report, 2008).

Undeniably, the developed, emerging, and developing countries faced different challenges and opportunities in greening growth as would countries with differing economic and political circumstances (OCED, 2011). Yet, there are some common considerations that apply to all contexts. Greening the growth path of an economy depends on the institutional settings, level of development, resource endowments and particular environmental pressure points (OCED, 2012). This indicates that the concept of green growth reframes the conventional growth model and re-assesses many of the investment decisions in meeting energy, agriculture, water and the resource demands of economic growth (Ibid). There is generally a high degree of ambition and political support for green growth across the developing world, but only where it can lead to poverty reduction, higher social welfare and job creation (OCED, 2012). This indicated that there is no "one-size-fits-all" prescription for implementing the green growth (OCED, 2011).

A similar problem was detected in LDCS in various natural resources like fishing sector in Tanzania with only 30 percent accruing to local government being collected (Schlegelmilch, 2007). Despite these challenges, fiscal reforms present major potential for green growth, particularly when applied to natural resource management. For instance, water pollution charges in Chile brought USD 15 million to its environmental authorities between 1997 and 2000, and fishery access agreements in Guinea Bissau raise approximately 30% of government revenues (World Bank, 2005). Pricing of natural resources can be seen as an immediate win-win option to promote sustainable management of resources and increased fiscal revenue to the government (OCED, 2011). However, green growth is facing challenges in its implementation. Greener behaviour by consumers facilitates smooth reallocation of jobs, capital and technology towards greener activities and provides adequate incentives and support to green innovation (Ibid). However, misguided government policies, market constraints and distortions all lead to or arise from market failures, which mean there is often a gap between private returns from economic activity and the overall benefits that accrue to society (OCED,2011 and EEA,2012).

Current research in climate science is focused on a few core lines of inquiry and several excellent reviews are available on the subject (Wilby, 2007). These research lines include 1) measurement, estimation and monitoring of greenhouse gas concentrations in the atmosphere; 2) sensitivity and radiative forcing: scenario development and testing via models of modeling of the earth - ocean - atmosphere system to simulate responses to external stimuli such as those resulting from increasing concentration of greenhouse gases or from projected emissions based on plausible socio-economic futures (Gina and Anton *et al.,* 2008). Most of these studies are general observations and reflections around the “green challenges” at global level which has to be handled in society be it in the urban or the not so urban spheres (Uno, 2011). This study, nonetheless, identified major factors associated with resource consumption growth and the green environment tradeoffs.

In urban areas, cities account 75 percent of energy consumption and carbon emissions that putt unmanageable load on the environment (UNEP, 2011). However, individual resource consumption and resultant effects on environment are not yet included on product life cycle assessment (Shri, *et al.*, 2012). In the case of Ethiopia, urban green areas were usedby industrial, commercial, residential and infrastructural developments as well as by spontaneous and illegal settlements along mountain slopes, river valleys and other open spaces. Following the Rio Summit held in Brazil in 1992, the country introduced a number of legal instruments to implement Agenda 21 at local level and established the Ethiopian Environmental Protection Authority in 1995, and went on to formulate the Ethiopian Environmental Policy in 1997. This included the enactment of Article 44 of the country’s constitution (1995), which states that the people of Ethiopia have the right to live in a healthy environment (FDRE, 2015). However, groundwater consumption and its payoffs on environment were not yet considered bymunicipal to rehabilitate the living and working condition in the environment.

2.4 Globalisation Payoffs on Environment

The globalization and intensification of environmental degradations induced by the contemporary mode of development question the long-term viability of the globalization process. The accumulation of wealth is today considered through the prism of its sustainability. The critics, in a more or less radical way, call into question the regulation mechanisms that govern the relations between economic systems and environment. The neoclassic authors pretend that the market remains the most efficient institution to integrate ecological constraints on the double condition that externalities are internalized and the technological progress is circulated. Heterodox economists dispute this optimist version of market failures and wonder about the necessity to adopt another paradigm of economic development (Matthieu and André, 2008).

The gains from growth, while distributed unevenly around the world, have been dramatic (OCED, 2011). More generally, a number of companies seek competitiveness gains through clean technology investment. Realising that environmental performance will be a major competitive factor in the future; leading companies are increasingly finding innovative ways of mainstreaming sustainability considerations into their core business. Perhaps the main dilemma of green business is that there are no universally applicable solutions. In other words, institutional logic of one company is often incompatible, or incommensurable, with the operational logic of another (Andrew, 2004). This leads the impacts of economic activity on environmental systems are creating imbalances which are putting economic growth and development at risk; natural capital, encompassing natural resource stocks, land and ecosystems, is often undervalued and mismanaged. This imposes costs to the economy and human well-being; the absence of coherent strategies to deal with these issues creates uncertainty; inhibits investment and innovation, and can thus slow economic growth and development (OCED, 2011).

The world faces twin challenges: expanding economic opportunities for a growing global population, and addressing environmental pressures that, if left unaddressed, could undermine our ability to seize these opportunities (OCED, 2011). The industrialization in many countries in the past 100 years and the resource-based industrial activities have used up resources, mostly produced by developing countries. The tremendous industrial growth in the world economy and the current strong economic growth in some regions of the world, for example in Asia, some Latin American countries, Africa have generated a high demand for specific inputs. Renewable as well as nonrenewable resources have been in high demand, and they are threatened with being depleted. In particular, natural resources, which are often extracted from developing countries, have significantly reduced the years to exhaustion for those resources (Greiner and Semmler, 2008).

Most literatures show globalisation has ushered in an era of contrasts characterized by a fast paced change and persistent problems in Africa. It implies a growing degree of interdependence among economies and societies through cross-country flows of information, ideas, technologies, goods, services, capital, finance, and people. The rapid pace of economic integration a central force behind and a manifestation of globalization led interlinked world markets and economies demanding synchronization of national policies on a number of issues. One dimension of this coordination concerns the environment. From shared natural resources such as fisheries and biological diversity, to the potential for transboundary pollution spillovers across the land, over water, and through the air (Esty and Maria, 2003). This has challenged the traditional capacity of governments to regulate and control.

Globalisation, thus, can exacerbate environmental problems as well as provide new means for addressing them (Anderson, Cavanagh, and Lee, 1999; Jobes, 2003; Speth, 2003). The globalisation of economic activities since the 1980s and 1990s, accelerated through free trade agreements, liberalized capital markets, and labor mobility, has brought into focus the issues related to global growth, resources, and environment. The resource-based industrial activities have used up resources, mostly produced by poor and developing countries (Greiner and Semmler, 2008). An inclusive green economy reflects a recognition that maximise well-being and fairness across generations requires that society find ways to constrain and channel market forces (EEA, 2013). It is true that technical progress reduced the dependence of modern economies on natural resources; developing nations producing with older technologies usually do not have this advantage (Greiner and Semmler, 2008).

A number of studies have been conducted on environment and economic activities interaction in previous literatures. Among many, Forster (1973), for example, studies a dynamic model of capital accumulation, the Ramsey growth model, with pollution as a byproduct of capital accumulation that can be reduced by abatement spending. In the long run, this model is characterized by a stationary state where all variables are constant unless exogenous shocks occur. Another early contribution by Mäler (1974) considered a classical contribution in environmental economics field, analyzes several aspects associated with environmental degradation in different frameworks such as a general equilibrium model of environmental quality and an economic growth model incorporating the environment. However, Mäler assumption lined a finite time horizon and is less interested in the long-run evolution of economies in contrast to Forster (1973) cited in Greiner and Semmler (2008).

As so often in the past, we see how scientific and technical ingenuity are being integrated into patterns of global inequality (Guha, 2000). And, throughout the world, the processes of institutionalization have also faced what has been termed a "green backlash" from those in powerful positions who have had enough of environmental protection and are unconvinced that ecology will ever be particularly profitable (Rowell, 1996; Beder, 1997). In contrast to earlier, more localized environmental calamities, the new problems tend to be more international, or global, in scope, reflecting the growing interconnectedness of the world's economic activity, and the attendant difficulties in keeping that activity under any kind of meaningful social control at a national, or sub-national level. Concerned citizens organized themselves into action groups so that they might move the risks away from their own neighborhoods, these new environmental challenges cannot so easily be moved away: they are in everyone's "backyard" (Andrew, 2004).

A 2007 report released by the IPCC declared that climate change or more specifically global warming is "unequivocal" and "most likely" due to human activity. According to the last IPCC report (2007), it is more than 90% probable that humankind is largely responsible for modern-day climate change. Deforestation and processes that release other greenhouse gases such as methane also contribute. Although the initial impact is a rise in average temperatures around the world, "global warming" also produces changes in rainfall patterns, rising sea levels, changes to the difference in temperatures between night and day, so on. This more complex set of disturbances has acquired the label "climate change' some times more accurately called "anthropogenic (human-made) climate change" (Yared, 2009).

The green economy offers considerable opportunities for mobilizing resources towards a lower emission, climate-resilient development pathway. This is, however, not without challenges. The key challenge is how the green economy will contribute to sustainable development and poverty reduction objectives while improving welfare and the quality of life for the sub region's poor. The green economy necessarily requires an increase in levels of consumption, in particular of food, energy and water (United Nation Economic

Commission for Africa (UNECA), 2012). Social equity needs to be enhanced by ensuring fair access to natural resources, sharing the benefits of nature, and securing a healthy living environment that protects society from pollution impacts. This implies international burden sharing in addressing the hidden ecological costs of trade; sharing the costs of tackling environmental issues and reducing the environmental footprints of consumption (EEA, 2013).

2.5 Urbanisation Spillovers on Environment

Urbanisation is a complex dynamic process playing out over multiple scales of space and time (Alberti *et al.,* 2003). Although urbanization itself is not necessarily a problem, haphazard and unplanned growth can result in many environmental problems such as public space and riverbank encroachment, air and water pollution, and solid waste generation (Troschinetz & Mihelcic, 2009). On the other hand, urbanization is marked as both a social phenomenon and physical transformation of landscapes that is now clearly at the forefront of defining humanity's relationship with the biosphere (IHDP, 2005). Urbanisation and urban landscapes have recently been identified by the Millennium Ecosystem Assessment (MEA) as research areas where significant knowledge gaps exist (Granahan *et al*., 2005). Development of any nation is closely linked to its level of urbanization for which cities are magnets for population migration, engines of economic development, and centers of information and global connections (Mopfu, 2013).

With reference to urbanisation and urban encroachment on dryland areas, Safriel and Adeel (2012) argued that "dry land cities as an alternative to dry land villages may be a sustainable option for settling more people in dry lands because the cities consume, and hence affect, fewer land (or water) resources than dry land farming and pastoral livelihoods do. This depends, however, on the potential of dry land cities to provide livelihoods as well as living conditions that are advantageous compared with those provided by other cities" (Safriel and Adeel, 2012). Given the potential advantages of living in dry land cities and their relatively low impact on services, a policy of encouraging urban livelihoods in appropriately designed and functioning dry land cities could significantly contribute to sustainable water development and management (Sobona and Alan, 2013).

In the current era, cities are the quintessential example of a complex adaptive system (Batty *et al*., 2004). On the other hand, cities are 'living' systems dynamic, connected, and open constantly evolving in many and varied ways to both internal interactions and the influence of external factors (Bai, 2003). For instance, in the developing world, cities are often changing faster than we can understand the diverse factors conditioning these changes, and to complicate matters further, many of the driving forces are also operating in contradictory directions and at differing scales and therefore do not lend themselves to simple solutions (Redman and Jones, 2005).

The pre and post emphasis on local action as a necessary part of 'thinking globally' led to increasing attention being placed on the role that cities could and should play in addressing environmental problems. In focusing on the urban arena, two different ways of conceptualising sustainability and the means of achieving it have emerged: the first approaches, which focus on modeling and monitoring environmental flows through and within cities, with the intention of reducing the resource use and waste outputs (Capello, *et al.* 1999; Giradet, 1999; Ravetz, 2000). The second approaches focus on redesigning urban space with a view to addressing the environment, economic and social dimensions of sustainability simultaneously, sometimes labelled the 'compact city' approach and evidenced in new ideas about urban planning and design (Breheny, 1996; Jenks, *et al*. 1996; de Roo and Miller, 2000).

Africa is the fastest urbanising region in the world and it is also one of the poorest. Although urbanization is closely associated with people seeking new livelihood opportunities, rapidly growing urban environments may not be able to provide these. Urbanization may create new pressures on existing infrastructure, leading to the spread of informal settlements. Some 72 percent of Africans living in urban areas live in slums without access to basic environmental or social services (UN-Habitat, 2003). A dramatic increase in urban and rural settlements is also believed to have put tremendous pressure on natural resources in the area, including water resources (WCED, 2013).

The urbanization phenomenon in Ethiopia has been associated with environmental problems in most cities, including Kombolecha and Addis Ababa (capital city). For instance,among the major problems are urban sprawl, solid and liquid waste management; water, air, and noise pollution; illegal settlements and the degradation of open green areas. The main drivers of environmental degradation in Ethiopia were included high population and urbanisation as well as an economic growth that is largely driven by agricultural production, infrastructure expansion and increasing energy demand (AFDB, 2011). Open green areas have been placed under extreme pressure, thus threatening their ability to maintain basic ecological, social and economic functions (Mpofu, 2013). Changing the payoffs in the economy, however, mismatches between private payoffs to economic decisions and social value has left an extraordinary challenge in changing the infrastructure of economies to avoid locking economic growth into a pathway that turns out to be regrettable (OCED, 2011).

Urbanisation process, among other causes, commonly associated with the movement of people from rural to urban areas. This results in high population densities relative to their surrounding areas (O'sullivan, 2007). On average, the world urban population growth rate is about 1.8% whereas that of Africa is about 4.4% (UN-Habitat, 2004 &2005). Furthermore, Africa's proportion of urban population is 39% while that of the Sub-Saharan Africa is about 29%. In Ethiopia, urban population is about 11.7 million or 16% of the total population of the country. Addis Ababa, which is the capital city and African union center, alone has an estimated population of more than 3 million or 25% of the total urban population, and an annual growth rate of 8% (Plan of Action for the Sustainable Development to End Poverty ((PASDEP), 2006; cited in Yewoinishet, 2007). This showed that population growth placed an immense pressure on natural resource and green environment problemsin the country.

2.6 Urban Economy- Environment Nexus

Economies have benefited from what nature has to offer but these gains have been achieved at the cost of diminishing biodiversity and degrading ecosystems (UNU-INRA, 2014). Economic activities straddle national boundaries and are affected by global, regional and national processes. Global policies and practices have direct impacts at national and regional levels on environmental sustainability and human well-being sometimes increasing opportunities but at times decreasing opportunities (WCED, 2013). However, today's environment is not new. Everyone talks about it but what is critical is pursuing positively along with human population consumption growth. A decade ago, climate change, biodiversity loss, unsustainable use of natural resources and environmental pressures on human health and well-being remain was important concerns. What has changed is the recognition of the complex links between the many challenges and the need for integrated responses (EEA, 2013).

Degradation of ecosystems and delivering of ecosystem services has implications for human well-being and economic development, especially for business activities. In fact, all business activities are fundamentally dependent on the planet's biological diversity and ecosystem services; and these activities impact positively or negatively on biodiversity and ecosystem services. In the wake of Africa's transition to a green economy which aims at meeting the dual goals of high human development and low ecological impact, there is the need to incorporate biodiversity and ecosystem services (BES) into business policies and practices (UNU-INRA, 2014).

According to Tony (2010), damage to environment, both in terms of quality and quantity, has been recently experienced to a greater extent than ever before. Acres of forest destroyed, amount of soil and organic matter eroded, number of wildlife lost, extent of biodiversity threatened are part of everyday news around the world. Reduction in air quality, emission of dangerous pollutant, apparent global warming and other environmental confrontations are often mentioned as a result of uncontrolled human interactions with environment. These interactions are diverse, but most importantly, they are based on the economic activities that human beings performed at different stages of economic development (Tony, 2010).

Developing countries, especially those on the African continent have contributed little to the observed global warming. Per unit of GDP produced African economies are the most CO_2 intensive in the world at 1.65 kg of CO_2 equivalent per US $ dollar of GDP (indexed by 2000 dollars), but the relatively low levels of economic activity on the continent result in low aggregate emissions (Gina and Anton, 2008). The same lack of economic activity and poverty, render African countries, and especially the poorest communities in these countries, disproportionately vulnerable to climate change impacts. Agricultural production and the biophysical, political and social systems that determine food security in Africa are expected to be placed under considerable additional stress by climate change (FAO, 2007). The climate change and its resultant environmental problems were increased until the population and water consumption growth was continued in Kombolecha.

The Environmental indicator report (2012) pays attention on the core challenge of improving resource efficiency while ensuring ecosystem resilience. Based on the analysis of the environmental themes, it concluded that whilst progress has been made in improving resource efficiency it may not be sufficient to conserve the natural environment and the essential services it provides to human society. It consists of four thematic assessments, focusing on food, water, energy and housing. It analyses the trends in demand and the corresponding supply mechanisms using, for example, consumption and production data and trade statistics. The environmental pressures arising from these resource use patterns are then described and interpreted in terms of human exposure and selected health and well-being impacts (EEA, 2012). The main sources of emission from the energy sector are the residential, transport and manufacturing sub-sectors. Greenhouse gas emissions from the energy sector are due to carbon dioxide released during combustion of fossil fuels and methane released from the combustion of fuel wood and the production of charcoal (CCRE, 2012).

The key new and emerging challenges to sustainable development in the sub region, nevertheless, include climate change and the associated extreme weather conditions; rising water scarcity; the unfolding financial crisis; halting progress towards the Millennium Development Goals (MDGs),which later replaced by the Sustainable Development Goals (SDG); the global food crisis and high food prices; the energy crisis precipitated by the unprecedented volatility in energy prices; biodiversity loss; the degradation of ecosystems, including marine ecosystems; inefficient and wasteful patterns of consumption and production; and a succession of natural disasters. The myriad of challenges justifies a total change of economic policy, including the patterns of production, distribution and consumption within a framework of green growth (UNECA, 2012)

Problems of environmental degradation have also been studied in endogenous growth models. There exist many models dealing with environmental quality or pollution and endogenous growth (Smulders, 1995 or Hettich, 2000). Most of these models assume that pollution or the use of resources influences production activities either through affecting the accumulation of human capital or by directly entering the production function. Examples of that type of research are the publications by Bovenberg and Smulders (1995), Gradus and Smulders (1993), Bovenberg and de Mooij (1997), and Hettich (1998). The goal of these studies, then, is to analyze how different tax policies affect growth, pollution, and welfare in an economy. Most of these models do not have transition dynamics or the analysis is limited to the balanced growth path (Greiner and Semmler, 2008).

Along with this, the intersections of environment, economy and social equity are commonly discussed and found in a vast literature of sustainable development. For instance, Maclaren (2009) "Sustainable development" implies a state *and* process of development (Reza, 2013). At the same time human societies and globally interconnected economies rely on ecosystems services and support is particularly discussed in

Millennium Ecosystem Assessment (MA, 2005). Nevertheless, reflecting on the succession of calamitous events that have occurred in recent years, scholars and policy makers alike have begun questioning whether humans' capacity for protecting the near-term resilience and longer-term sustainability of the earth's fragile ecosystems has been inexorably surpassed by these converging environmental and societal perturbations (Gunderson and Folk, 2011 and Schoon *et al.,* 2011).

The Eastern African sub region faced a number of emerging challenges to sustainable development, including climate change, increasing water scarcity, the global financial crisis, halting progress towards the MDGs, the global food crisis, biodiversity loss and the degradation of marine, freshwater and other important ecosystems, inefficient and wasteful patterns of consumption and production and frequent natural disasters. These challenges are evident in all the countries in the sub region, albeit to different extents. In many cases, the challenges have been further exacerbated by poverty, competition for scarce resources, the rapid pace of rural-urban migration and the concomitant challenges to provide food, infrastructure and access to basic health, water and energy services. Meeting these challenges has put immense pressure on the meager resources in the region (UNECA, 2012).

The most appealing model so far is that of the "green economy". UNEP defines a green economy as one that achieves improvement of human well-being and social equity while significantly reducing environmental risks and ecological scarcities (UNEP, 2010). The key elements of green growth include improving the quality of life of people and the global community (UNCEA, 2012). Moreover, many models are dealing with environmental pollution and endogenous growth (Smulders, 1995 or Hettich, 2000). Most of these models assumed that the use of resources influences production activities either through affecting the accumulation of human capital or by directly entering the production function. For instance, research publications by Bovenberg and Smulders (1995); Gradus and Smulders (1993); Bovenberg and Mooij (1997) and Hettich (1998) analyse how different tax policies affect growth, pollution, and welfare in an economy (Greiner and Semmler, 2008).

One aspect that tends to be overlooked is the economic competitiveness that can be enhanced with resource efficiency. In view of the long-term upward trend and volatility of commodity prices, resource efficiency has become a major factor that determines the competitiveness of firms, cities and countries. Many profitable new business opportunities are available both in input-efficient production and in environmentally responsible recycling and waste disposal. Meanwhile, cities should also be mindful of the fact that over-reliance on conventional waste collection, treatment and disposal is not sustainable and it is too costly. Waste management should be designed and planned in a holistic, integrated way on the principles and practices of reduce, reuse and recycle (3Rs) (Chandak, 2010).

From the social perspective, developing countries can benefit from viewing the environmental technology industry as a potential source of employment or "green jobs" and long-term asset protection. The number of people involved in waste management in both formal and informal sectors is a significant number. Providing a better occupational environment and protective measures, and by formalising the informal sector workers, cities can contribute in a meaningful way to raising the living standards of its citizens. The crucial notion that measurable effects of environmental pressures on human health and well-being will always be the combined result of multiple exposures and multiple contextual factors. These contextual factors include demographics, education, wealth, lifestyles, and the psychosocial effects of the physical environment (Morris *et al*., 2006).

Policies should address upstream challenges that can help support effective management downstream. For example, with growing emphasis on the green economy, sustainable production and resource efficiency, new improved forms of technology will be required to allow for sustainable design. Design for Sustainability (DfS), Eco-Design, Design for Environment (DfE) and Design for Disassembly (DfD) all refer to an approach to design, manufacture, use and disassembly that allows for easy recyclability of used products, thereby widening the scope of materials suitable for recycling. This would be included under a comprehensive policy framework encouraging reuse and recycling of special waste streams as resources (Chandak, 2010).

Renewable natural resources that is land, water, forests and trees as well as other forms of biodiversity, which meet the basic needs for food, water, clothing and shelter have now deteriorated to a low level of productivity (Environmental policy of Ethiopia (EPA),2010). Despite the presence of mineral resources in quantities and qualities suitable for exploitation, they currently contribute only about 2 per cent of the GDP. Only 1 percent of the potential of Ethiopia's vast water resources used for irrigated agriculture and hydropower generation (EPA, 2010). Consumers were used groundwater sources without payment that could be reducedthe water consumption inefficiency and wastes discharges torivers and nearby environment.

2.7 Cities' Resilience

The resilience perspective was revived in the early 1990s through research programs of the Beijer Institute, where it came across as essential in interdisciplinary studies on biodiversity (Perrings *et al.*, 1995 and Folke *et al.*,1996), complex systems (Costanza *et al*., 1993), property rights regimes (Hanna *et al.,* 1996; Berkes and Folke, 1998) cross-level interactions and the problem of fit between ecosystems and institutions (Folke *et al.,*1998 and Costanza *et al*., 2001) and in relation to economic growth and socio economic systems (Arrow *et al*, 1995 and Levin *et al*., 1998). Resilience is defined as "a measure of the persistence of systems and of their ability to absorb change, disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973). Resilience seeks to enhance the capacity and ability of a social or ecological system to absorb disturbances for self organisation to adapt to stress and change (IPCC, 2008).

Vulnerability is a core concept of resilience and it includes the attributes of persons or groups that enable them to cope with the impact of disturbances, like natural hazards or socio-economic crises (Janssen *et al*., 2006). Also, environmental, social and economic sources of resilience such as social capital (trust and networks, experiences for dealing with change); resource consumption efficiency and recycling and keeping the environment safe for living and working are essential for the capacity of social-ecological systems in rural areas to adapt to and shape change (Folke, 2006). However, this study focused on urban areas, particularly in a city, where dense firms and population are consuming resources to ensure their interest such as utility and profit.

Since social, economic and ecological subsystems cannot be completely decoupled, building resilience also means increasing the diversity of intersystem relationships at numerous varied connections between subsystems enable to adapt to new conditions (Folke *et al.*, 2002). To do so, it requires resourcefulness: the capacity of self-organization, and the ability to combine different types of knowledge in order to cope with change and uncertainty (Tierney, 2007). However, it may prove very difficult to transform a resilient system from the current state into a more desirable one (Scheffer *et al.*, 2001; Gunderson & Holling, 2002 and Walker *et al*., 2004). As a solution, two approaches were suggested for assessing resilience at different scales 1) the development of a resilience index to compare resilience across countries; and 2) case study or series of case studies (Gunderson and Holling, 2002). However, this study employed a case analysis to apply a socio–eco efficiency framework and aimed at resilienting the green environment through balancing the water consumption and recycling efficiency.

In an analogy to urban resilience (Colding & CSIRO, 2007) and Rural Resilience (Heijman *et al.,* 2007), the concept of green environment resilience determines the degree to which a specific industrial area is able to tolerate alteration before reorganizing around a new set of structures and processes. It describes how well an area can balance ecosystem, economic and social functions (Heijman *et al*., 2007). This study further extends the conceptby exploring in detail what the importance is of resilience theory in a growing industrial area. Since the introduction of the concept of resilience in 1973 by ecologist Holling, the concept also emerged in literature on psychology, economics and sociology (Gardner *et al*., 2007). The application of resilience to the uncertainties and rapid changes of rural areas has been minimal. Heijman *et al*. (2007) introduced the concept of rural resilience. This is based on the idea that ecological, economic and social systems become increasingly entangled, and interactions between these systems are increasing in intensity and scale. The environment and its natural resources are conditioned by the actions of the population (Albala *et al*., 2008).

They should be seen as overlapping components, together forming a holistic complex adaptive system. The adaptive capacity of a rural system is a central feature of resilience and refers to the ability of a system to adjust to changing internal demands and external circumstances (Carpenter *et al*., 2008). Highly adaptive systems not always enhance resilience. Highly adaptive systems can lead to a loss of resilience through an increase in adaptability in one place, that may lead to a loss of adaptability and thereby resilience in another place. Moreover, increasing adaptability to known shocks, may optimise the system for this regime of shocks, but makes the system less resilient to unknown shocks (Walker *et al*., 2006). The interactions between and within systems should, therefore, always be taken into account. However, measures of resiliency had not been developed until recently, making it very difficult to generalize results or compare studies (Friborg *et al*., 2005).

Processes on a local scale can have global impacts on a longer run, while global trends can have direct or indirect effects on a local level or the levels in between (Van Den Bergh et al., 1991). An area's specific environmental, economic and social structures determine the resilience of the area, or the adaptability to external environmental and socio-economic forces (Bergh *et al*., 1991). Holling (2001) and Alberti *et al.*

(2003) defined resilience as the degree to which cities are able to tolerate alteration before reorganising around a new set of structures and processes. They assert that urban resilience measured by how well a city can simultaneously balance ecosystem and human functions. Most people think of urban resilience is generally in the context of response to impacts for example hazard or disaster recovery. However, understanding of resilience in regional social-ecological systems is a society that is flexible and able to adjust in the face of uncertainty (Berkes and Folke, 1998; Barnett, 2001). Though much progress has been made in the area of resilience research, there is still no definitive set of factors that constitute risk or protective factors (Hoge *et al.*, 2007).

This notion reveals that disturbances in one system of resilience can affect the resilience in other systems. For instance, factory and household's water consumption and waste recycling process affects environment that resultantly created the social and economic vulnerability for residents. Stakeholders in growing industrial areas were included the key participants, such as factories, households and government. The integration of these stakeholders built the economic, social and environmental subsystems which is keenly important. These stakeholders all weigh economic, social and environmental outcomes in a different way. Cooperation and motivation within a social network depend strongly on the structure of the network, and thereby determines the adaptive capacity of the network. A lack of trust within the social network leads to inefficient information flows and deteriorates the social structure and thereby the system's resilience (Callaghan *et al*., 2008).

Given the various pitfalls, most methodologies are applied to limited geographical and time scales and quantitative approaches have been largely based on valuation (ESCAP, 2008). Carpenter *et al*. (2004) is famous for their well-defined systems and focus on system dynamics. These case studies use simple mathematical models that allow for an analysis of the long-run behaviour of these systems, while looking at the possible attractors and the states in which the system can be. Also, case studies with asocial background exist in which social processes are included in the system dynamics and in which multiple resources are involved (Berkes *et al*., 1992 and Gunderson *et al*., 2006).

The varieties of frameworks that exist for the study often lack a clear description of the structural changes and a comprehensive analysis of the system dynamics, which are key aspects for resilience theory. According to Folke (2002) argument, resilience measures a socio-economic system (SESs) and should focus on the variables that underlie the capacity of environmental systems to provide ecological services to SESs. All resilience assessments in SESs are constrained by complexity and the availability of data. (Folke *et al*., 2002). When looking at the macro level comparative analysis, Brenkert, *et al.* (2005) and Briguglio, *et al*. (2005), attempted to provide an indication of the relative subsystem resilience, be it social, ecological or economic. The construction of a unified resilience index for integrated social-ecological systems is challenging. Rose (2005) and Elbourne, *et al.* (2008) focused on economic resilience by using general equilibrium models. Two articles, namely Cumming, *et al.* (2005) and Bennet, *et al.* (2005), considered on surrogate variables, mainly in ecological case studies, that could be appropriate empirical measures for resilience.

2.8 Resource Consumption Growth

Environmental debate in the 1960s and 1970s, have tended to give way in the course of the 1990s to the encouraging, good-news rhetoric of sustainable development. The emblematic depiction of doom, identifying “limits to growth” and “population bombs,” has come to be replaced by more upbeat messages and conciliatory slogans: “changing course,” “greening of industry,” “ecological modernization,” “partnership ethics” (Fischer and Hajer, 1999). In this regard, former activists regularly advise private business firms on how best to improve their environmental performance. Even the World Bank, we are told, is building an environmental ethic into their programs these days (Jamison, 2004). In east African including Ethiopian cities, household’s natural resource degradation and environment problems were speeding up parallel to industrial growth in Kombolecha.

The conventional economic model fails to account for environmental externalities in decisions concerning natural resource use and allocation. It is therefore increasingly regarded as insufficient to tackle these major environmental challenges. Within this context, environment and human-health concerns may provide incentives for innovation, for example in land use, improved building construction, efficient mobility and energy saving (EEA, 2013). Whatever, the case, the management of a common resource inescapably requires the participation and cooperation of multiple jurisdictions (Kaul, Grunberg, and Stern, 1999). Yet, incentives to pursue behavior that is individually rational but collectively suboptimal are especially strong with regard to shared resources, which at once may be seen as belonging to everybody and nobody (Esty and Maria, 2003).

UNEP (2010) and UNDP (2011) reports indicated that industrial and population growth were increased the consumption of resources that eroded the nature of environment. Along with this context, White, *et al*. (1985) define a disturbance as ‘any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability or the physical environment. A disturbance regime is defined in terms of scale, frequency, predictability and severity (White *et al*., 1985 and Turner *et al*., 1998). Within social-ecological systems, other types of disturbances need to be included such as abrupt changes in regulations and world market shifts (Janssen *et al*., 2005).

The Eastern African sub-region largely depends on natural resources to achieve growth. It is, therefore, very vulnerable to climate change. Climate change and its impacts have significantly altered its development pathway (UNCEA, 2012). Many of the persistent environmental problems that we face, such as air pollution, water stress, biodiversity loss and hazardous waste, are rooted in unsustainable production and consumption patterns. These common and interlinked drivers have largely been left unaddressed in policy practice that has mainly focused on partial and local mitigation of environmental pressures. As exemplified by global climate change, the environmental effects of human over-consumption of natural resources manifest at ever-growing geographical and time scales (EEA, 2013).

2.8.1 Resources Consumption by Industry

Most development forums looking at economic transformation, environmental sustainability and poverty reduction in Africa have endorsed with a general consensus for the need for rapid industrialization in Africa. Nevertheless, it is also recognized that industrial growth might have detrimental effects on the environment and use up exhaustible natural resource (OCED, 2012). It is, however, to be noted that while in general growth in industry has been slow, positive performance in a few countries and an increase interest in foreign direct investment in African industry indicates a potential for industrial take off. The challenge is to ensure that environmental best practices are incorporated at these early stages of industrialization whenever manufacturing investments are being considered (OCED, 2012).

Environmental constraints to development are acutely felt in the industrial sector in relation to both production and consumption of manufactured goods (GTP-2, 2015-2020). While most problems arising from the consequences for the environment of the consumption of industrial products is an economy wide concern, environmental effects of industrial production fall within the purview of the industrial sector alone. Here, the key to solve many of the problems lies in technology (Urgaia, 2007). The environmental problems are caused by industrial production outside the realm of the market mechanism. Thus, corrective policy measures are needed to reduce or eliminate such effects. The response of industry to such policies is in almost all cases of a technological nature. Hence, industrial technology and its continuous innovative changes are properly shaped by market and policy incentives make an important contribution to solving the environmental sustainability problem (UNIDO, 2004).

The role of industry, however, has been at the core of Ethiopia economic planning efforts ever since the economic reform of 1990s. This reform heralded “free market economic system” as the backbone of Ethiopia’s efforts to advance socio-economic development and improve the welfare of the Ethiopian people (The Policy Framework Paper, 1998). Industrial growth puts pressure on activity as well as quality of people life. For instance, WHO defines health in this context as: 'not merely the absence of disease or infirmity' but 'a state of complete physical, mental and social well-being'. It further acknowledges that these are multidimensional concepts, influenced by biomedical, psychological, social, economic and environmental factors, affecting people at different life stages. At the heart of the new WHO health strategy for Europe is the notion that well-being can serve as a possible focus for reorienting 21st century public policy, alongside considerations of how well-being can be defined and measured in the context of health (WHO, 2013a, 2013c cited in EEA report,2013).

Even though, Ethiopia remains a predominantly agrarian country for ages, modern manufacturing was introduced to the Ethiopian economy toward the end of the 19th century (EPRDF, 2010). During 1927 to 1941 about 35 factories were established in Addis Ababa and Dire Dawa. Although the growth was not significant, this was after the completion of Ethio- Djibouti railway which cited as one of the contributing factors for such improvement (Mohammed, 2002; Moti, 2004). One of the reasons was the guiding industrial development strategy, which was mainly import substitution until 1991(Moti, 2004; cited in Getachew, 2009).In Kombolecha city, there are relatively large industrial companies that consumed the groundwater without restriction and compensation.

2.9 Green Consumption Trends

Green inspired operational efficiencies known as green productivity is introducing new business models and practices where resource productivity and cost-consciousness are key drivers. By practicing the tenet of reduce, reuse, recycle, dispose, companies are realising cost savings in areas such as materials and energy, thereby increasing the efficiency and productivity of their organisations while reducing their climate change impact (Orsato, 2006). Porter and Linde (2007) found green-driven operational efficiencies, which have a greater impact on both the reduction of greenhouse gas emissions and increasing cost-competitiveness, and have better chances of success for companies in industrial markets with high levels of processing, waste generation and/or by-products, such as the food and beverage industries. Green productivity integrates productivity improvement with climate change mitigation and is applicable across businesses and industries (Dow & Downings, 2011).

Eco-design in the form of increasing the productivity of natural resources, shifting to ecology- inspired products and services, or harvesting from waste that becomes an input to another process in a cradle-to-cradle supply chain concept, is ushering tremendous value for marketing differentiation (Ottman *et al*., 2006). By adopting an outward focus, companies are moving beyond their physical borders and creating collaborative partnerships which can be optimised in terms of waste, by-products and even energy among different supply- and value-chain partners (Kumar & Putman, 2008). Some companies with aggressive green product strategies are creatively destructing their own product lines to develop innovative new green products that allow them to tap into new products, market segments and geographic territories thereby creating significant competitive advantage (Braungart *et al*., 2007).

However, there are some companies, which are focusing on providing bundled services and end-use value while ensuring cradle-to-cradle product stewardship for products such as leasing as opposed to selling outright (Ibid). The steady flow of monthly lease payments stabilises cash flows and leasing also reduces the need to maintain manufacturing capacity to meet peak demand (Kumar & Putman, 2008) a source of waste and risk. Leasing also reverses throw away societal behaviour. Instead of using planned obsolescence to boost sales, manufacturers are motivated to produce more durable and easily upgradeable products that lower the amount of materials used and avoid waste and overflowing landfill sites (Chinoda, 2013). The household's water consumption and recycling inefficiency has also contributed for green environment depletion besides to industry's water consumption growth and its negative consequences.

2.9.1 Consumption Practices of Households

The resources that society relies on for production and consumption can be roughly classified into four major categories: food, water, energy and (other) materials (McKinsey Global Institute, 2011). Materials include, for example, building materials, fibre, wood, chemicals and plastics. Many of these examples also overlap with the other resource categories. Rather than attempting to analyse the environmental and well-being implications of this heterogeneous category of resources, EEA (2013), merely addressed a subset: materials related to housing services. This emphasis is consistent with the report's focus on humanity's fundamental resource needs (EEA, 2013b).

Limited resource consumption patterns and growth, consumption in its broadest sense is a fundamental driver of urban change (Jayne, 2006). The heightened awareness of the fragility of the earth has led to the acknowledgement of the unsustainability of business strategies and practices. It is clearly evident that business activity, in particular the marketing function which drives consumption-production cycles, has largely contributed to the degradation of the earth (JingJing *et al*., 2008 and McDonagh & Prothero, 1997). There are many areas in which a business can green itself; for example, green products, green logistics, green staff training, green buildings and green IT. It should also be noted that businesses should indicate the impact of green initiatives on business performance in their annual integrated report (Jenkins & Yakovleva, 2006 cited in Smith, 2013).

Population growth is one of the most important drivers of environmental change in Africa, particularly as this relates to the exploitation and use of the environment as well as to waste generation and its management (WCED,1987). Increasing demand for food, water, arable land and firewood as well as other material needs such as education, health care, housing, energy, transport and infrastructure. Related activities in, but not limited to, industry and trade create new environmental pressures and thus, if poorly managed, economic growth can negatively impact on the environment. Expanded economic activities, which are poorly planned and inadequately monitored, increased pressure on ecosystems through the loss of biodiversity, habitat degradation, and water, land and air pollution (FAO, 2003). Central to environmental change in Africa are multi-layered interactions involving the physical world, flora, fauna and human activity. These interactions also encompass tradition, beliefs, ideas, perceptions and prescriptions regarding habitats and inhabitants (Kwashirai, 2012).

People in developing nations are noticing how well people in developed nations are living and want to have some or many of the same amenities as do people in developed nations. They too want washers and dryers, air conditioning, televisions, cars, computers, cell phones, and so on. The result has been increased depletion of resources, increased pollution, and increased accumulation of waste in these countries as well. So, it appears that the increasing pressure to produce more goods and services to create a higher material standard of living for the 5.6 billion people living in less developed countries. It means that our world will continue to face environmental problems now and in the foreseeable future (Population Reference Bureau, 2009). In Ethiopia, the causes for the deep rooted environmental problems in the country are lack of environmental awareness. The recurrent and disastrous droughts that have affected the country are considered to have compelled various members of the society and the government to give attention to environmental issues (EPA, 2003).

2.9.2 Green Consumerism

In the case of green consumer, Edwards (2010) defined green consumer as those consumers who are highly environmentally concerned. In the case of green consumption, it is explained as a process that has led to individuals feeling both responsible for and empowered in dealing with risks to both themselves and to the wider environment (Soonthonsmai, 2007). Consumers accepted green products when their primary need for performance, quality, convenience, and affordability were met when they understood how a green product could help to solve environmental problems (Ottman, 1992). This poses a challenge for the green revolution because if people are not aware of what greening entails, they are not likely to buy green products (Makower, 2009).

The clearest way to understand green consumerism is by viewing each individual's consumption behaviour as a series of purchase decisions (Peattie, 1999). These decisions may be inter-related and underpinned by common values or they may be unconnected and situational. Consumer purchasing behaviour consists of "behavioural patterns of decision units" (households and businesses) which make "decisions for the acquisition of need satisfying" market offerings (Plessis and Rousseau, 1999 and Cant*et al*., 2006).

However, without changes to the built environment, some sustainable behaviour cannot take place (Williams and Dair, 2007). As a result, it is vital to pursue further research how consumers view environmental issues, and how they behave, especially in their attitudes towards environmentally friendly products (Chen, 2010).

According to Makower (2009), consumers may be interested in greening, but cannot identify it. Many consumers cannot identify the steps a business had taken to go green. This poses a challenge for the green revolution because if people are not aware of what greening entails they are not likely to buy green products (Smith, 2013). So, it is important for businesses, government and consumers in developing countries to follow this example by improving their perceptions of greening and its impact on consumer purchasing behaviour (Polonsky, 1994). Consumers could be more motivated to reduce energy consumption when their performance is measured against neighbours than they would by more general information describing the environmental harm caused by excessive consumption (Houde and Todd, 2010). In addition, specific concern for environmental issues can be important in, for example, explaining support for recycling programmes (OECD, 2011d).

Consumers' perceived level of self-involvement towards the protection of the environment may prevent them from engaging in environmentally friend activities such as recycling (Wiener and Sukhdial, 1990). So as to integrate consumer’s behaviour and their purchase, green marketing is considered one of the major trends in modem business (McDaniel and Rylander, 1993; Pujari and Wright, 1996 and Kassaye, 2001). To explore individual perception and attitude inequality, recently, the relationship between economic development and environmental behaviour is usually addressed by the Environmental Kuznets Curves (Kuznet, 1955). This model used in this study to assess consumer’s green perception and behavioural inequality, which attempts to balance the consumption growth and green environmental tradeoffs. In this binary logistic regression model was used to measure the household’s green awareness, perception and consumption behavioural inequality along with monthly income level.

2.9.3 Green Behaviour

Economists have increasingly questioned the traditional model of household behaviour and proposed alternative models that bear closer resemblance to reality (Haddad, Hoddinott, and Alderman, 1997). The economic literatures in their attempts to explain green behaviour have introduced the idea of "moral" gain. The idea behind this can be expressed as if "green" people not only care about their personal welfare but they are also concerned about the society's well-being (Jacquelyn, 2011). This can be achieved by putting employees to educate them on the benefits of greening and how it improves the bottom line of the firm (Thompson, 2009). Despite an increased interest of the general public in sustainable development (European Commission, 2005 and DEFRA, 2002), many individuals do not translate this increased interest in altered consumption decisions (Grunert, 1993; Pieters, Bijmolt, Raaij, & Kruijk, 1998). An often cited reason for this phenomenon is people associate sustainable behaviours with behavioural costs like money, time, effort, and inconvenience (Follows & Jobber, 2000; Pieters, 1989; Pieters *et al*., 1998 and Thøgersen, 1994 cited in Cornelissen and Pandelaere, 2006).

In environmental psychology, common measures of pro -environmental behaviours are based on a list of pro environmental behaviors usually developed by the researcher. Respondents are provided with such a list, and they are asked to indicate how often they perform each of these behaviors. Whereas some studies focus on one specific type of behaviour such as recycling (Guagnano, Stern, & Dietz, 1995; Porter, Leeming, & Dwyer, 1995; Schultz & Oskamp, 1996), transport (Steg & Vlek, 1997; Van Lange *et al*., 1998), or political behavior (signing petitions, supporting an environmental organization; Cameron, Brown, & Chapman, 1998; Stern, Dietz, Kalof, & Guagnano, 1995), other scientists develop scales that combine different types of behavior (Berger, 1997; Kaiser, 1998; Karp, 1996; McKenzie-Mohr, Nemiroff, Beers, & Desmarais,1995; Painter, Semenik, & Belk, 1983; Pelletier, Tuson, Green-Demers, Noels,&Beaton, 1998; Whitherspoon &Martin, 1992). By use of factor analysis and reliability analysis, researchers developed one or more scales of pro environmental behaviour (Charles, 2002).

According to Stern *et al.* (1997), many studies focus on relatively uninteresting variables from an environmental point of view. Consequently, an important disadvantage of common social science measures of pro environmental behaviour is that they focus on behaviours that do not significantly contribute to environmental problems; that is, they do not reflect the actual (lower) environmental impact of persons or households (Charles, 2002). In general, the results of these studies suggest that consumers are more likely to engage in post-purchase environmental behaviours than in point of purchase environmental behaviours (Roper Organisation, 1991; Berger and Corbin, 1993). Few studies have focused primarily on the pro-environmental actions adopted by consumers when buying products (Schwepker and Cornwell, 1991; Balderjahn, 1988; Lempert, 1991). These studies also suggest that consumer involvement in pro-environmental point of purchase behaviour is limited. This sentiment has not generally been reflected in behaviour in African cities in particular, Ethiopia.

According to Charles (2002), a dependent variable of environmentally significant behaviour that does measure the actual environmental impact of household behavior is meter reading. In the 1980s, many such studies were conducted. Data on a household's gas, electricity, or water use were gathered by reading the relevant metres or studying records (Katzev & Johnson, 1984; Winett, Leckliter, Chinn, Stahl, & Love, 1985). A problem with these measures is that the relationship between people's actual behavior and the environmental impact (i.e., the energy use) of that behaviour is not very clear. It is difficult to determine which behavioral changes result in which savings and which specific individual within a household is responsible for these savings. These measures were limited to the environmental impact related to the direct use of energy (or water) within a household and did not consider the environmental impact related to buying and disposing of goods, which requires energy use in the manufacturing process (Charles, 2002).

Many consumers cannot identify the steps a business had taken to go green Makower (2009). This poses a challenge for the green revolution because if people are not aware of what greening entails they are not likely to buy green products. In addition, consumers are often not willing to pay more for green products. The work of Jackson (2005) provides a comprehensive review of the literature on consumer behaviour and behavioural change and concludes on the evidence base for different models of change and recommendations to policy-makers to encouraging more sustainable lifestyles. Faiers et al. (2007) have also produced a useful categorization and review of consumer behaviour theories that relate to the critical internal and external factors influencing consumer choice in respect of energy use. In essence, consumers with a stronger concern for the environment are more likely to purchase products as a result of their environmental claims than those who are less concerned about environmental issues (Chan, 2000).

2.9.4 Green Marketing

Economic theory contends that the free market can be expected to produce an efficient and welfare-enhancing level of resource use, production, consumption, and environmental protection if the prices of resources, goods, and services capture all of the social costs and benefits of their use (Anderson, 1992&1998; Panayotou 1993). However, when private costs, which are the basis for market decisions, deviate from social costs, a “market failure” will occur resulting in an allocative inefficiency as well as suboptimal resource use and pollution levels (Daniel and Maria, 2003). Green marketing is a viable market development strategy in which a company attempts to adopt its present product line (with some modifications of product characteristics and/or sometimes highlighting of green characteristics to environmentally friendly missions. It involves developing and promoting products and/or services that dramatically increase the productivity of natural resource flows (Polonsky, 1994), biological or cyclical production models, encourage dematerialisation and reinvest in and contribute to natural capital (Ottman *et al*., 2006).

Several authors suggest factors that may prevent greater involvement in pro-environmental purchase behaviour, such as the importance of other purchase criteria (Carson, 1991; Davis, 1992; Roper Organisation, 1991) and a subsequent unwillingness to forego other product benefits, such as convenience, quality, price, effectiveness and availability (Bennett, 1992; Wasik, 1992; Roper Organisation, 1991; Lempert, 1991); disbelief of environmental claims in advertising and on product labels (Bennett, 1992; Davis, 1993); busy lifestyles that leave little time to shop around for environmentally friendly product options (Roper, 1991); and a low level of environmental concern (Balderjahn, 1988). In Ethiopia’s case, particularly, water supply was public and government owned services and hence the consumption behaviour could not have brought a significant change by private enterprises and household’s resource consumption decision and recycling efficiency.

However, few studies have examined the influence of many consumers’ characters on purchasing pro-environmental behaviour. For instance, the possible influence of personal characteristics such as age, income, education, occupation, marital status, number of children and personal values were investigated on the environmental purchase behaviour. Studies, which have examined these characteristics with other forms of pro-environmental behaviours were found inconsistencies and mixed results. However, more often than not, they suggest that individuals, who engage in pro-environmental behaviour tend to be white, better educated, younger, and higher in income, occupation and socioeconomic status (Schwepker and Cornwell, 1991; Granzin and Olsen, 1991). There is evidence that the climate of the Earth is changing due to increases in greenhouse gases caused by human consumptions (Stern, 2006 & 2007and IPCC, 2007).

This in support of Orsato (2006), van Hoek (2001) and Polonsky (1994) assertions that customers should be willing to pay for the differentiated value for green marketing campaigns to make business sense. This is also in line with Reyers (2011) and colleague's finding that companies are responding to climate change only where the business case prevails, unless there are other strategic decisions such as regulatory or social justifications. However, in reality, companies that pursue green marketing encounter numerous challenges mainly from the variability of demand, un-favorable consumer perception and high cost (Gurau and Ranchhod, 2005). The key concern lies in an understanding of green consumers and their characteristics to enable firms to develop a new target and segmentation strategies (D'Souza *et al.,* 2007). Consumers feel morally obligated to protect the environment and to save the limited natural resources on the earth. However, Tanner and Kast (2003) found that consumers' green food purchases were not significantly related to moral thinking.

2.10 Water Scarcity Challenges

Water is both economic and social good in daily activity of human interactions. However, the existence value of water could not be measured solely using monetary values. Whatever the case, we live in a world of increasing scarcity (Modak, 2011). The most serious problems facing the world today water and food supply crises, extreme volatility in energy and food prices, rising greenhouse gas emissions, severe income disparity, chronic fiscal imbalances and terrorism (World Economic Forum, 2012) either stem from environmental mismanagement or inequality, or both. Aside from the chronic fiscal imbalances that mostly concern the developed economies, developing countries are the most vulnerable to all of these risks. The key question is if (and how) environmental goals can be reconciled with growth and poverty reduction in the developing world. In particular, water scarcity is another big challenge that many African countries have to grapple with.

The fast population growth, uncontrolled urbanization and industrialization, poor sanitation situation, uncontrolled waste disposal etc. causes serious quality degradation of surface and groundwater in particular (Tamiru A., 2004). Nevertheless, in most developing countries, capital cities and the centers of political and economic power are commonly institute in the areas of higher rainfall, and at some distance from dry land regions such as in Brazil, China, Ethiopia, Kenya, Uganda, and the coastal cities of West Africa like Legos. Higher added-value of production in drylands could compensate for the higher costs but is often ignored due to failure of investment in markets so to capture it. The development needs are rarely prioritised in national political and development agendas and resulting policy processes may be largely 'off the shelf' and based on little in-depth analysis (Mtisi and Nicol, 2013).

The Eastern African sub region is one of the least developed areas in terms of water storage. It has a per capita storage capacity of about 100 cubic meters, compared to the global average of 1,000 cubic meters. Increasing storage options and improving to existing storage will address the challenges associated with infrastructural water scarcity (UNCEA, 2012). Hence, the Eastern African sub region includes some of the most water stressed countries in the world. Countries, including Ethiopia, are identified to be suffering from economic water scarcity, based on the criteria that less than 25 percent of water from rivers is withdrawn for human purposes, but malnutrition exists indicating that more water could be used for production of food (World Bank, 2006; Awulachew *et al*., 2010). Africa Water Atlas (UNEP, 2010) identified that Ethiopia, Kenya, Somalia and Tanzania are some of the water-constrained countries that have to feed their people using rain-fed agriculture.

The region also contains some of the world's driest lands. These arid and semi-arid lands are generally the areas in which food security is most tenuous in Africa. However, the region also contains are areas of high rainfall that contribute generously to the total flow of major rivers including the Nile. In spite of their importance, these areas mostly forest also face an onslaught of environmental degradation, leading to significant reductions in stream flow. A rise in cases of water pollution has also been reported (UNEP, 2010). For poor people in Ethiopia, land, water, forests and other natural resources are important for their livelihoods. Similarly, environmental quality and sustainable management of natural resources play important roles for the people of Ethiopia and the country's prospects to reduce poverty, enhance welfare and sustain economic growth. However, the key poverty-environment linkages are mainly related to natural disasters and drought; lack of secure tenure of land and water source and other natural resources;

deforestation and decreasing resilience of ecosystems; unreliable access to food and water, and climate change (César and Ekbom, 2013).

2.10.1 Water Consumption

Water is essential for sustaining life. Increasing income might increase production and therefore pollution, but this may be bearable if the benefits that accrue to the population outweigh the costs. At the very low level of income per capita, an increase in income per capita can improve sanitation and increase the number of watering holes. A lack of clean water and urban sanitation both improve uniformly with increasing income and over time (Shafik and Bandyopadhyay, 1992) and a lack of clean water affects productivity. Economic growth could enhance the health of individuals by increasing stamina, flexibility and agility and thereby stimulate economic growth (Webber and Freeman, 2005 cited in Webber and Allenα, 2004). Efficient utilization of water resources in Sub Sahara African countries including Ethiopia would have significant impacts on economic, social and environment issues. Particularly, the groundwater resource consumption growth altered the green environment and in turn negatively influenced the household's social and economic benefits in Kombolecha.

Environmental degradation can exacerbate water scarcity and disrupt adaptation systems that many people traditionally used to manage scarcity of water. Environmental degradation coupled with water scarcity undermines the economic contribution of dry land areas to national development, the latter of which is crucial to their future incorporation in equitable economic growth processes. Dryland management has therefore increasingly become more than a struggle to protect and conserve dry land resources from degradation, but also find pathways out of marginalisation and towards greater growth and prosperity (Mtisi and Nicol, 2013). Properly managed water resources are a critical component of growth; poverty reduction and equity; and access particularly affects the livelihoods of the poorest. However, water resources development and management in Ethiopia is still in its infancy, mainly due to the various natural, technical, economic, environmental and legal challenges associated with the availability, accessibility, allocation and harnessing of water resources for sustainable socio-economic development (European Report on Development, 2011&12).

Pricing the use of environmental resources has proven to be a powerful tool for influencing consumer and household decisions. For example, recent work based on a survey of 10,000 households across ten OECD countries indicates that households charged for water consume approximately 20% less water than those who are not (OECD, 2011d). Water management is a key component of green growth from several perspectives. It involves use of water for food production, industrial uses for example cooling, drinking and sanitation, energy production, and recreational activities. It requires a consideration of watershed services in addition to water supply and sanitation. However, ageing water infrastructure is increasingly a problem in developed countries (OCED, 2011). Thus, appropriate financing strategies are required not only for day-to-day management practices, but also for "cost recovery" to replicate the system (Nyarko *et al*., 2006; Harvey, 2007, and Mbata, 2006).

2.10.2 Water Recycling in Ethiopia

Ethiopia is highly rain fall dependent country and it is evident that the economy is highly relied on natural resources extraction. Resources exploitation particularly water may generate large economic benefits in the shortterm. However, in the long term, unsustainable use of natural resources increases not only environmental degradation but also decreases economic growth and livelihood opportunities. Moreover, the country's flourishing economy is both a key driver to environment degradation and at the same time is negatively affected by environment problems (Emelie and Anders, 2013). Industry growth continues in Ethiopia until poverty eradicates and high growth demand sustainable in the long run. In Kombolecha, where infant firms were clustering in an organized manner, factoriesused the groundwater sources for consumption and production processes and discharged wastes without treatment (Kombolecha Municipality, 2017).

The challenges faced by the developed countries are not necessarily the same as those experienced in the developing countries. The differences between these countries are discrepancies in their socio-economic status, levels of industrialisation, urbanisation and levels of education (Kassim & Ali, 2005). Virtually everything in the "waste stream" has residual value for someone or some business in the community (William, 2005). Unfortunately, our collecting and dumping process mix and crush everything together; and make separation an expensive and sometimes impossible task to properly manage wastes (Sharama, 2005). Some of the developed countries find it difficult to establish new landfill sites due to land scarcity and large-scale opposition from the general public negative perceptions associated with landfill sites and other waste disposal sites (Fadel *et al.*, 1995). This inappropriate management of solid and hazardous waste does not only affect African continent (Fannie, 2008) but also European cities were spawned with outbreaks of cholera, typhoid and plague epidemics resulting from widespread accumulation of waste along roadsides (Chung *et al.,* 2005).

Citizens have an important role to play in separating waste at the source in order to facilitate collection of waste streams. The wastes collected typically end up in open dumps, where they may be burnt and in some cases are deposited in illegal dumping sites (Chandak, 2010).More disturbingly, most of the waste dumps are located in ecologically sensitive areas whereby toxins may find their way into ground water resources (Fannie, 2008). The habit of open field disposal of liquid waste is one of the main causes of soil and water contamination and consequently a cause of many communicable diseases. According to Abebaw (2008), indeed, waste management is a growing public concern in Ethiopia. However, in many cities, waste management is still reported as poor and wastes are dumped along roadsides and into open areas, endangering health and attracting vermin (Tewodros *et al.*, 2008). Urban households are more than three times as likely as rural households to have access to improved toilet facilities (UNICF and WHO, 2010).

With a rapidly expanding population and a growing trend of industrial development, problems related to the management of industrial waste have become of considerable magnitude in Ethiopia. The problem is more severe in Addis Ababa the capital where most of the industrial establishments of the country is taking place. At present among the existing industries operating in the city, only a few of them treat their wastes to any degree while the majority discharges their wastes into nearby water bodies and open land without any or little form of treatment. Industrial wastes are disposed together with the respective domestic wastes at poorly designed underground septic tanks, allowing pollutants to leak into the ground water. Furthermore, hazardous industrial wastes are not treated separately but are mixed with other inert solid or liquid wastes (Getachew, 2009).

Generally, high waste generation is commonly associated with the throw away culture associated with rapid urbanization, accelerated economic and population growth (Middleton, 2004; Chung *et al.,* 2005). Unfortunately, the general waste streams frequently contain hazardous waste materials, often emanating from local industries, health care facilities, commercial and residential institutions. As a result, toxic and infectious materials are discarded along with general waste throughout the region. In the rural and poor communities of the African continent, uncollected solid wastes accumulate illegally along roadsides whilst another fraction is burnt within household yards (Fannie, 2008). As a result, unsanitary environments are favorable for the outbreak and spread of different types of communicable diseases (Mehlers, 1976 cited in Fesseha, 2012). Most of the disease-causing agents that contaminate water and food come from human and animal wastes. Without proper management, they result in communicable diseases (Fesseha, 2012).

Unsafe industrial waste disposal causes surface water contamination in many developing countries. This is particularly true for the peri-urban shanty towns and the rural hinterland villages downstream of cities that are reliant on rivers passing through an industrialized area. Discharge of untreated industrial waste is a major problem for many communities dwelling near rivers basins through causing different health problems (Adem, & Alemayehu, 2014). Hence, the present challenge is how to effectively manage the increasing industrial waste due to a host of environmental and health problems associated with poor waste management. Unfortunately, like other developing countries, Ethiopia did not possess a sufficient resource to deal with this and other serious environmental issues (Getachew, 2009). In sum, waste management shows that it is not only a technical problem for the municipalities, but that it involves other aspects, such as the social, political, economic considerations and others (Fannie, 2008).

Presently most industries do not treat their wastes if it contains no recyclable products which could be reprocessed or sold to generate additional revenue. As treatment would be more costly, industries are not interested to participate in safe waste disposal activities since there is no binding rule of how to dispose their wastes without affecting the nearby exposed society. Poor storage of industrial and other waste products also results in ground and surface water pollution. Major causes include the poor design of storage facilities, leakage from damaged stores and the seepage from treatment ponds (Adem and Alemayehu, 2014). Thus, there are economic costs, which related to the use of polluted water for consumption and production. The costs of using contaminated water for production decreased both quality and quantity of products (World Bank, 2007).

In Ethiopia too, the generation of industrial waste, including hazardous waste, is increasing rapidly as a result of industrialization, urbanization, and the implementation of a new economic policy. The industrial pollution, however, increased disproportionately at higher rate compared to the economic growth in the country. During this time, the GDP growth record was 5.8% while the toxicity intensity of the industrial production grew by 2.3% (UNIDO, 2001 cited in Getachew, 2009).With increasing urbanisation and economic growth with rising consumption, waste generation will continue to grow (Kuma, 2004). The inefficient solid waste management by the municipality increase accumulation of waste on open lands and in the open drainage system causing environmental pollution through leaches from piles (water and soil) and the burning of waste (air pollution) which affects people's health (Mazhindu *et al.*, 2012. Kombolecha city waterconsumption and waste recycling management was not exceptional from Addis Ababa and seen waste as a resource for further production.

2.12 Environment, Economy and Social Equity

The intersections of environment, economy and social equity are commonly discussed in a vast literature of sustainable development. For instance, Maclaren (2009) "sustainable development" implies a state and process of development (Reza, 2013). At the same time, human societies and globally interconnected economies rely on ecosystems services and support is particularly discussed in Millennium Ecosystem Assessment (MA, 2005). Reflecting on the succession of calamitous events that have occurred in recent years, scholars and policy makers alike have begun questioning whether humans" capacity for protecting the near-term resilience and longer-term sustainability of the earth's fragile ecosystems has been inexorably surpassed by these converging environmental and societal perturbations (Gunderson and Folk, 2011 and Schoon *et al.,* 2011).

The relationships between the human activities and their environment are approached through the concept of sustainable development (CMED, 1987). Sustainable development three pillars, economic, social and ecological, interact to lead the society on the path of a long-term growth. In order to determine the conditions of sustainability, most of the authors focus on the link-up between economic and environmental spheres. This study aimed at studying the consequences of the inclusion of the social relations' influence to resilient green environment. Behind the impact of the GDP per capita, the social and power inequalities play a prominent part regarding the evolution of the relations between environment and society (Matthieu and Meunie, 2008).

Cities around the globe are trying to figure out how to grow green and generate economic activity that preserves and enhances environmental quality while using natural resources more efficiently. Though the path to reducing human impact on the environment is clear, we are less sure about how to grow our economies and benefit society's least advantaged members at the same time. In other words, it referred how to link the three E's such as environment, economy, and equity of development (Karen, 2008). The EEA (2012) interprets a 'green economy' similarly emphasising the need to manage the multiple interactions of economic, environment and social systems. The analysis focuses in particular on the twin goals of increasing resource efficiency and maintaining the natural capital and ecosystem resilience (EEA, 2012).

In a green economy context, social equity needs to be enhanced by ensuring fair access to natural resources, sharing the benefits of nature, and securing a healthy living environment that protects society from pollution impacts. This implies international burden sharing for example in addressing the hidden ecological costs of trade, sharing the costs of tackling environmental issues, and reducing the environmental footprints of consumption (EEA, 2013). Inter-generational fairness also needs to be addressed, most fundamentally by ensuring continued flows of essential ecosystem services for future generations. Selecting appropriate 'discount rates' (which are used to derive a price in today's terms for actions that will yield costs and benefits in the future) can also play an important role in this context, shaping the economic analysis that underpins long-term economic projects and environmental policies (EEA, 2012).

The environment is disproportionately important in poor nations. World Bank (2005) illustrated that environment assets were 26% of national wealth in developing countries as opposed to 2% in OECD countries (World Bank, 2005). The economy, industries and society are intimately dependent upon the health of the Environment. Environmental assets were including for example, fertile soil, clean water, biomass and biodiversity, yield income, offer safety nets for the poor, maintain public health, and drive economic growth (Ibid). However, environment and developmental institutions and decisions tend to be separate, which results in environment being viewed, asset of problems rather than potentials (Barry and Steve, 2009). Bad management of environmental assets, poor control of environmental hazards such as pollution, and inadequate response to environmental challenge such as climate change, threaten development (Ibid).

Our societies, and our world, have largely emphasized short-term gains, especially in a capitalistic economy in which we emphasize profit and keeping costs to a minimum (and hence not wanting to include the costs of pollution and waste storage) rather than considering long-term costs such as climate change and ozone depletion (Marchetti, 1986). Many government institutions, in particular, increasingly have to bail out failing financial and social institutions and are greatly concerned about the confluence of these with ecosystem and climate system collapse. With persistent poverty, in part entrenched by such system failures, there is a growing interest in ways to minimise the chain of costs that arise from environmental shocks and stresses (Barry and Steve, 2009).

Most of these studies, however, look at general observations and reflections around the “green challenges” at global level which has to be handled in society be it in the urban or the not so urban spheres (Uno, 2011). Cities account 75 percent of energy consumption and carbon emissions that put unmanageable load on the environment (UNEP, 2011). Individual resource consumption patterns and resultant effects on environment are not so far incorporated into product life cycle assessment (Shri *et al.,* 2012). Increased extraction of natural resources, accumulation of waste and concentration of pollutants will therefore overwhelm the carrying capacity of the biosphere and result in the degradation of environmental quality and a decline in human welfare despite rising incomes (Francisco, 1991). Significant shortcomings, threats or vulnerabilities in multiple parameters are interpreted as indicating a high level of insecurity in relation to water services (ESCAP, 2012).

In prevailing development paradigm, it has been seen that even in countries where efforts to include environment in the national development planning document have been successful, associated environmental provisions such as environment impact assessment (EIA) tend to be ignored by politicians, authorities and investors. This is often because ‘higher level’ policies and associated incentives keep environment as an ‘externality’: Dominant development models are based on economic growth and are considered inviolable and measured by inadequate indices such as GDP rather than people’s rights and welfare, or environmental processes and limits. Environmental benefits and costs are externalised; poor people are marginalised, and inequities entrenched; governance regimes are not designed to internalise environmental factors, to iron out social inequities, or to develop better economic models (Shri *et al.,* 2012).

2.12.1 Analysis of Indicators

The term "indicator" traces back to the Latin verb *indicare,* meaning to disclose or point out, to announce or make publicly known, or to estimate or put a price on. Indicators communicate information about progress toward social goals such as sustainable development. But their purpose can be simpler too: the hands on a clock, for example, indicate the time; the warning light on an electronic appliance indicates that the device is switched on (Hammond and Adriaanse,1995).The process of converting natural resources into energy has always played a central role in human development from providing the means to keep warm and forge tools, to power the economic and social systems of production, transport and communication that today provide for much of our material well-being (EEA, 2013).

Environmental indicators can provide insights into resource use patterns, and help in identifying the governance tools available to improve human well-being. The EEA maintains an extensive set of 146 environmental indicators, grouped into 12 environmental indicators are developed and categorised according to a causal framework that organises interactions between society and the environment into five stages: driving force, pressure, state, impact, and response. In simple terms, framework works as follows: social and economic developments drive (D) changes that exert pressure (P) on the environment. As a consequence, changes occur in the state (S) of the environment, which lead to impacts (I) on society. Finally, societal and political responses (R) affect earlier parts of the system directly or indirectly. This framework structures the interplay between the environment and socio-economic activities (Stanners *et al*., 2007). The Environmental indicator report (2012) used state indicators to quantify resource efficiency and resilience. These specific indicators addressed energy, water and land uses the latter mainly determined by environmental pressures.

BASF (2005 & 2009) findings on company product portfolio and manufacturing performance measures the social aspects of sustainability with the aim of incorporating them into existing eco-efficiency analysis. Numerous instruments are used in practice for the ecological assessment of products and processes; a gap still has to be closed by developing social life-cycle assessment procedures. The new integrated instrument, the so called SEE balance by BASF (2004&2009) and Sailing, *et al*. (2013) used to improve the performance of the company’s quality product and manufacturing processes. SEE balance is a comparative life-cycle assessment tool that consisted of the three main aspects: economic (costs), ecology and society effects of different product alternatives. A Socio-eco-efficient solution is a relatively good environmental performance with high social benefit and at the same time low costs for the end customer. The developed method for the social life-cycle assessment is based on an industrial sector analysis of statistical data (Manfred *et al*., 2004).

Improving eco-efficiency and socio-efficiency is a basic challenge for corporate sustainability management. Eco-efficiency and socio-efficiency increase the positive ecological and social performance of the company in relation to economic value creation, or reduce negative effects (Schaltegger *et al*., 2002; Dyllick and Hockerts, 2002). It must be recognised that eco- and socio-efficiency lead only to relative ecological and social improvements, which can be compensated by economic growth. That is why, according to that concept, eco- and socio-efficiency contribute to economic sustainability, but not necessarily also to ecological and social sustainability (Dyllick and Hockerts, 2002 cited in Isabell Schmidt, Manfred Meurer *et al*.,2004).

While the principles of eco-efficiency and socio-efficiency are primarily discussed with reference to the company ('gate to gate' approach), they can also be applied to the life-cycle management of products and processes ('cradle to grave' approach). Here, the complete product life-cycle, consisting of production, use and disposal, forms the basis of consideration. The following equations demonstrate such a product-related interpretation of eco - and socio-efficiency. The ecological and social impacts that occur throughout the entire product life-cycle are put in relation to the costs for the end customer for buying, using, maintaining, and finally disposing or reselling the product (Ibid). Social assessment criteria were developed on the basis of literature and other references. It realised that there has been no consensus so far on the social dimension of sustainability and considerable overlap with other welfare concepts (Schmitt and Noll, 2000; Empacher and Wehling, 2002).

2.12.2 Eco-Efficiency Indicator

The concept of eco efficiency has been traced back to 1970s as the concept of "environmental efficiency" and received significant attention in sustainable development literature (Brady, 1999). The term "eco" refers both to "environment" and "economy" which is measured as the ratio between the values of what has been produced (income, high quality goods and services, jobs, GDP etc) and the sum of the environmental life cycle impacts of the product or service ((WBCSD,1996 & OECD, 1998). Along similar line, Peck (1996), Stigson (1997) and Bruce, *et al.* (2010) described that eco-efficiency measures the relative amount of pollution or resources required to produce a unit of product or service. For various purposes, governments may set micro and macroeconomic eco efficiency targets correspond to their sustainable development (Bruce *et al.,* 2010).

This shows eco efficiency is measuring the life cycle environmental impact and cost for production that provides alternative value of output (Annika *et al.,* 2012). However, product's life cycle will be considered relevant system boundaries for example cradle to grave or cradle to cradle boundary conditions (Judith, 2012). This life cycle assessment is technical and solely rested on product lifecycle without focusing on consumption process of water and wastes and recycling to save resource and keep environment. Hence, this study attempted a micro sectoral analysis in the household and factory's resource consumption process.

Several sustainable development indicator initiatives have tried to capture the synergies and trade-offs among the economic, environment and social dimensions. For instance, eco efficiency indicators develop by WBCSD (1996) presents a set of indicators that link between economic activity, resource usage and environmental impact. Definitions of indicators are variables, which are an operational representation of an attribute such as quality, characteristic, property etc. of a system (Gallopin, 1997). The ultimate purpose of indicators is to summarize a large amount of information in an easily understandable format and make indirect interpretations about a phenomenon that cannot be directly measured (Rosenström and Palosaari, 2000).

Environmental indicators are defined as qualitative and quantitative information that allow the evaluation of enterprise effectiveness and efficiency in the consumption of resources (Bartolomoe, 1995). According to

ESCAP (2009) indicators can be classified as scope and subject wise indicators. Scope-wide indicators apply for economy and sector wide indicators. Subject-wise indicators consider intensity or productivity of resource use which will apply in this research (ESCAP, 2009). These indicators should be comparability with threshold values and targets; compatibility with economic models and information systems; ability to guide planning and decision-making; stimulate change; reflect the goals of society; combine all three dimensions of sustainability stakeholders (Rosenström, 2002).

Accordingly, they set many principles to select indicators. For instance, first, eco efficiency indicators should reflect the sustainability challenges of the countries in the region. Second, indicators should consider data availability and methodological issues which dependent on cost effective data of a known quality. Third, most of the selected eco efficiency indicators (EEI) have been identified and adopted by countries in the region as part of their criteria in achieving their national development strategies. And last, generally applicable or the overarching purpose of the EEI has been to inform policy both at the national and sectoral levels. In addition, it should leave room for flexibility in terms of incorporating new indicators or non-adoption of existing ones according to their environmental relevance (ESCAP, 2009). Hence, this study shared BASF (2009, ESCAP (2011) and Sailing, *et al*. (2013) indicators analysis and concepts to build the socio - eco efficiency frameworkthat helped to recover the green environment in Kombolecha industrial zone.

2.12.3 Triple Bottom Indicators

Sustainability is widely regarded as a journey, not a destination (Scott, 2005). It is generally accepted that the sustainability concept has three distinct, but related ecological, economic and social components (Global Reporting Initiative, 2002). The term "triple bottom" describes performance reporting against economic, social and environmental parameters and departure from previous bottom line perspectives which traditionally focused on financial considerations (Elkington, 1997). At its broadest, the term is used to capture the whole set of values, issues and processes that companies must address in order to minimize any harm resulting from their activities and to create economic, social and environmental value (Sustainability, 2005). Therefore, sustainability involves at a minimum interacting economic, social, and environmental factor. Progress toward sustainability thus requires directing policy attention to all three (Hammond and Adriaanse *et al*., 1995 cited in Scott, 2005).

For more than half a century, gross domestic product (GDP), which measures production and consumption activities in an economy, has served as the flagship indicator of progress and well‑being. Today, however, most agree that GDP provides misleading signals about both current well-being and future prosperity (EEA, 2013). Many aspects of human well-being such as liberty, family life, social cohesion and safety from harm, are partially or wholly absent from such economic measures. From a public health perspective, the health and well-being of populations and individuals is influenced by social, economic and environmental determinants. These may interact through multiple pathways at different spatial scales from local conditions up to global drivers of change (Barton and Grant, 2006 and EEA, 2010).

The relative strengths and weaknesses of the different instruments with respect to those criteria indicate that the best choice of instruments will vary by environmental issue as well as across country- or region-specific circumstances. Indeed, given the presence of several interacting market failures, the most appropriate green growth policy response will, in most cases, require a combination of instruments. This combination will differ depending on a country's stage of development, its particular environmental concerns, political economy considerations, the importance of different natural assets to a country's growth prospects and social preferences (OCED, 2011).

2.12.3.1 Economic Indicators

There might be so many questions asked with regard to sustainable growth. For instance, in this study, how can a green community create a sustainable economy? This question gets due attention for further description of economic indicators. On the other hand, Guy (2010) pointed out that looks at your current economic conditions and learns how they are linked to social and environmental issues. Hence, key economic sustainability indicators include: production area, yield, quality, gross value, profitability and regional economic activity (Guy, 2010). Employment and profitability have historically been major indicators used by regions to reflect economic success, but communities want to give greater consideration to environmental and social implications of any actions (UNEP, 2011). It is, therefore, useful to use economic indicators to provide information on current conditions, trends and movements towards targets (UNEP, 2012).

For most countries, instruments that directly impact price signals are a necessary, though not always sufficient, condition for greening growth. The main strengths of market-based instruments are that, if well-designed, they modify price signals so that they internalise externalities like pollution and that all factors of production, including natural capital, are properly valued. They can thus set the right incentives for broadly based actions that reduce environmental damage with the least resource cost, and also promote and guide "green" innovation. Hence, at their most simple, prices on large point source pollutants, such as large industrial installations, or on large scale resource use such as mining or water abstraction, are relatively simple to administer (OCED, 2011).

2.12.3.2 Social Indicators

Health and wellbeing indicators developed by EEA (2013) convey that the complex nature of the relations between the environment and human health and well-being. In their work, the impacts component is separated into two elements; exposure' and 'effects'. This helps to clarify the link from the environment's state, to human exposure to hazards, and on to measurable effects on health and well-being (Corválan *et al*., 1996). The demographics measured in our community starts to tell us how the population is distributed. However, social indicators also measure our social well-being and quality-of life. Green communities offer equal opportunity, social harmony, and mutual respect for a diverse community (UNEP, 2011). So that major social sustainability indicators include education levels, demographics, employment, health, community attitudes, social capital, research and development and compliance with the law (Guy, 2010). Characterising the structure of social capital involves describing the size and density of networks, while the content of social capital includes the degree of trust and prevalence of reciprocity with networks (Johnson *et al.,* 2005).

In recent years, the importance of "human capital" and social development to overall development has been emphasized by the Human Development Index pioneered by the United Nation Development Programme (UNDP, 2009). So too, indicators of sustainable development must also reflect the degree to which human needs including that for a safe, healthy, and productive environment are met. Thus, measures of environmental impacts on human health and welfare are key to sustainability either as environmental indicators or as components of social indicators. Equally important are measures of the degree to which exposure to pollution or access to clean water and clean air vary among social and economic groups. There are certainly subjective elements in quantifying well-being for example happiness and satisfaction, pain and worry there is a growing consensus on a range of objectively measurable factors that contribute to quality of life. These include criteria such as health, a healthy living environment, education, social equity, participation in the political process and personal and economic security (EEA, 2013).

OECD (2013b) has identified eleven dimensions that contribute to well-being namely; community, education, environment, civic engagement, health, housing, income, jobs, life satisfaction, safety, and work-life balance. The OECD (2013) places each of these dimensions of well-being into one of three 'pillars': material living conditions; sustainability; and quality of life. Moreover, (Gut, 2010) uses key social sustainability indicators such as education levels, demographics, employment, health, community attitudes, social capital, research and development and compliance with the law to measure economic, environment and social sustainability indicators of the Australian cotton industry. Within this respect, it was relevant to use these and others social indicators to assess the tradeoffs between consumption growth and green environmental problems in Kombolecha.

2.12.3.3 Environment Indicators

The European environment state and outlook 2010: synthesis (EEA, 2010d) emphasised the increasingly systemic nature of environmental challenges and highlighted the need for greening the economy. EEA (2012) initiated a series of annual environmental indicator reports aimed at analysing selected issues in more depth. The first report in the series, the environmental indicator report (2012), measured progress towards the green economy, focusing on two key aspects of the transition: resource efficiency and ecosystem resilience. However, they argued that while improving resource efficiency remains necessary, it may not be sufficient to conserve the natural environment and the essential services it provides in support of economic prosperity and cohesion. UNEP (2013) environmental indicator report extends the analysis of the green economy, which focuses on the environmental pressures associated with the resource use patterns and impact on human health and well-being.

Mapping the diverse connections between environmental change and human health impacts involves considerable conceptual complexities and relies on a relatively fragmented evidence base. Known health issues are linked to resource-use patterns and associated environmental pressures. In this case, environmental indicators describe the effects of human activities on the environment as well as the implications of those actions on human health, quality of life and the integrity of ecosystems. Environmental indicators are usually scientifically-based information that describes environmental conditions and trends (UNEP, 2011). Key environmental sustainability indicators were including soil, water, solid and liquid waste, biodiversity and greenhouse emissions. However, these generally give a ‘point in time’ picture rather than a long term trend and are rarely industry wide (Guy, 2010).In this study, environmental indicators included werewater quantity limit and waste recycling efficiency in the course of consumer’s consumption processes.

2.12.4 Environmental Kuznets Curve (EKC)

Grossman and Krueger (1991) were the first to model the relationship between environmental quality and economic growth, and their methodology is worth further description. Grossman and Krueger (1991) which concern urban air quality found that “Economic growth tends to alleviate pollution problems. Meanwhile, it was argued that economic growth and the environment are not necessarily in conflict and revealed that there is controversy even from this early stage of empirical investigation. For instance, Hettegi, *et al*. (1992) indicated that no evidence to suggest the inverted U-shape relationship exists for toxic intensity from manufacturing industries (Webber and Allenα, 2004). Nonetheless, globally, there are major inequalities in terms of access to basic resources (McKinsey Global Institute, 2011; Sutton *et al.,* 2013). There is a wealth of evidence to suggest that increasing income will not be beneficial to water quality. As the relationship for water quality is not usually found to be either negatively sloped or Inverted-U shaped, most empirical studies identify that the quality of water supplies and income are positively related (Shafik and Bandyopadhyay, 1992; Vincent, 1997; Hettige *et al*., 2000).

Critics against EKC are profound in both econometric method and conceptual formulation. For instance, Barbier (1997) disparaged the threshold income level which appeared to be unstable, suggesting that EKC may not be accurate representations of environment–income relationships. However, semi-parametric and non-parametric methods have been introduced for detecting the systematic relationship between environment and economic development (Taskin and Zaim, 2000; Millimet *et al*., 2003; Bertinelli and Strobl, 2005; Azomahou *et al*., 2006; Zapata *et al*., 2008). Advantage of these methods is that interaction can be found at local level, with minimal assumptions and no advance specified functional forms. In a semi-parametric setting and using a panel data, Nguyen (2009) investigates the relationship between energy consumption and economic development. A brief survey on non-parametric EKC can be found at Azomahou *et al*. (2006). In addition, eight functional form analysis and specification test using semi-parametric and nonparametric models found at Zapata *et al*. (2008).

According to Stern (2004), the EKC hypothesis is an intrinsically empirical phenomenon, but most studies in the literature are weak in econometrically terms. Generally, little attention has been dedicated to statistical proprieties of data used, such as spatial dependence or stochastic trends in time series. Besides, little consideration has been dedicated to model appropriateness issues, such as the possibility of omitted variable bias. The majority of studies assumes that, if the regression coefficients are individually or jointly significant and their expected signs are obtained, hence the EKC hypothesis exists (Maddison, 2006; Ruphasinga *et al*., 2004). In this context, Ruphasingha *et al*. (2004) remember that almost all studies in the literature, which have ignored spatial effects when analyzing this environmental phenomenon. This study has contributed to the EKC literature by providing a more sophisticated econometric model, taking into account statistical proprieties and several controls both for household effects and other pollution determinants in order to improve the model fitness. The spatial relationships and household are very important in EKCs. This due to household's emissions per capita or income are affected by events occurred in neighboring households (Maddison, 2006).

As the reduced form environmental Kuznets curve is not driven by any particular economic model, there is little theoretical guidance for the correct specification. According to Webber and Allen (2004), there is an aggregate relationship between specific environmental pollutants and income per capita. However, the shape of the relationship is not uniform across pollutants and turning points, when they exist, differ across pollutants. This leads to the conclusion that there is no single relationship between income and environmental quality and the rate of environmental degradation. It is possible to grow out of some types of environmental degradations, but whether this is the case would depend on the type of pollution that is under examination. This study used the binary logistic regression to compute the inequality between household's green awareness, perception, consumption behaviours along consistent to the household's monthly income.

2.14 Chapter Summary

This chapter reviewed some basic theoretical literature pertinent to the green environment issues; industry consumption growth and eco efficiency indicator on the company's production and consumption process. It began from the notion that the world's growth path is expensive, especially for developing countries, which can ill-afford it (World Bank, 2009). In the study context, greening growth is aimed at creating a safe living and working environment. In principle, competitive markets can contribute to human well-being by matching economic output to human demand, allocating resources to the uses that generate the highest returns (EEA, 2013). This revealed that the task of analysing the well-being implications of resource use is rendered more complex by unequal distribution of environment related costs and benefits across society (WHO, 2012b &2013a).

Ethiopia is a highly rainfall dependent country and the economy relies on the agriculture sector. Exploitation of water resources might be generated a large economic benefit in the short term. However, in the long run, over-use of the groundwater is not only increased environmental degradation but also make economic growth and livelihood opportunities questionable. Ethiopia's flourishing economy is both a key driver to environmental degradation and at the same time, the economy is negatively affected by environmental problems that the country is phasing (Emelie and Anders, 2013). Particularly, water consumption put an immense pressure on resource degradation and environmental depletion. Consumers such as households and factories were key participants to erode the green environment in the growing industrial cities like Kombolecha.

The water resource is, however, unevenly distributed amongst urban people and factories, and consumed at an accelerating pace. Studies, for instance, WBCSD (2009), ESCAP (2011), and BASF SEE balance by Sailing *et al*., (2013) used eco efficiency concepts in order to improve the company's product quality and environment problems. The household's consumption was not, yet, integrated into the living and working environment in Kombolecha. The "triple bottom" is notably used to capture the whole set of values, issues and processes that companies must address in order to minimize any harm resulting from their activities (Sustainability, 2005; BASF, 2004 & 2009 and Sailing *et al*.,2013). This study, nevertheless, considered the social, economic and environmental indicators and built the socio- eco efficiency in the water consumption and recycling processes. Meanwhile, this study designed methodologies and derived different econometric models in chapter three

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter attempted to cover the overall research design and methodology used in the study. It employed a descriptive research design to scrutinize the cross- sectional surveyed data. Households and factories were key participants of the study and provided data in Kombolecha. Quantitative methods markedly consisted of different econometric models, which integrated the social aspects into economic and environment indicators during water consumption and recycling process. Principal to this, this chapter pursued the phenomenology paradigm that would be made to understand social reality that has to be grounded in people's experiences of social reality. An appropriate triangulation approach, which consists of both qualitative and quantitative methods were designed to describe this study paradigm. Binary logistic regression, instrumental variable model, propensity score matching model, and simultaneous equation models were used to determine and identify the statistically significant factors that affect the resource consumption growth and green environment tradeoffs. This chapter used SPSS 24 and STATA v15 software version to insert, code and regress factors.

3.1. Research Design

This research design presents the overall approach in the study objectives from the theoretical underpinning in the methodology. This methodology consisted methods and consistent proposed variables during data collection and used data for discussion results. This research design helped the researcher to decide how the data were collected; analysed, and needs an overall configuration of the research process to ensure success; include limited access to data or insufficient knowledge of the subject or an inadequate understanding of the subject or time constraints. This research design also abetted to determine proper research methods so as to elucidate the why's, how's and what's of the subject in the study. For instance, the developed socio - eco efficiency framework was consistent with cross- sectional surveyed data, which do not require control events, to answer why's, how's, and what's of the resource consumption and recycling process in Kombolecha industrial zone.

Mentioned questions why's, how's and what's relate with the household's perception and behavior about resource consumption growth and green environment tradeoffs; socio-eco efficiency framework application on water and waste consumption and recycling process were required answers. Hence, for this study, which was best fitted to answer the main and corresponding research questions, a descriptive survey research design was chosen. This survey research design makes use of a triangulation research paradigm; approach and methodology, which consisted quantitative and qualitative methods. Besides, population, sampling, data collection procedures and analysis techniques, data validity, and reliability tools were designed for each objective.

3.2 Description of the Study Area

Ethiopia is a country having great geographic diversity and endowed with large water resources. The main source of water in the country is rainfall that results in having many trans-boundary rivers, which have different water volume in different seasons. This is factually true when one considers part of the country, particularly western, south western parts and the highland areas (Seleshi, 2007). Despite industrial growth is being at infant stage, still, the government continues to shift the vast agriculture sector to manufacturing growth. This manufacturing industry began by industrial zone establishment at different cities that expected to ensure the country's macro-economic growth by enhancing exports of domestic goods but reducing the urban poverty and unemployment growth. Kombolecha industrial zone was amongst the major industrial zone established in Ethiopia. Due to industrial growth and population density rising in Kombolecha, continuous drought and starvation are daily phenomenon at rural areas due to shortage of rainfall and its variability.

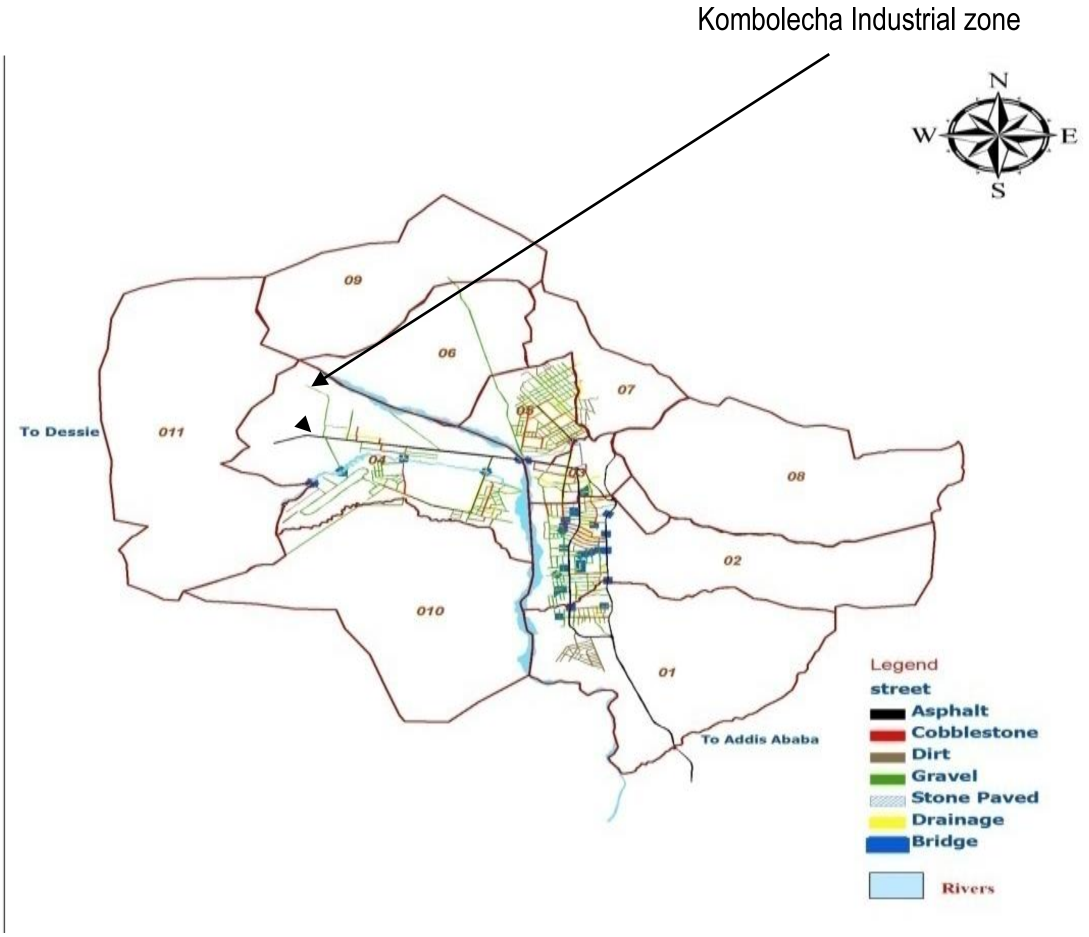
Kombolecha is among Sub-Saharan drought affected industrial city that government encouraged industries by providing land per lease; project finance loans; exempting imported construction and machinery equipments from abroad; delivering training and capacity building services. However, government tiers in Ethiopia were not considered groundwater as a resource and yet charged per leases. As a result, water resource is going to be over consumed and eroded the limited water resource, which is unevenly distributed amongst spatial areas. Consumer's water consumption and production implications on groundwater depletion were serious challenges for industrial cities in least developing countries including Ethiopia. For instance, household and factories were consumed groundwater sources without payment in Birr. Nevertheless, consumers discharged wastes to an environment that affect people's living and working conditions. As observed in the field, Liquid waste emitted to the river was exceeded than solid waste emitted to the nearby environment.

Balancing resource consumption and environmental tradeoffs become a burning agenda to rehabilitate eroded environment and mitigate climate changes. On the other side, industrial and manufacturing growth, however, become a key pillar to transform the agriculture to industrial sectors in GTP-1 (2010 & 2015) and GTP- 2 (2016-2020). As a result, the new emerged firms were alarmingly increasing in various sectors in Kombolecha industrial zone. The environment was depleted by rising production and consumption without balancing water recycle efficiency. As a result, the population growth and resource consumption have been shown tradeoff that treats the nature of green environment. The groundwater, in fact, was seriously depleted by factories and household's overconsumption processes and insufficient payments per water quantity use, city administration has done nothing to protect the environment.

Kombolecha industrial zone is found in the north west of the city. This industrial zone has been declared as an industry center by the Ethiopia government since 1996. This industrial zone is 480 km far distance from Djibouti port to export and import of goods. However, the new industrial zone was inaugurated and clustered on 10,000 hectares of land that expected to create above 20000 job opportunities. The availability of required services like dry port, skilled manpower and public service were basic criterion to build as an industrial city. Some part of industrial zone is used by permanent factories and the remaining hectare of land is fenced and constructed by firms for further production. In addition to this, the government has been clustered new industrial zone, which increased exports of domestic and foreign manufacturing firms during 2015 (Kombolecha Communication office report, 2016). Importantly, it is located 373 km distance from Addis Ababa, capital city of the country. There are a relatively greater number of large-scale manufacturing plants, such as BGI-Brewery Factory, Textile Factory, ELFORA-Meat Processing Factory, Kombolecha Tannery, Steel Product factory, meat processing factory, and Flour Factory and etc (Kombolcha Industry office, 2016).

Among mentioned permanent factories, six factories have above 525 million Birr registered capital laid on 57.5 hectares of land and created 2037 job opportunities for unemployed people. There are also 220 number of new factory owners called investors, which have been taken license to invest on 366.8 hectares of land in industrial zone (Kombolcha Trade and Industry Office Report, 2013). After 2013, municipality and industry office has been clustered a new industrial zone, which in sum covered 163 hectares of land. Out this, 134 and 29 hectares of land was used during 2015 and 20016 respectively. Out of this, 41 percent of the land has been utilized and constructed by firms. Water service provision lied on ground water source, which was major consumable inputs for all factories (Kombolecha Water Supply and Sewerage enterprise office, 2016). Out of the total land, 26 factors were started production and consumption of water resources (Kombolecha trade and industry office, 2016). Firm's water consumption eroded the natural source and green environment in an industrial zone. Water consumption and its negative tradeoffs on environment was not considered and studied further to recover over-depletion in Kombolecha.

Due to distinct push factors, people migrate to Kombolecha and hence population and factory growth are rising and interacting with environment to fill their daily demand. For instance, water resource consumed shamelessly without recycling and keeping green environment. Households, who reside in and around industrial zone, were affected environment during resource consumption. So, this study key analysis was households and factory's consumption, which used water resources and emitted wastes, put tradeoffs to the green environment. Household's consumption culture, awareness, perception and behaviours to adopt green mind, technology and job searches were included and assessed the tradeoffs between consumption growth and green environment resilience. Along with reviewed literatures gaps, this study integrated the household's social, economic and environmental aspects and built a socio-eco efficiency that resilient the green environment.



Source: Kombolecha Municipality office (2016)

Figure 3.1 Kombolecha city Map and infrastructure network

Figure 3.1 shows Kombolecha city and its industrial zone located at 04 in the map. A new industrial zone which clustered on 10000 hectors found in Kebele 07. Since, 90 percent of the population relied on vast agriculture sector in Ethiopia, government encouraged companies to engage in textile and garment products due to its high demand. However, yet the quantity supplied by domestic and foreign garment factory could not address this rising consumer's demand. Accordingly, the Federal government, Amhara regional state and Kombolecha city administration promoted domestic and foreign investors to increase the performance of manufacturing companies.

3.2.1 Description of Companies in Kombolecha

In this study, Kombolecha Textile factory was one of recruited sample to assess resource consumption and environment tradeoffs. It is the oldest and highest technology user in garment industry. The company was established in 1986 and later reorganized in Nov 1992 by proclamation No 146.1998. Under the then National Textile Corporation with a designated and attainable capacity of 22 million squatter meters of fabrics per annum, company import and export goods and services. Kombolecha trade route passed though the main roads of Afar to Djibouti, which is still nodal for import and exportable trades in Ethiopia.

The main customers of the company's products were regional distributors, wholesalers, super market and garment factories for fabrics and knits wear factories and blanket plants for yarn. The main raw material for the production of fabrics and yarn is domestic cotton. Imported dyestuffs and chemicals are used dyeing and finishing products. Utilities used to produce products such as water and steam, compressed air and furnace oil, electricity, all of which are locally available in sufficient quantities. Water is major inputs used to produce distinct brands of cotton final products. The company used both groundwater and 'Woreq' river water source during production processes. In sum, Kombolecha Textile Company has six groundwater wells, which used to produce final textile products. However, this company was not reused the treated waste after production.

The factory's final products included; cotton fabrics such as 'abudeji', 'Mulmul', pulpin, khaki drills, twills, sheeting, terry towel, canvas; and also yarn. Currently, the company has 2206 employees, who are hired both permanent and temporary, professionals and experts. Foreign consultants and research and marketing team have also established to improve company products. Final liquid and solid wastes were gathered and soled to retailers and remain put in to garbage. The company solid wastes sold for traders and individuals whereas liquid waste to Borkena river after treatment. The company still was not yet recycling liquid waste after production processes. According to data collection result, the factory consumed 6979m^3 water per week and emits 2001 m^3 liquid waste to Borkena River. None of this waste water was recycled for further consumption process.

Kombolecha Textile factory used the groundwater for cleaning machine and painting of clothes. The source of water is ground well and Worqa river besides to tap water. After extracting ground water and diverted

Worqa river, the factory treated the water and checked in laboratory so as to reduce negative externalities on cloth and garment products. Liquid waste emits to factory's prepared waste collection and filtration site. Meanwhile, the treated waste disposed to Borkena river. This waste water flows to Borkena river and used for urban irrigation and livestock drinks. Textile factories consumed water resource for cooling, dye bath, other fabric preparation, and finishing and color printings purposes. In most factories, the residual hot water was used for dyeing bats. However, factories' residual water directly released to waste collection tanker and discharged into the river.

According to Textile Company's water consumption intensity, almost 60% of water used for wet processing of undyed and unprocessed fabrics in to finished products. At each stage of the garment and textile product production such as fabric preparation, dyeing, printing and finishing used water either for chemical bath or remove impurities of excess chemicals used for printing activities. Kombolcha textile factor was treating waste water better than other factories after production process and emit wastes to Borkena river. However, china Textile Company consumed groundwater and directly emitted liquid wastes without treatment to Worka River, which is tributary of Borkena river. These rivers used for cattle drink as well as small urban irrigation by farmers. However, this study confirmed that none of the factories were recycling and reusing the discharged waste.

In this study, beer producing companies were samples and hence provided information about water consumption intensity to produce distinct beer and soft drinks. However, there was no soft drink producer factory yet in Kombolecha industrial zone. Bji brewery producing company was, therefore, the only firm participated to compute the water consumption and waste recycling processes. This factory consumed water for bottle washing, refrigeration, equipment cleaning, boilers for pasteurization, and sterilization, and final beer product.

Bji brewery factory used water, by its end use for consumptive, cooling, processing, and other purposes. However, company's most water intensity was used for production of beer, cooling and pasteurization. Among the surveyed factories water consumption intensity, this brewery factory was consumed more water but its solid wastes reused for livestock production and food stuffs. It was directly discharge water waste to Borkena River. The brewery factory solid waste sold and distributed for farmers and households who engaged on fatten and dairy activities. However, used groundwater source for production purposes and discharged waste without treatment. According to the municipal office (2016), this company, nevertheless, was not integrating the social, economic and environmental factors in the period of resource consumption.

Kombolecha metal and steel producing company in short form KOSPI is the only single factory established in Kombolecha industrial zone. The factory used water for cleaning, treat, coat and paint metal parts. Water is mainly used for rinsing components after the various chemical processes and washing chemical baths. Out of total water consumption, 70 percent of water consumption used for processing, and the readings share of water consumed for cooling and other purposes in the factory such as drinking, cleaning and gardening and forestation. This metal company was emitted liquid waste to Woreka and Borkena river without treatment. Liquid waste is not reused and recycled so as to keep the water source degradation and environment depletion.

KOSPI is a member of the MIDROC Ethiopia technology group established in 1999 and is produced in steel sheet shearing, ribbed sheet forming, wire drawing process, wire galvanization, batch galvanization, nails, shoe tack and wood screw manufacturing, steel pole fabrication (swaging process, continuous MIG welding, etc.) and steel structure fabrication and installation (KOSPI, 2017). It is built on a total land holding area of 60 thousand sq. meters. The company produces various types of products and steel structures such as steel poles, building steel structures, power transmission and communication towers, fuels and water tanks (horizontal and vertical), cargo bodies, agricultural trailers and trailed tanks, canopies, refuse containers, and other customized engineering products. This study, in sum, included factory's water consumption growth and green environment tradeoffs in Kombolecha industrial Zone by applying a socio-eco efficiency framework.

3.3. Research Paradigms

This study paradigm began from social scientist's epistemological philosophy for which it tried to understand what it means to know and provides a philosophical background for deciding what kinds of knowledge are legitimate and adequate (Crotty, 1998). According to Smith *et al*. (1991), having an epistemological perspective in research is important for several reasons than ontology (David, 2004). Among many, the first reason of epistemology states the overarching structure of the research including the kind of evidence that is being gathered, from where and how it is going to be interpreted. Whereas, the second reason of employing epistemology was that it helped the researcher to recognize which designs were worked for a given set of objectives and which were not (Ibid). Based on this, an epistemological philosophy was, therefore, an initial bench mark for this study paradigm.

In this study context, an epistemology helped to philosophise and explored what means to know about people preference and consumption behavior about green environment and resource consumption tradeoffs (focusing objective 1). It helps to describe what it means to know about socio - eco efficiency framework and indicators significance to reduce environmental problems regard to people and factory's resource consumption process. That is, it also helped to know about indicators legitimacy and significance to recover the green environment in Kombolecha industrial zone (focusing objective 2 and 3). Besides, it helped to decide what type of resources were required for identified indicators and their adequacy for altering social, economic and environmental interaction on water and waste consumption and recycling process (focusing objective 4).

Among dominant paradigms, this study, epistemology was triangulated with phenomenological and positivist research paradigms which are consistent and pertinent for descriptive survey research design (David, 2004). Phenomenology paradigm holds that any attempt would be made to understand social reality that has to be grounded in people's experiences of social reality. The basic belief here was the feature of the existing fact of the world and people social progress is interconnected with their activity (Smith *et al*., 1991). Likewise, household social aspects were inseparable with economic and environmental affairs during resource consumption. Hence, it was assessed the subjective experience of household's phenomenology such as perception and behaviour, which weighing scale the consumption and recycling efficiency in meeting the social, economic and environmental problems.

Along with this, neither criterion, neither of WBCSD (1996) and ESCAP (2009) nor Bruce, *et al*. (2010) eco efficiency studies consider and integrate people phenomenological characters, social reality and subjective experience values to balance between resource consumption and green environment problems. Phenomenology paradigm was therefore uniquely designed for this study to explore the social factors cause and effect nuances during a survey besides too suitable to accommodate factors that cannot be translated into number based results (focusing specific objective 1).

Of the different theoretical perspectives available today, positivism is, or has been arguably among the most influential in social sciences (Smith, 1991; Crotty, 1998 and David, 2004). In essence, positivism argues that reality consists of what is available to the senses; what can be seen, smelt, touched, etc. For positivists, then, both the natural and social worlds operated within a strict set of laws which science had to discover through empirical inquiry (David, 2004). For instance, the quantity of water consumption and recycles were positively measured using meter cubic (m^3), liter, and etc. Hence, the positivist paradigms were concerned and measured quantity of water and wastes consumed by households and factories in Kombolecha (focusing objective 1, 2, and 3). It also used to compute socio-eco efficiency indicators quantitatively with regard to social, economic, and environmental quality using physical and monetary terms (focusing objective 2, 3 and 4 below).

Indeed, there have been many different versions of positivism which overlap, and which rarely agreed precisely on its essential components (Bryman, 1988 & David, 2004). However, this positive paradigm is attempted to fit for this study to analyse a correlation and association between variables such as independent variables (perception, behavior, resource consumption, and socio - eco efficiency indicators) and dependent variables (green environment). Hence, this paradigm was quantitatively measured people and factory's expenditure (costs) in terms of resource value adds on social, economic and environment recycling costs. The cost was computed based on Kombolecha water supply and sewerage enterprise's tap water payment rates.

3.4. Research Approach

An appropriate triangulation research approach which consists of both qualitative and quantitative was designed to describe this study paradigm. For instance, a phenomenological paradigm was described by qualitative approaches whereas the positive paradigm is described or interpreted by quantitative approaches (David, 2004). Descriptive research approach was used as a means to an end which able to draw conclusions for both qualitative and quantitative approaches (Saunders *et al.*, 2000). With this respect, positive paradigm was interpreted by quantitative conjunct with descriptive research approaches that able to identify, determine, test and evaluate variables or indicators (focusing objective two, three and four).On top of this, descriptive quantitative approach was provided objective and unbiased results which also helped to direct towards gathering primary data directly from the samples (people and factories) to provide a basis for making inferences about the larger population (Manheim and Rich, 1995 and Hussey, 1997).

The qualitative approach, which describes the qualitative phenomenon of people like perception and behaviours, would combine correlation and descriptive research approaches based on Hussey and Saunders, *et al. (*2000) suggestion. Hence, this study was employed a qualitative triangulation approach which consists of both qualitative conjuncts with correlation and qualitative conjunct with descriptive research approach. The former one would be applied at the early stage of this study (focusing objective 1 below). It is uniquely designed to assess people social aspects and determine whether variables (indicators) are covary, if so, to establish direction and forms of economic and environmental indicators relationship in Kombolecha city (focusing objective 2).

The later one, qualitative conjunction with descriptive research approach, was used to describe and portray an accurate profile of events during people and factory's resource (water and wastages) consumption process. Hence, qualitative descriptive research approach was applied to describe qualitative characters of variables and their association (e.g., people perception, behaviour and level of green environment) (focusing objective 1). Moreover, qualitative conjunct with descriptive approach was used to describe, compute and interpret indicators quantitative values and impacts on the environment (concerning objective 2, 3 and 4). Since this study included in a short time frame, both approaches were used cross sectional surveyed data from Kombolecha industrial zone.

3.5. Methodology

There is a debate regarding qualitative or quantitative methods and the impact of various methodologies on the reliability and validity of the research results. Those in favour of quantitative methods, such as Mintzberg (1973) and Hodgson, *et al*. (1965) base their arguments on the objectivity and internal validity of results obtained. They consider bias on the part of the researcher as an inescapable part of the qualitative methodology. The validity of the results may, therefore, be questioned, and it would be difficult to compare the results of studies (Gill & Johnson, 1997). However, supporters of the qualitative method, such as Neustadt (1960) and Burgess (1993), base their criticism of quantitative methods on whether quantification is possible under all circumstances and the possibility of uncontrolled bias.

Scholars like Cormack (1991) as a solution suggests multiple methods are vital to reduce the qualitative and quantitative method's drawbacks through triangulation, multiple research methods that can be used to gain a total picture of some phenomena. Saunders et al (1997) identify two major advantages of multiple research methods. First, different methods may be used for different purposes. Second, different data collection methods may be used to provide convergent evidence (a process referred to as triangulation). Based on this, this study, therefore, used a triangulation methodology, which comprised of both qualitative and quantitative methods for all specific objectives.

3.5.1 Objectives 1: Assessment of Household's Behaviours and Perception of Resource Consumption and Green Environmental Tradeoffs

This study was conducted in Kombolecha city, which is among industrial city in Amhara Regional State, Ethiopia. Hence, it mainly targeted 'Kebele' four administrations ('Kebele' here refers the lowest administration unit in Ethiopia) and the industrial Zone where people and factories are densely populated. The population frame was 3252 households, who composed of households that consumed water resources and recycled wastes differently. Nonetheless, the target population was sample households, who provided information in the period of primary data collection in the study area.

Based on household's complex socio-demographic characters and consumption patterns, the target population was divided into mutually exclusive groups and classified into four major categories: namely, factory employees (1537), consumers excluding factory employee (1265), suppliers (450) and service providers (125) such as hotel, garage, café services etc. To get accurate information from each category, stratified random sampling techniques were applied to sample households. Household's category served as a stratum. Out of each stratum, individual households were selected randomly to give each household an equal chance of being selected.

Out of four categories of households, the total sample households from all stratawas $n_i = n_1+n_2+n_3+n_4$. Accordingly, sample households were factory employee (n_1=154), consumers (n_2=126), suppliers (n_3= 55), and service provider (n_4 = 4) from each stratum. Hence, 338 sample households from Kombolcha industrial zone were selected to gather data using semi structured questionnaires and interview (for further detals use Annex 2).

The questionnaire and interview schedules consist of both open and close ended questions.

In the questionnaire, the household's consumption behaviour (qualitative) was measured based on respondent's consciousness to adopt green thinking (green mind), product consumption, technology and green job use; ability and willingness to buy green inputs; product (whether green or grey); consumption strategy; water quantity; awareness about green environment and management. As a guideline and standards, the study used Amhara Regional State; Kombolecha Municipality Clean and Beautification Office environment management manuals; and Water Supply and Sewerage enterprise Office manuals (2014-2017). Whereas, household's qualitative perceptions were measured in terms of respondent's emotionality and sensitivity to adopt a green mind, consumption, marketing, technology and job searches that balance the water consumption and recycles regards to the social, environmental, economic wellbeing and understandings. These qualitative measurement and characters were explained in nominal five-point Likert scale categories (from strongly agree up to strongly disagree). Besides, neutrality categorical scales such as don't perceive, don't behave, not at all, etc. were included in questionnaires.

Before conducting a questionnaire survey, the validity of constructs was checked. Cronbach's alpha was computed to measure reliability and internal consistency of the measurement of qualitative characters and scales. Face validity of qualitative measurement scales were checked by researcher, experts and pertinent with literature reviews. In order to test the dimensionality of qualitative scales measurement and constructs, an explorative factor analysis was applied following the procedures recommended by Kuznets (1955) and Churchil (1979). Moreover, the household's awareness, behaviour, perception towards practicing a green mind, product consumption, marketing, and technology use inequality was computed by following the environment Kuznet's curve model (Kuznets, 1955).

After group key informant interviews, data collection was undertaking using questionnaire interviews. A researcher delivered data collection trainings for five data collectors. They were distributed the questionnaires and respondents were filled the questions. However, data collectors were read the questions for respondents and filled response for which they were not read and write on the questionnaires. Photograph was taken by experts using digital camera. This instrument was used to gather precise information and substantiate household perception and behaviour regarding to seek the green environment. The questionnaires were administered in several ways. But, for this study, a researcher read questions for respondents and writes their answer on questionnaire. It was interviewed, managed and collected by the researcher so as to probe respondent's perception and behaviours. The collected data were analysed using the qualitative and quantitative techniques. The qualitative methods applied content methods, description and proportional techniques, and case analysis. The quantitative techniques were used both the inferential statistic and econometric regression and computation.

This study used econometric model to identify the correlation and to determine association between variables (perception, consumption behavior, resource consumption, level of green environment) and test the variable significance. Whereas, the descriptive inferential statistics were used to inference statistics and information from sample to a large population and help to evaluate the impact of variables. Gujirati and Maddala (1983&2004) and Greene (2004&2011) logistic regression model was applied to investigate the association between variables. Kuznet's (1955) Environmental Kuznet Curve Model was also used to assess inequality between the household perception and behaviour along with their monthly income (economic instrument) and poverty status (social instrument) intertwined with their water consumption and recycling efficiency (environmental instrument).

This study, furthermore, used secondary data such as indexes, reports, manuals, national and international institution standard measurement scales and indexes that helped to substantiate and support the result of primary cross-sectional data. The sources of these secondary data were libraries, websites, publications, journals, and etc.

3.5.2 Objective 2: Determined Socio-eco efficiency Indicators on Resource Consumption and Recycling processes in Kombolecha

Like the previousobjective1, objective 2 was conducted in Kombolecha city. Relevant information concerning the household's social (poverty status, behaviours and culture); economic (monthly income) and environmental aspects (water quantity and waste recycle) were keenly collected to integrate the three key indicators and determine the significant socio-eco efficiency indicators effect on water resource consumption and recycling processes. In pursuit of this, 338 sample households, who consumed water resources, were participated during data collection. Moreover, data were gathered purposively from 14 factories, which are consumed water resources (Kombolecha municipality, 2013). In this regard, factory's production managers were purposively sampled respondents. Based on consumer's (both household's and factories) water consumption and types of production, the researcher classified them into six sectoral categories: cloth and garment produces, beer and soft drink, metal and steel, leather and related product, food and related processing, manufacturing and others sectors. Factory managers were presented as a sample and hence counted as 14 respondents. Based on Kombolecha municipality and investment profile document (2013), this study, thus, took all factories, such as two factories from cloth and garment producer company, one beer factor, two metal and steel producer, one leather and related, three food and related processing factories, two manufacturing and other three factories were sampled and taken to collect the primary data.

The data collection phase was undertaken from factories and other professionals using structured questionnaire, which consists of both open and close ended questions. Social, economic and environmental indicators on water resource consumption process were used as a guide line to prepare structured questionnaires. The various indicators of socio- eco efficiency framework in questionnaires were used as data survey instrument. Consistent with the proposed questionnaires, the descriptive survey methods were constructed and undertaken so that correlation levels or strength of relationships between variables such as level of green environment and socio- eco efficiency indicators were assessed, characterized and quantified.

In doing so, this study generated a list of indicators in a questionnaire and respondents determined how each indicator criterion weighted on water and waste consumption process. Based on indicator criterion, the selection grid should have a scoring system for ranking the indicators. The weighted voting can be a simple Yes or No to a numerical rating system. Many numerical systems are possible such as (1-5) and (1-10). The larger number or "YES" was represented a desirable rating. In some cases, large number may mean "less", for example cost of water or waste removals. In order to set scoring, the researcher asked every sample household to score each indicator against the criteria. Respondents completed the questionnaires to evaluate how well the economic, social and environmental indicators were pertinent to resolve the consumption and recycle inefficiency problems. The average score from each respondent were taken. Finally, total and average score were computed and summed based on the respondent's scoring result.

Accordingly, this study used the highest ranked economic, social, and environmental indicators to gather information from the household and factory's water consumption and waste recycles. For instance, monthly income, poverty status and culture and quantity of water were high ranked indicators among economic, social and environmental indicators. These indicators defined as the effect of household and factory's water and waste consumption activities on the environment as well as the implication of those actions on other indicators integrity that described conditions during consumption process. Three major social, economic and environmental indicators and their integration were generated for respondent's indicator voting and scoring purposes in the questionnaires.

Based on these classifications of indicators, a pilot study was undertaken by distributing 20% of questionnaires to samples (people and factories) so as to check validity of content and constructs. In order to check correlation between variables and quantitative measurement scales, Pearson chi square value was calculated to measure and test internal strength and relationship between variables or indicators and level of green environment. To test the dimensionality of measurements scales and construct variables or indicators (socio-eco efficiency indicators), descriptive factor analysis was done following WBCSD (1996) and ESCAP (2009) indicator principles and criterion.

Meanwhile, the researcher computed households and factory's intensity water consumption and waste recycle efficiency relative to green environment impacts. In this study context, waste is defined as an end product, which consists of both solid and liquid waste, having negative economic value on environment. In Kombolecha industrial Zone, household and factory's water consumption and waste recycle intensity or productivity were measured using the formula:

- Water consumption intensity: cubic metre of water per households and factory's product
- Liquid waste recycle intensity: cubic metre of liquid waste per consumer's product

In this case, environmental items were measured using physical units, such as cubic metre (m^3) of water and liquid waste consumption, tons (t) of solid waste. Whereas, water consumption and product value adds were measured using in monetary terms. For this study, Ethiopia currency called Birr were used to measure monetary value of resources such as water, wastes, costs, value adds and etc. To measure efficiency of indicators, it was computed the ratio of water consumption and recycle efficiency relative to households and factory's value adds of product with respect to social, economic and environmental values. These ratios were measured environment burden of water and waste consumption per unit of economic and social values in Birr. For example, M^3 of water consumption per value added of respondent's products were computed in Ethiopia birr.

On the other side, in this study, indicators were categorised in to eco - efficiency, socio - efficiency and socio- eco efficiency. Eco efficiency was computed economic value of products relative to environmental quality in physical and monetary terms. Whereas, socio- efficiency was measured social value adds of water and waste like health effect with respect to environmental quality in monetary terms. Socio - eco efficiency was calculated physical items of environmental quality (water and waste per units) relative to economic and social value add combination or summations. Similar conceptual formula was used to measure the indicator efficiency.

Eco efficiency of water = $\frac{\text{water consumption / } M^3 \text{ (environmental quality)}}{\text{Economic value adds of water on products/Birr}}$

Socio efficiency of water = $\frac{\text{cubic metre of water consumption (environmental quality)}}{\text{Social valued adds like health/cost in Birr}}$

Socio- eco efficiency of water = Eco- efficiency of water + Socio- efficiency of water

After computing and measuring these indicators, the content validity of variables (indicators) will also be checked by WBCSD, (1996), BAZF and ESCAP (2009) indicator criterion and principles; SO standards 14040 and latest criterion; UNEP (2009) and UNIDO (2011) environment and industry strategy manuals, FDRE Environmental Protection Agency Manual (FDRE, 2010); FDRE Industry Development Strategies (2010); and FDRE Product Quality Assurance and Measurement Agency manuals (2010) literatures and experts. Using environmental item in physical or financial terms relative to economic and social value adds, determinant indicators were identified on the water consumption and waste recycling process in the Kombolecha Industrial Zone.

It was, therefore, both qualitative and quantitative descriptive data analysis techniques were used to probe the data and interpret the result. The qualitative techniques were factor grounding theory and descriptive factor analysis. Whereas, the quantitative techniques were applied econometric models, descriptive statistical inferences and central tendencies such as percentage, mean ratio, average and etc. Importantly, econometric models were used to identify and determine association of indicators and their correlation. Hence, binary Logistic Regression Model (BLRM), Instrumental Variable model (IVM) and Two Stage Least Square estimation (TSLM) were used to measure association and correlation between variables. Model goodness of fit and correlation status of variables were measured and checked by Pearson chi square along with the guideline set by Guajarati (1983 & 2004) and Greene (2011). This study model fitness was computed 74 percent, which indicates this model sufficient prediction capacity between explained and explanatory factors.

The validity of statistics and econometric models were checked and accredited by Gujarati (2004) and Greene (2011) and Wooldridge (2012) criterions along with each model proposed purpose and importance to analyze the data for objective two. Secondary type of data such as WBCSD (1996), BASF and ESCAP

(2009) social, economic, and environmental indicator measurement, scales, indexes, ISO standards, reports and statistics were used to support and strengthen the primary data. The data sources were libraries, internet or website, journals and publications, factory profile and annual reports, Ethiopia environment protection agency, Amhara regional state, and Kombolecha municipal office unpublished documents. Data inserting, coding, editing and interpreting procedures were done using the latest SPSS24 and STATA 15 Software programs. An alpha value of 0.05was used as the level for determining the factor significance.

3.5.3 Objective 3: Evaluated the Extent to Which Indicators on Consumption of Water and Waste Recycles Would Impact the Environment

For this study, purposive sampling techniques were used to collect data from consumers (126), service providers (4) and factories employees (14) to evaluate indicators impact on water consumption and recycling processes in Kombolecha Industrial Zone. A simple random sampling technique was employed to collect data from mentioned categories. The study used structured questionnaires and field survey research method to collect information from respondents. In the questionnaire, the researcher categorised indicators into three dimensions. First, it applied indicators classification such as social, economic and environment indicators in socio- eco efficiency framework; second, the extent at which indicators impact on the environment in physical items is called characterization and third, calculation of indicator's impact on environment relative to value adds in monetary terms, Ethiopia Birr is known as quantification. These indicators categorization was appropriate for propensity score matching estimation that gauge indicators impact on the green environment.

Product life cycle assessment following by WBCSD and ESCAP (2009), social life cycle assessment by BASF (2009) chemical company group and environmental life cycle and quality standards by ISO (2012&13), UNEP (2011) and Ethiopia Environment Protection Agency quality criterion (EPA, 2010) were used as a guide line instrument to design a questionnaire and an interview. Hence, interviews using prepared questionnaires were used for key professionals or experts who concern water and waste management and recycling process in the factory. Besides, field observations were undertaken. And hence photograph image were taken during interview and field observation. This was helped the study to consist precise information about waste recycles, wastes removal systems, operation management and etc. Thus, primary cross sectional data, which used to evaluate indicators impact on water consumption and recycles, gathered from both households and factories.

Meanwhile, the researcher prepared objective scoring system for social, economic and environmental indicators so as to evaluate their potential impact on water and waste recycling process in a questionnaire. The study generated a list of possible indicators in questionnaire and hence each sample household and factory's key professionals were allotted number of votes to select what indicator is their priority to evaluate water and waste recycling. Among many criterions, this study generated indicators in the questionnaire and took indicator's concerns and understandability by respondents; flexibility, measurability, comparability to previous findings, long term reliability, temporal scope and measure scientifically to evaluate potential impacts on environment. In order to determine how each criterion was weighted and the selection grid would have a scoring system for ranking the indicators, the weighted voting was a simple 'Yes' or 'No' to a numerical rating system.

Many numerical systems are possible, but for this proposal 1-5 up to 10 were taken in a questionnaire. The larger number (or "YES") must always represent a desirable rating. In some cases, this may indicate "less", for example water and waste recycling rate. Each respondent was, therefore, total their score for each indicator. The score from each indicator was then averaged. The researcher summed total and average the score. Based on this ranked Indicators, water and waste recycle data were gathered from people and factories. Meanwhile, the researcher computed households and factory's consumption intensity of water and waste recycling to keep environment.

In this context, waste is defined as an end product, which consists of both solid and liquid, having negative economic value on green environment. In Kombolecha industrial Zone, the household and factory's water consumption and waste recycling intensity measured and evaluated as:

- Water recycling intensity: cubic metre (m^3)/household and factory's product
- Waste recycling intensity: cubic metre (m^3)of liquid waste/household and factory's product

Like objective 2 in this study, environmental items were measured using physical units such as meter cubic (m^3) of water, liquid waste recycles. Whereas, the water consumption and waste recycle value add per quantity of product were measured in monetary terms (Birr). Based on this, water and waste recycle (environmental items) relative to value adds of recycling on social and economic values were computed. Value add in this context is calculated as product sale minus cost of input like water. These ratios were evaluated quantity of water and waste recycles environmental burden relative to economic and social value in birr.

As a result, eco efficiency, which considers only economic and environmental aspects, of water recycle was calculated using the formula: Environmental item divide by economic value of water intensity or M^3/ Birr. Whereas, waste recycle was measured as: M^3 of waste divide by waste intensity or M^3/ Birr. Environmental item (water and waste per m^3) divided by social value in monetary terms (birr) measured socio-efficiency, which considers social and environmental aspects. Hence, conceptual socio-eco efficiency of water and waste recycle was computed as:

Socio- eco efficiency indicator = eco-efficiency + socio-efficiency i. e

$$= \frac{\text{env'tal item (water or waste recycle)}}{\text{Economical values of intensity in birr}} + \frac{\text{env'tal item (water or waste recycle)}}{\text{social value of intensity in birr}}$$

Where,

m^3 = cubic metre of water

env'tal = environmental

The researcher, therefore, checked content validity and measure indicators impact using WBCSD (1996), ESCAP (2009), Ethiopia environmental protection Agency manual (2010); FDRE, Industry Policy and Program Strategy; GTP (2010), BAZF (2009) and UNEP (2011) indicator measurement procedures. The reliability of indicators was checked by Product life cycle assessment by WBCSD and ESCAP (2009); social life cycle assessment by BAZF (2009) chemical company and environmental life cycle assessment by Kuznets (1955) and UNEP (2011). Moreover, to make indicators reliability while evaluating impact on water and waste recycling process, Propensity Score Matching Model (PSCM) was applied to evaluate indicator's impact on environment. The units of analysis for this case were households and factories which consume water and recycle wastes.

In addition to this, the study used secondary data from factory and people's water consumption and waste recycling profiles and reports, factory's index, national and international standard index, journals, publications, national statistical reports, socio-demographic data etc. The sources of secondary data were libraries, factory's websites, and etc. To begin this analysis, data processing was begun from data entry from questionnaires to computer files. Secondly, data editing and coding procedure were done seriously using SPSS20 and STATA14 software version.

3.5.4 Objective 4: To Develop a Conceptual Resource Model for Identifying Indicator Gaps Between Water Consumption and Recycling Process

For this study, the study took sample households, which were used in objective 1 and key professional representative from each factory (14 households) (used in objective 2) using purposive sampling techniques. Moreover, the researcher conveniently and purposively took 50 sample households, who were representatives of municipality (5), Kebele administration (4), consumers (8), suppliers (12), NGOs (5), universities (4), professional unions (2), political parties (4), religious and community leaders (4) and other concerned bodies (2) in Kombolecha. Representative samples were conveniently and purposively selected to integrate knowledge and experience from diverse working areas, which provide viable information about the required resources that used to narrow groundwater resource consumption and recycling intensity gaps. Hence, for this study, data were gathered from 64sample households using semi structured questionnaires and focus group discussion. The questionnaires were distributed in hand for respondents.

Significantly identified indicators found in objective 1, 2 and 3 above were a guide line for the questionnaire and agenda for focus group discussion. Focus group was consisted of 10 members. For each group, the researcher prepared and trained a writer and data recorder during discussion. Video recording and photograph was taken by experts as viable instrument to take clear information from group discussion. In addition to this, the researcher organised one-day workshop conferences for purposively selected households. In this case, explorative data survey collection method was used to gather data for sustainability of indicator's that filled gap between water and waste consumption and recycling process in Kombolecha industrial zone. During conference, three professional data recorder (photo graph man, video recorder and writer) were used. Observation, managing and controlling conference and participation were used to keep data reliability.

In pursuing this, the study generated various possible significant indicators during water and waste consumption and recycling separately. And hence, multi voting principles by all sample respondents were used to let them to decide which indicators are important to fill the gap. Thus, strength, weakness, opportunity and threats of each significant indicator during consumption and recycles were listed and proposed on questionnaires during resource planning, operation, evaluation and management procedures. Meanwhile, required resources were listed which can reduce weakness and threats and sustain indicators strength and opportunity for households and factories. That means, this study compared social, economic and environment indicator's synergy and sustainability that balance water consumption and waste recycle gaps.

Each economic, environment and social indicator was measured in physical and monetary value measurement like objective 2 and 3. For instance, physical and monetary values of economic, social and environmental indicators of water consumption and waste recycling per m^3were compared and computed to find out the gap. The larger the result represented highest problem (wide gap) whereas the lowest number represented narrow gap between water consumption and waste recycling. This computation was applied for both households and factories in Kombolecha.

Many different assessment methodologies exist to check content validity of data and indicators. However, this study used regulatory impact assessments, poverty impact assessments and environmental impact assessments as a guide line and instrument to set information and base line for each specified indicator. The assessment was lined with legal, economic, environment and social instruments regarding to resource consumption and recycling process in Ethiopia. Following this, indicator factorisation and resource matrix were done separately on water and waste consumption and recycling process. An integration of resource and indicators were made using simultaneous econometric models. Determinant resources for each identified indicator were discussed in detail to examine the effects and changes of household and factory's consumption and recycling activities.

In order to investigate the collected data, both qualitative and quantitative techniques were used in this study. Qualitative techniques were used a case and factor analysis. Whereas, quantitative analysis used econometric models such as simultaneous equation model lined with Guajarati and Maddala (1983 &2004)

and Greene (2011). This is used to compute the predicted value of required resource for social, economic and environmental aspects. This model depicted causality and synergy between identified indicators, resource consumption and green environment. Identified indicators were taken monthly income (economic indicator), consumption culture and behaviour (social indicators) and water quantity (environment indicator). A socio-eco efficiency framework, which consists an economic, social and environmental indicator, probed the tradeoffs between the consumption growth and green environment.

Using proposed indicators and resource variable combinations, a reduced form of resource model was built which consists of both indicator and resource. This reduced resource model computed the predicted value of indicators and resources relative to green environment. Besides, the reduced model helped to check the association of indicators and resources during resource consumption and recycles. So as to support and strengthen primarily collected data, the secondary data such as government policy and program documents, annual reports, factory statistics, publications, municipality unpublished document, international institution's environment, economic, and social indicator indices etc. The sources of data were government and non-government libraries, websites, and etc. SPSS software latest version used to code, clean, and interpret the data.

There would be major challenges during field work and data collection. For instance, participant's information hide and over exaggeration response were major challenges during the data collection. Different tools and questions were used to get clear information during interview. Data collectors were trained how to overcome challenges during data collection besides to preparing alternative question that cleared participant's information.

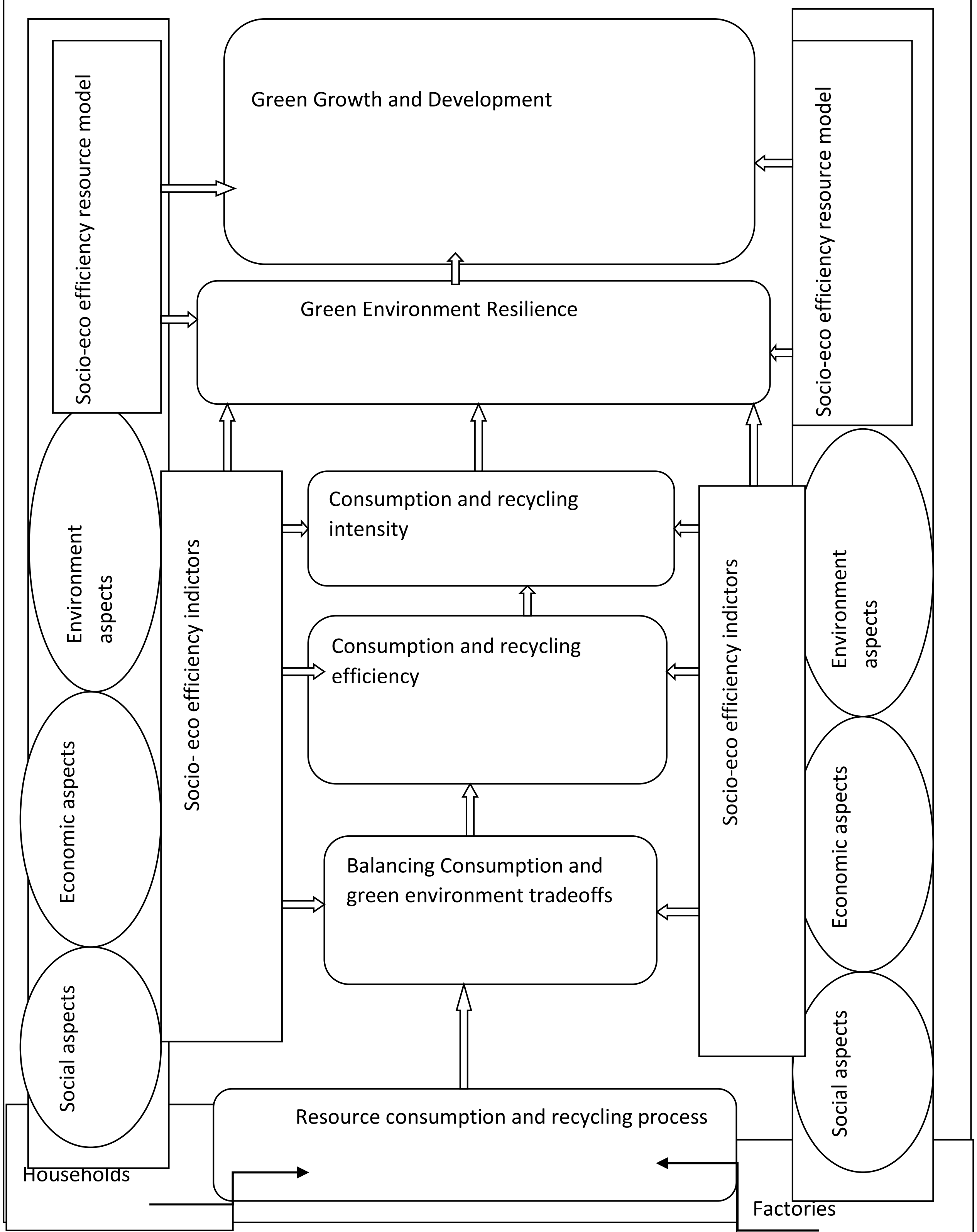
3.6. Data Coding, Inserting and Interpreting Methods

As explained in each objective above, in general, this study adopted an econometric regression model, variable computation and interpretation techniques. So as to suitable for data analysis, the collected data were inserting, coding, cleaning and interpreting results using SPSS 20 and STATA 14 software version. Tables and figures were used to shows quantitative results and interpret them consistent to topics in the discussion.

3.7 Theoretical Framework and Indicators

The green environmental problem begun from water resource consumption in a growing industrial Kombolecha, Ethiopia at large and over the entire world. On the one hand, theoretical evidence and literatures has been considered economic and environmental issues so as to reduce environmental problems. On the other hand, some scholars investigated environmental problems from ecological perspectives. This was the facts, which are prevailed in current studies. Whether these two side analysis considered the economic vs environmental or social vs environmental, people and factory's consumptions were inexorable interlinked so as to attain the economic, social, and environmental benefits. Hence, social, economic and environmental issues were integrated to build a combination of the three indicators on both households and factory's resource consumption would have a unified socio- eco efficiency framework. It, thus, leads the green environment resilience by supporting the framework and resource model. This theoretical framework and significant indicators of the socio- eco efficiency would be discussed in chapter four. Figure 3.1 below shows the study's theoretical framework.

Figure 3.1: This study Theoretical framework



Source: Adopted from BAZF (2009) and SEE balance, Sailing, *et al*. (2013

3.8 Econometric Models

3.8.1 Binary logistic Regression Model

Econometrics measures the relation between two or more variables, running statistical analysis of historical data and finding correlation between specific selected variables. Econometric exercises include three stages specification, estimation and forecasting. The structure of the system is specified by a set of equations, describing both physical relations and behavior, and their strength is defined by estimating the correlation among variables such as coefficients relating changes in one variable to changes in another using historical data (UNEP, 2014). There were many factors included in this case to assess tradeoffs between household's consumption and green environment problems. The logistic models, therefore, fitted with recruited indicators. However, it was assumed that respondents would have a binomial response whether the tradeoffs between consumption growth and green environment existed or not. This study used binary logistic regression model would be identified the significant factors on the resource consumption growth and green environment tradeoffs.

In previous studies, for instance, BASF (2005 & 2009), sailing et al. (2013), and ESCAP (2011&2014) indicator analysis did not employ econometric model to regress the effect of social, economic and environment indicators in the course of company's productions. Instead, this literature and institution reports revealed quantitative computation of resource consumption efficiency and the value add on product portfolio and quality along with product life cycle assessment. However, this study, therefore, filled the identified literatures and methods gaps using distinct econometric models for each object mentioned in chapter one along with the nature of indicators. In addition, descriptive and inferential statistics were used to calculate the effect of independent factors on the dependent variable using SPSS 20 and STAT 14 software version.

Koskela, *et al.* (2000), who studies an overlapping generation model, with a renewable resource served as a store of value and as an input factor in the production of the consumption good. They find that indeterminacy and cycles result in their model depend on the value of the intertemporal elasticity of consumption. The analysis of the dynamics of model by Alfred and Willi (2008) demonstrated that it is characterized by local and global determinacy. However, they point out that the results may be due to the assumptions made, especially concerning the utility function of the household and then give a complete characterization of the dynamic model and contribute competitive economies with externalities (Greiner, 2007). Among examples of such studies is the contribution by Benhabib, *et al*. (2000). The difference of other findings is that they consider negative external effects of production. That is, pollution as a byproduct of production, in contrast to the aforementioned papers, which assume positive externalities associated with production or capital.

This study used mixed approach and methodologies to assess household's green perception and behavioural affect between consumption and green environment tradeoffs. More importantly, household demographic characteristics: age, sex, education, family size, marital status, and etc. were recruited to portray the household's perceptions and behavioral effects. The rationality of this study stood from households have distinct perception and behaviours along with their socio-demographic characters, which were independent factors. Even so, the resource consumption and green environment tradeoff was dependent factor. Accordingly, this study identified an association between dependent and independent factors using a binary logistic regression. This model was managed the probable effect of multiple independent variables and determined their association and a relationship between dummy dependent variables.

Along with this, variables namely, household's income, employment status, education level, perception, attitudes, behaviour, ability and willingness to pay, culture, awareness, sensitive and emotionality were major explanatory variables included in the working hypothesis. The dependent variable was household's consumption growth and green environment tradeoffs (CONENVTRD). This tradeoff would be affected by household's employment status (HHEMP), perception (HHPRC), behaviour (HHBEH), Attitudes (HHATT), Awareness (HHAWR), Income (HHINC), Education level (HHEDU), sensitivity and emotionality (HHSEMO), ability to pay (HHABI), willingness to pay (HHWPA), and etc. Meanwhile, it would be formulated a relationship between the explained and explanatory factors.

In other words, resource consumption growth and green environment tradeoff (CONEVTRD) is a function of independent variables in the following ways:

CONENVTRD = f(HHEMP, HHPRC, HHBEH, HHATT, HHAWR, HHINCom, HHEDU, QWA, HHSEMO,HHABI, HHWPA, and etc)

Where;

- CONEVTRD = Resource Consumption growth and green Environment Tradeoff.
- EMP, PRC, BEH, ATT, AWR, INCOME, EDU, QWA, SEMOE, ABP, WPA, SOW respectively presents household's employment, perception, behavior, attitude, awareness, income, education level, quantity of water consumed and recycled, sensitivity and emotionality, ability and willingness to pay.

After specifying this tradeoff function in linear form including error term (e_i), it was formulated a multiple linear regression model as follow:

$$CONEVTRD = \beta_0 + \beta 1HHEMP + \beta_2 HHPRC + \beta_3 HHBEH + \beta_4 HHATT + \beta_5 HHAWR + \beta_6 HHINC + \beta_7 HHEDU + \beta_8 QWA + \beta_9 QWAS + \beta_{10} HHSEMOE + \beta_{11} HHABP + \beta_{12} HHWPA + \ldots + \text{and etc} + e_i$$

Where, it is possible to present CONVETRD = Y_i and the explanatory factors = X_i. The model would be;

$$Y_i = \beta_0 + \beta 1X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_i + \ldots + e_i$$

The rationality of constructing binary logistic regressions was the fact that it helped to hold multiple factors and showed association between binary response factors and measurements. Based on the constructed model, which shows association between dependent and independent factors, hypothesis for each explanatory variable was proposed and represented by H_i. Where, i= 1, 2...,n.

3.9.1.1Variable proposition and Hypothesis

H1: Household's employment status has no significant effect on water resource consumption to protect environment

H2: Household's sex has no significant effect on water resource consumption to protect environment

H3: Household's perception has no significant effect on water resource consumption to protect environment

H4: Household's consumption Behaviour has no significant effect on water consumption to protect environment

H5: Household's attitude has no significant effect on water resource consumption to protect environment

H6: Household's Awareness has no significant effect on water resources consumption to protect environment

H7: Household's income has no significant effect on water resource consumption to protect environment

H8: Household's education level has no significant effect on water resource consumption to protect environment protect environment

H9: Household's quantity of water use has no significant effect on water resource consumption patterns

H10: Household's sensitivity and emotionality has no significant effect on water resource consumption to protect environment

H11: Household ability and willingness to pay money has no significant effect on water resource consumption to protect environment

To test the multicollinearity problem during result analysis variance inflation factors (VIF) was used and tested. VIF greater or equal to 10 was an indicator for the existence of serious problem of multi collinearity. Contingency coefficient was calculated during the analysis section variable have not multicollinearity effect despite it was showed the degree of association between the dummy variables. Contingency coefficient is a chi-square based measure of association. Value of 0.75 shows strong relationship. Heteroscedasticity was detected by using Breusch-Pagen test (Httest) in STATA 14 software version. Furthermore, the reliabilities and validity of data were checked using Cronbach alpha method. When the alpha result was greater than 0.7, the data is more valid. Accordingly, the Cronbach value calculated 0.84 and presenting valid. This depicts the collected data were sufficient to portray the association between consumption growth and green environmental tradeoffs.

3.8.2 Environment Kuznets Curve Model (EKC)

Household's perception and behavioural effect between consumption and green environment tradeoffs, inequality on resource consumption and resilient green environment was computed using an environment Kuznet Curve Model. This was done using household's monthly income and poverty status. Household's poverty measured using WHO (2012) income threshold line. Accordingly, household's monthly income, which is found below 1.5 dollar/day, is poor. Otherwise, non-poor. Based on this poverty line, household's perception and behavioural towards keeping green environment associated with income inequality. EKC model computed income inequality effects on household's consumption and green environment tradeoffs.

This concept is supported by different hypothesis and economic theories. For instance, household's perception to purchase green goods and consumption activities were varied across their income level, ceteris paribus. Expenditure and consumption of green goods were assumed unequal besides to respondent's willingness to keep the green environment. Hence, it was vital to explore consumption behaviours, perception, and awareness, inequality between households etc., which resilient the green environment, along with income measurement. To do so, it was assumed that respondents were rational and thinks at the margin to balance an economic costs and benefits during consumption. Based on this, there was respondent's expenditures inequality during resource consumption and recycles, holding other factors being constant.

To investigate income inequality and green environment association, variable categorization, identification and determination were done and used logistic regression model. With this respect, the independent variables were household's income, perception, and consumption behavior. Dependent variable was the tradeoffs between resource consumption and green environment problems. In pursuit of this, it was considered the following major assumptions: binary or dichotomous response dependent variables, which take 1 for existence of income inequality between households. Otherwise, zero. Household's consumption behavior was assumed to be nonlinear along with the resource elasticity of demand. There is omitted variables called latent effect of household's perception and behaviours. For instance, household's sensitivity, emotionality and preference to consume resource efficient varied across the economic, environment and societal reason.

Based on these assumptions, among independent factors, household's monthly income was measured in birr. Other independent variables were household's perception; consumption behaviors; willingness and ability to pay money, and etc measured using five-point Likert scales. It was appropriate to use Logistic regression model for binary dependent variables, which has either 1 or zero values. In other words, if green environment problems existed due income inequality = 1, otherwise, 0. Pertinent to the issue in hand and assumption for binary logistic regression model, independent variables were household's perception (HHperc), behaviour (HHbehav), income (HHincom). However, the dependent factor was tradeoffs between consumption growth and green environment. Logarithmic of household's income was independent factors besides to qualitative characters mentioned. It was assumed that disturbance term was logistically distributed with these factors.

Based on Kuznet's model application, this study proposed income inequality, which was associated with household's perception and behaviors, during resource consumption. This inequality also associated with green environment and resource consumption tradeoffs. In pursuing so, household's incomes categorized into low, middle, and high income groups. The household's low income category comprised of less than 500; middle income from 500-2000 and high income above 2000 Birr. Other independent variables were assumed binomially distributed. That is the functional relationship between the variables and binary logistic model formulated as follow:

The variable association refers to measure income inequality and its impact on green environment awareness and perception as well as its resilience. To do so, two major hypotheses were mentioned as follows;

i. The probability that household's behaviour would be affected by their income and in turn influenced the greening environment, 'Yes' = P(HHbehav), p) = 1
ii. Otherwise, the probability that household's behaviourstwould not be affected by income and influenced the green environment, 'No' response = P(HHbehav),1-p) = 0

The same dummy factor presentation was proposed and worked for the household's perception, awareness, and etc factors association with the consumption growth and green environment tradeoffs. Nevertheless, income inequality created difference on household's behaviour, and perception to resilient the green environment. In other words, income inequality determined household's consumption behaviours, awareness, perception and widen the consumption growth and greening environment tradeoffs. To elaborate these relationships, it was proposed that household's behaviors and perception were dependent and affected by income coefficient byβ_i.

By assuming binomial response between respondents, binary logistic regression was formulated. That is

$$HHBehaviourorperception = \beta_0 + \beta_i logincome + e_i$$

Where,

- HHBEHAV = household's behaviour
- HHPERCE = household's perception
- LOGINCOME = logarithm of monthly income
- e_i = disturbance term

This model computed the marginal effect of each explanatory factors mentioned and their association. For instance, as incomes of households were changed by one birr, their consumption behaviours and perception to keep green environment were changed positively by β_i. Moreover, there is a probability that there would be income inequality between households to keep green environment during water consumption process. Meanwhile, there was a possible chance of household's behavior and perception independently would have shown inequality towards greening environment gets a p value = 1. Otherwise, 1-P = 0. The household's income and its logs were computed by EKC model and inserted into the logistic regression.

Water consumption and waste emission (W_t) inequality between households was computed along with principles of environmental Kuznet model. This was computed and regressed with respect to household's monthly income. The dependent variable E_t is liquid waste emissions per income. The choice of this variable as environmental degradation indicator justifies because these pollutants were main component for the emergence of green environment problem. Accordingly, variable W_t is a dummy that takes on the value 1 for factories or households, who discharged wastes to Borkena river. Otherwise, 0. This variable was used to check if respondents were signatory of reducing their waste emissions through recycling processes.

In this sense, these variables were measured household's waste reduction inequality and prone. Consumption per capita (WN_t) is the ratio between water consumption quantity and average monthly income. The water consumption (m^3) comes from the municipality and water supply and sewerage enterprise office (2016). One expects theoretically that there is a positive relationship between water consumption and waste emission. Hence, this variable was aimed at demonstrating that wide income inequality leads to a greater social conscience about environment problems and a pressure in favor of green regulation.

3.8.3 Instrumental Variable Model (IVM)

This study used Instrumental variable model (IVM) to identify and determine endogenous (economic and environmental factors) and exogenous (social factors) effect on resource consumption growth and green environment tradeoffs. Economic and environmental indicators, which are assessed in previous studies such as ESCAP (2011) and WBCSD (2009), were endogenously determined factors for environment protection and sustainability. However, social aspects were excluded in these findings and could not have interlinked by using econometric models. Nevertheless, this study showed social aspects as exogenously determined factors and influenced tradeoffs between consumption growth and green environment problems. Social, economic and environmental indicators were used as guide line to build indicators on factory's resource consumption intensity. The various indicators integratedinto the socio- eco efficiency were used as the data survey instrument and weighing factors. Correlation levels or strength of relationships between indicators such as the level of green environment and socio- eco efficiency were assessed, characterize and quantified.

In doing so, this study listed indicators and let respondents to determine how each indicator criterion weight during consumption and recycling. Based on indicator criterion, the selection grids have had a scoring system for ranking indicators. The weighted voting can be used numerical systems from 0-10. Where, 1 presents not at all, 5 presents moderate or average and 10 represents maximum or very high. That is the larger number was represented a desirable rating. In some cases, large number may mean "less", for example cost of water or waste removals. In order to set scoring, the researcher sampled to score each indicator against the criteria. Every stakeholder completed how well the indicators would satisfy each criterion. The average score from each respondent is taken. Finally, total and average score is computed based on respondent's selection and scoring. Accordingly, economical (monthly income), social (culture, religious, gender and etc) and environmental indicator (water consumption quantity and recycles) were weighted highest and recruited as major factors.

However, other factors such as perception, behaviours, awareness, sensitivity and emotionality, ability and willingness, and quantity of resource consumption were included and rated high and found effects on gaps between consumption and green environment problems. To determine indicators, econometric model such as multiple logistic regression models, instrumental variable (IV) and Two Stage Least Square model (2TLS) using Maddala and Guajarati (1983 & 2004) guidelines. Variables consistency, errors, and biasity were checked and tested using maximum likelihood estimation techniques. This study began from assumption and conceptual model, which would capture the interactions of firms, people and environment in different aspects. These aspects included the social, economic and environmental indicators. However, in previous studies, the social aspects were not incorporated into an eco-efficiency. Thus, this study integrated the social aspects to economic and environmental indicators and formulated asocio-eco efficiency framework using an instrumental variable model.

In doing so, it was assumed that there is a relation and interaction between social aspects (consumption culture) and eco- efficiency indicator (economic and environmental) to the green environment. Suppose that social aspects present (S_i) and eco efficiency indicators (E_i) are independent variables whereas the green environment indicator (G_i) is dependent variables. That is the green environment resilience is a function of social and eco- efficiency indicators, which consists both environment and economical aspects. Standing from this notion, it is possible to formulate a linear relationship between these variables. Each variable also depends on own independent factors. This model formulation ultimately aimed at integrate and to show the relation of social aspect and eco efficiency with the green environment resilience. WBCSD (2009) and ESCAP (2011) proved that eco-efficiency, which consists economic and ecological aspects, could reduce environmental problem. What was left were social aspects integration into eco- efficiency indicators and built a socio - eco efficiency framework. This framework was constructed, in this study, using instrumental variable model.

Hence, the following variable relation and model formulation proved that they have relation and association with green environment. First, let social aspects of people in industrial zone depend on factors. i.e social aspect is a function of factors (X_i) and other variables (Z_i). Where, i is the number of factors in each variable.

$S = f(X_i, Z_i)$ ……………………………………………………………………………… ………(1)

Where;

- X_i is consisted of factors, which explained the social aspect of people like socio- demographic characters, consumption behavior, culture and perception, health and etc.
- Z_i are factors influenced the social aspect includes water price and quantity consumed, lack accessibility of infrastructure services, pollution, and depletion of resources like groundwater, behaviour, norms, habits and etc. Thus, social aspects linear function is explained as

$S_i = a_1+b_2X_i+c_1Z_i+u_i$……………………………………………………………………………………(2)

This indicates that social aspect is a function of industry's product, resource consumption (X_i) and other factors (z_i) due to industrialization process. Where, u_i is error term which may found in the process of data survey or analysis stage.

The Eco- efficiency indicators applications were assumed varying and depending across the people and factory's consumption and production activity. This study assumed and proposed that eco-efficiency application is determined by society's progress in and outside the industrial zone. Therefore, eco efficiency is a function of social aspects in and outside the factory (S_i) and including other factors (R_i) such as types of factory consumption activity, technology and green job searches used to reduce an environmental pollution and etc. That is eco efficiency indicator application (E_i) is explained as;

$E_i= f(S_i, R_i)$………………………………………………………………………………………(3)

From this function, it is possible to formulate, the linear relation model

$E_i = a_2+b_2S_i+C_2R+u_2$……………………………..……………………..………….……….……..………(4)

Third, the next relation is built between green environment (G_i), eco efficiency (E_i) and other factors (Y_i). This is standing from the notion that green environment is depending on eco efficiency and social aspects as well as other factors (Y_i) such as factory's consumption and production activities. Household's water quantity consumption and recycling relation becomes: -

$G_i = f(E_i,Y_i)$ ………..…………………………………………..…………………………………………….(5)

Whereas, in a linear form:

$G_i= a_3+b_3E_i+c_3Y_i+u_3$……………………… ……………...…………………..………………………..…………(6)

Substitute equation (2) into equation (4) and insert equation (4) in to equation (6), we get

$G_i= a_3+b_3(a_2 + b_2a_1 +b_2b_1X_i + b_2c_1Z_1 + c_2R_i) + c_3Y_i+v_{i,}$ in simplified way

$G_i= (a_3+b_3a_2+b_3b_2a_1) + b_3b_2b_1X_i + b_3b_2c_1Z_i + b_3c_2R_i + C_3Y_i + v_i$ ………………………..……………….(7)

Suppose that $\alpha = a_3+b_3a_2 + b_3b_2a_{1,}$ $\beta = b_3b_2b_{1,}$ $\theta = b_3b_2c_1$ and $\lambda = b_3c_{2.}$ Substitute these variables in equation (7), we get a linear regression model, which describe green environment, depends on social aspects, eco efficiency and other factors including errors.

$G_i=\alpha+\beta_iX_i+ \theta_iZ_i+ \lambda R_i+ C_3Y_i + v_i$……………………………..…………………………………………..……………...8

Equation (5) is the reduced form of the structured equation. Along similar calculation, let $b_1 = \beta 1/(b_3b_2)$, $b_2 = \beta_1/(b_3b_1)$, $b_3 = \beta_1/(b_2b_1)$, $c_1 = \theta/(b_3b_2)$ and $c_2 = \lambda/b_3$

Equation 1, 2 and 3 used and helped to estimate the parameters or value of coefficients. Thus, G_i depends on both social aspects and eco efficiency indicators. Such that green environmental resiliency was determined by the joint interaction effect of the social aspects and eco efficiency indicators called socio-eco efficiency, which is a contribution of this study.

Scholars discussed in problem statement and literatures were ignored the social aspects while they investigated the environmental problems by using eco-efficiency indicators in the production life cycle of a product. As argued so far, social aspects are found outside the model and hence this study incorporated social aspects in and outside the factory to get socio- eco efficiency frameworks. This study instrumental variable model proved exogenity of social indicators. It also estimated the predicted value of eco efficiency and social aspects using equation (4) in the first stage regression. However, instrumental variable model (IVM) would have its own limitation to estimate the value of estimator's equation (8) in the first stge. Two Stage Least Squares estimation (TSLS), therefore, applied to determine social indictor's effect on consumption and green environment tradeoffs. Indicators in the model were supposed to be endogenous and exogenous variables respectively.

3.8.3.1 Endogenous and Exogenous Factors

This study used both endogenous and exogenous factors to build socio- eco efficiency framework which balance tradeoffs between consumption growth and green environment. Based on Guajarati (1983 &2004); Greene (2011) and Wooldridge (2012), econometric use the terminology "Endogenous" means "determined within the system." That is, a variable is jointly determined within the model subject to simultaneous causality. Whereas, exogenous variables are not determined in the model but have impact to influence the dependent variables. All part of exogenous factors could not influence the explained factors. Instead, some part of exogenous variables, which is associated with explanatory factors, have some bearing on the explained factors. In the context of this study, endogenous variables were eco-efficiency indicators, which interrelated with the residuals, and determined in the model. In other words, consumer's economic and environmental indicators endogenously influenced tradeoffs between consumption growth and green environment problems.

Consumer's social aspects (consumption culture), however, were exogenous variables which, are partly associated with eco efficiency indicators and have indirect impact on tradeoffs between consumption and green environment. In other words, social aspects are not determined in the system and uncorrelated with the error term (e_i). However, they are associated with eco-efficiency indicators which consists both economic and environmental issues. This interpretation is narrow and hence instrumental variable regression was used to address omitted variable bias and errors-in-variable bias but not just simultaneous causality bias. Precisely, an endogenous variable is correlated with error terms (e_i) whereas exogenous is uncorrelated with error terms (e_i).

Step one

i. Exogenous Factors (Social aspects, S_i)

Instrumental variable model regression, loosely, breaks eco efficiency indicators into two parts. A part that might be correlated with e_i, and a part that is not. By isolating the part that is not correlated with residuals (e_i), it is possible to estimate coefficients (parameters). To attain this, instrumental variable should be valid. Hence, it is assumed that instrument relevance is exist when the covariance of instrumental and independent variables $Cov(S_i,E_i)$ and instrument exogeneity $Cov(S_i, e_i)$ would be equal to zero.

Step Two: Model Justification

One of the basic justifications and rationality to apply multiple linear regression models is to integrate instrumental variable (social aspects) to eco efficiency and consists of X_i's number of endogenous variables determined in the model. Accordingly, Greene (2011) and Guajarati (2004) assumptions helps to explain important threats to internal validity. That is omitted variable bias from a variable that is correlated with E_i but is unobserved cannot be included in the regression. Whereas, simultaneous causality bias endogenous explanatory variables assumed: (E_i causes G_i, G_i Causes E_i) and Errors in variables bias (E_i is measured G_i.).

Step three: Factors in the Model

According to the given assumption in step two, suppose that G_i represents green environment resiliency (dependent variable), E_i consists of various eco- efficiency indicators (explanatory variables), S_i consists of several social aspects (instrumental variables) and e_i and u_i are residual or errors terms.

Step four: Multiple Linear Regression Model

Suppose that green environmental resilience is depending up on eco efficiency indicators and social aspect in growing industrial zones. That is in a function form:

$G_i = f(E_{i,} S_i)$……………………………………………………………………...…………………………..……(1)

Where;

G_i = green environment resilience

E_i = eco efficiency

S_i = social aspects such as culture, norms, habits, and etc.

In a linear regression form:

$G_i=\beta_0 + \beta_{1i}E_i + e_i$………………………..………………...…………………..…………...…………………………(2)

Step five: Assumptions

In order for a variable $S_i$to serve as a valid instrument for E_i, first the model consists of m endogenous (eco efficiency indicators) and k number of exogenous variables (social aspects). Second, the instrument (social aspect) must be determined outside the model. That means only eco - efficiency is investigated within the model to reduce environmental problems but social aspect is not considered during consumption process. In other words, Cov $(S_i,e_i) = 0$. Third, the instruments, social aspect (S_i) were correlated with endogenous explanatory variable (eco efficient indicators (E_i)). That is Cov $(S_i, E_i) \neq 0$.

Step six: Estimation and Interpretation of Parameters

The instrumental variable regression breaks the E parts in two parts as explained so far. Hence, it detects movements in E_i that are uncorrelated with e_i, and uses to estimate coefficients (β_i). To find the value of estimators, this proposal applies two stage least square methods (TSLS). As it sounds, it has two stages.

First stage: isolate the part of E_i uncorrelated with the residuals (e_i) but correlated with S_i. Regress E_i on S_i using Ordinary Least Square Techniques (OLS). That is

E_i= f(S_i)……………………………………..……………………………………………………..…….(3)

From this function, it is possible to formulate linear regression between eco efficiency indicator (E_i) and social aspects (S_i).

E_i= $\alpha_0 + \alpha_1 S_i + e_i$ …………..(4)

Since S_i is uncorrelated with e_i in equation (2) and also $\alpha_1 S_i + u_i$ is uncorrelated with e_i, α_i's are estimators of S_i and their value will estimate after data survey.

Meanwhile, this proposal will compute the predicted value of Ei, which is;

$E_i = \alpha_0 + \alpha_1 S_i$; where, I = 1, 2,……………………..…………………………..…...…..………………….….(5)

The predicted value of the estimator or coefficients in equation (5) will tell us the directional change and association between eco efficiency indicators and social aspect. Nevertheless, it does not predict the estimator of predicted E_i. Thus, this study passed in the following steps to find the solutions.

Second Stage: to compute the predicted estimator values of eco efficiency indicators ($_i$) in the interest of green environmental resilience (G_i), replace the value of E_i by its prediction, S_i. Such that this proposal regress G_i on using OLS to get the estimators of β_i's and explore the association between the dependent and explanatory variables. That is

G_i = $\beta_0 + \beta_1 X_i + e_i$……………......……………………..………….………………………………….……….(6)

The resulting estimator of equation (6), which is β_i's the two stage least square estimator (TSLS) or β_i^{TSLS}. These estimators will show how and how much the predicted value of eco efficiency indicator variables determine or changes the green environmental resiliency.

Step six: Testing the Model using Wu-Hausman Test

To test the endogenity and exogenity of the variables in the model, this study applied the idea of Hausman test which help to see if the estimates from OLS and IV are different. If this problem will come, the proposal will use auxiliary regression which is easiest way to do this test. Hausman (1978) and in Guajarati (2004) compares the OLS and TSLS estimates and determining whether the differences are significant. If they differ significantly, it was concluded that E_i is an endogenous variable. This would be achieved by estimating the first stage regression:

$$E_i=\alpha_0 +\alpha_1 S_i+u_i \qquad (7)$$

Assume that, since, each instrument is uncorrelated with e_i, E_i is uncorrelated with e_i only if u_i is uncorrelated with e_i. To test this, this study formulated and ran the following regression using OLS methods:

$$G_i = \beta_0 + \beta_{1i} E_i + \theta_i + e_i \qquad (8)$$

Test whether $\theta = 0$ using standard t-test that is

- If $\theta = 0$, null hypothesis
- if $\theta \neq 0$ alternative hypothesis

Thus, the result would be concluded by rejecting the null hypothesis; it is possible to say that E_i is endogenous variables, since u_i and e_i are correlated. With the same procedures, exogenity of variables S_i would be tested. The variable final result would be represented using table and figures in chapter four.

3.8.4 Simultaneous Equation Model

This study simultaneous equation model, which is used Gujirati (2004) and Greene (2012) principles, computed the predicted value of indicators and required resource for social, economic and environmental aspects to green environment. This model indicated synergy between identified indicators and consumption of resource on one hand, green environment and resource consumption on the other hand. That is let X_i was identified indicators, C_i was required resource during consumption such as water and waste. Y_i was green environment, other required resource variables such as D_i and R_i. Hence, the simultaneous causality of these variables explained below in the equation.

$$C_i = X_i + D_i + Yi + e_i$$

$$Y_i = C_i + R_i + u_i,$$

Where;

- C_i = consumption of water resource
- D_i = factors resource such as, awareness, behaviours, perception, and etc.
- X_i = significant economic, social, and environmental indicators identified in this study
- Y_i = Resource consumption and recycle intensity, tradeoffs and efficiency
- R_i = other factors which affect green environment like consumption culture and poverty
- e_i and u_i were errors

3.8.5 Propensity Score Matching Model (PSM)

Propensity score matching model used to evaluate indicators impact on green environment resiliency. Social, economic and environmental indicators were identified and integrated by using instrumental variable model and built socio-eco efficiency framework. These indicators were varied across the household's awareness, perception and behaviours regarding adopt the green mind (i.e. increasing consciousness about safe the living and working condition), technology and job use (i.e. choose safe technology and jobs that keep safe the living and working condition). Moreover, indicators would be different between the household's poverty status (poor and non-poor), income level, sex, family sizes, education level and etc. With this respect, the green environment resilience (balanced resource consumption growth and the green environment tradeoffs) was an outcome factor; the water consumption and recycling efficiency was atreated dependent factor, the socio-eco efficiency and sub indicators were treated independent factors. After propensity score estimation, this indicators impact evaluation paved was to develop the resource model.

With this respect, in the first step of PSM, according to Rosenbaum and Rubin (1983); Heckman, *et al*. (1997), Dehejia and Wahba (1999), andBecker & Ichino (2002) propensity score performed conditions and probability of matchings between variables. This study evaluated social, economic and environmental indicators (treated independent factors) impact on the green environment resilience (outcome factor) via water consumption and recycling efficiency (treated dependent factor). In pursuing this, first, social indicators were included such as sex, family size (small and large family size), culture, and poverty status (poor and non-poor). Second, economic indicators used the household's monthly income. Third, environment indicators were water quantity consumption and recycles. These factors were executed matching between probabilities of 'Yes' or 'No' discrete response that presented a binomial controlled and non-controlled responses respectively.

The treated dependent factor, which is water consumption and recycling efficiency, was represented by respondent's binomial response "Yes", which refers the consumption and recycling efficiency. Otherwise, "No" response. In this study context, water consumption and recycling efficiency was measured by household's daily cubic metre water requirement consumption and reuse the waste for other purpose replied ''Yes''. Otherwise, ''No'' response. The controlled household's response (yes), which integrated social, economic, and environmental, achieved the consumption and recycling efficiency that resilient the green environment. However, the non-controlled response (No) could not integrate social, economic and environmental indicators to ensure consumption and recycling efficiency. This propensity depicted score estimation household's decision on two choices. The first choice reflected "Yes" response was equal to 1 value. Otherwise, "No" response was equal to 0 value. Regarding to respondent's decision to choose either of this response required types of model to be used.

Furthermore, this study used the resource consumption growth and green environment tradeoffs (CONVETRD) was an outcome factors whereas water consumption and recycling efficiency was treated dependent factor. Nonetheless, the treated independents factors included the household's poverty, sex, family size, education level, income, culture, water quantity and etc. In addition to this, the household's green behaviours, social, economic and environmental indicators and socio- eco efficiency framework were treated independent factors. Along this formulation, this study employed a binary treatment model(logit) in the period of propensity score matching estimation. Owing to complexity of the probit model estimation and procedures, this study used logit model to find out the reliable impact analysis, between treated and non-treated factors (Caliendo and Kopeinig, 2005).

Hosmer and Lemshow (1989), Guajarati (2004) and Greene (2011) model fitness exhibits that the binary logistic regression and distribution has advantages over the dichotomous response and interpreted them in precise ways. Based on the binary choices of the factors used, a matching strategy was built on the conditional independence assumptions referred in Gujarati (2004). Along with this line, the outcome variable in this case, poverty status, socio-eco-efficiency framework, was independent of treatment conditional on the propensity score. Using logit model in Gujarati (2004) and Greene (2011) assumptions, the independent factor (household's water consumption and recycling efficiency) was coded by "Yes" and "No" response and presented by 1 and 0 values respectively.

With this respect, the dummy dependent factor, which takes 1 and 0 values, revealed the probability that a household said Yes ($P_i = 1/X_i$). Otherwise, No ($P_i = 0/X_i$). Where, X_i was treated independent factors that directly and indirectly affected the treated dependent and outcome factor respectively. Accordingly, the logit model was formulated of which a probability of the households, who consumed water and recycled efficiently, were P_i written as:

$$(\mathrm{Pi})^{\mathrm{n}} = \frac{(\mathrm{e})^{\mathrm{Zi}}}{1+\mathrm{e}^{\mathrm{Zi}}} \quad \text{……………………………………………………………………………(1)}$$

Where,

P_i indicates the probability that household's water consumption and recycling efficiently. This was out come factor in PSM estimation

$$Z_i = \beta_0 + \beta_i x_i + e_i \quad \text{…………………………………………………………………………(2)}$$

Where,

Z_i = treated dependent factor such as household's poverty status (poor and non-poor)

X_i = treated independents such as economic, social, environmental indicators.

β_i = coefficients

e_i = disturbance term

i = 1,2, 3…n

The probability that households who were not consumed water and recycling efficiently, 1-P_i could be written as;

$$(1-\mathrm{Pi})^{\mathrm{n}} = \frac{(\mathrm{e})^{\mathrm{Zi}}}{1+\mathrm{e}^{\mathrm{Zi}}} \quad \text{……(3)}$$

The ration of households who used water efficiently and non-users was described by odd ration. Thus, this ratio becomes;

$$\frac{\mathrm{P_i}}{1-\mathrm{P_i}} = \frac{1+\mathrm{e}^{\mathrm{Zi}}}{1+\mathrm{e}^{-\mathrm{Zi}}} = (\mathrm{e})^{\mathrm{Zi}} \quad \text{……(4)}$$

As it is indicated above, the left side the odd ratio that referred household's in favors of user vs non-user or water consumption and recycling efficiently or not to resilient the green environment. In other words, the probability of households who consumed water efficiently vs non-efficient users were odd ratio. So, the logarithmic of this odd ratio written:

$$\mathrm{Li} = \ln(\text{odd ratio}) = \mathrm{Z_i} = \beta_0 + \beta_i \sum_{i=0}^{n} \mathrm{x_i} + \mathrm{e_i} \quad \text{……(5)}$$

Where;

L_i = natural logarithmic value of odd ratio = P_i/1-P_i

x_i = poverty stratus, sex, family size, socio-eco efficiency indicators and etc

This L_i used to find out propensity score estimation using logit model along with the above mathematical formulation and results were computed using STATA 14 software. To minimize the probability of unobservable characteristics on water consumption and recycling efficiency using evaluating indicators, the following model proposition was done. In other words, water consumption and recycling efficiency was determined by household's sex, poverty status, education level, awareness about green technology, socio eco efficiency indicators and etc. That is water consumption and recycling efficiency was formulated in equation form:

$$\text{WCORECF} = \beta_0 + \beta_i \sum_{i=0}^{n} (\text{poverty}, \text{educ}_i, \text{culture}, \text{socio} - \text{eco effciecny}, \text{indicators}) + e_i$$

Where,

- WCORECF, Y_i = household's consumed water and recycle efficient (if Yes =1. Otherwise, No=0)
- Household's poverty status (if they are non-poor =1, poor =0 values)
- Socio-eco efficiency adoption (Yes =1, No=0)
- Indicators includes such as social, economic and environmental.

3.9 Chapter Summary

This chapter attempted a descriptive research design and a triangulated methodology used in this study. It used a cross-sectional surveyed data collected from the factories and households. It was, outlined the proposed various specific objectives that would be addressed in the study. In pursuit of this, different analytical tools were employed to compute the social, economic and environmental indicator's effect on water consumption and recycling efficiency. This chapter also integrated consumer's exogenous (social aspects) into endogenous factors (economic and environmental aspect) to balance the water consumption and recycling efficiency. Particularly, the household's social aspects were consisted of the consumption culture, behaviour, poverty, family size, attitude, perception, awareness, ability and willingness, sensitive and emotionality to practices the green mind, technology use, market and jobs, which were associated and determined the resource consumption growth and green environment tradeoffs.

The household's social aspects and characters would be measured using the five-point Likert scales and Cronbach alpha values. However, quantitative factor's significant effect on the resource consumption growth and environment tradeoff were measured by using descriptive statistics and econometric models. For instance, a binary logistic regression model; instrumental variable model; simultaneous equation model and propensity score matching estimation were used to measure the effects of each explanatory factor mentioned in this chapter. For each model, different assumption and propositions were placed to evaluate the various indicators impact on the consumption and green environment tradeoffs; consumption and recycle efficiency; water consumption and recycling intensity. The various econometric assumptions described the socio-eco efficiency consequence on water consumption and recycling efficiency. The collected data and model results were computed using SPSS 24 and STATA 15 software version and discussed in chapter four.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the result of this study. It discusses green environmental problems in Kombolecha; identifies factors associated with the consumption growth and green environment tradeoffs; determines significant socio-eco-efficiency indicators during water consumption and recycling processes; evaluates indicator's impact on the groundwater consumption and recycling intensity and finally developed a conceptual socio-eco efficiency resource models for each statistically significant factor that could be narrowed the gaps between water consumption and waste recycling intensity. This chapter result and discussions denotes meeting the demands for industrialization in Kombolecha, increasing water consumption, as well as the mounting agriculture and water demand that created a multi-faceted environmental problem in Ethiopia. Water conservation is the most critical global problems and one which is only increasing in its importance, with the continuing population growth and the effects of global warming. Along with this notion, the water consumption growth and green environmental tradeoffs were amongst critical concerns hold in this chapter.

This was due to the fact that the households and factories groundwater resource consumptions were depleting the green environment without restriction and some fraction of payments per cubic metre of water. Indeed, consumers have used the groundwater sources for various purposes so as to get the optimal benefits, factories were weather-beaten the groundwater sources compared to the household's water consumption process. Kombolecha municipal and water supply and enterprise offices were not considered groundwater protection that triggers the future water consumptions and environment sustainability.

Consequently, the agriculture sector in Ethiopia, yet, faced water shortage to uphold continuous production in rural Kombolecha. This was due to factories were unethically subjugated the groundwater despite continuous draught was prevalent in Kombolecha and environmental problems were widespread in Ethiopia. This was due to factories were in a hurry to purchase green technology that increased water consumption and recycling efficiency. In addition to this, the household's water consumption behaviours and perception towards experiencing green mind, technology and jobs use was increased the groundwater degradation in Kombolecha city. Households were not discussed with factories so as to protect groundwater degradation and environment protection. This study used binary logistic regression model, to identify the major significant factors that affected the water resource consumption growth and green environment tradeoffs.

The water resources have been significantly under pressure by consumers (factories and households) in Kombolecha. This was due to households, who worked at in factories and outside factories, have a diverse green awareness, behaviour, perception, sensitivity and emotionality, willingness and ability to adopt the green consumption and recycling processes. Kombolecha city administration attempted to increase the manufacturing industry growth by delivering incentives for investors, such as inputs import without tariffs; land delivery at the lowest lease rate, and project financing loan provision. This showed that the population density and their diverse water consumption behaviours were associated parallel to an industrial growth. Since households have heterogeneous consumption cultures, they were reflected different perception and behaviours for groundwater sources due to their different economic, social and environmental attention. This study instrumental variable model, thus, identified the significant consumer's economic, social, and economic indicator's effect on water resource consumption and recycling processes in Kombolecha industrial zone.

However, consumer's social, economic and environmental indicators were simultaneously associated with water resource consumption and recycling intensity. As a result, Kombolecha is among drought affected cities in eastern Africa; nonetheless, the groundwater was not far thought-out as a resource and became a source of revenue in Ethiopia. Consumer's economic, social and environmental aspects were continuously influenced by the water consumption and recycling intensity. This study used simultaneous equation and propensity score matching model, which identified the consumer's economic, social and environmental aspects effects and evaluated that the socio eco efficiency indicator's impacts on water consumption and recycling processes. This study finally developed an appropriate conceptual socio-eco efficiency resource model. In pursuit so, the study began its discussion by identifying different green environmental problems in Kombolecha city.

4.1 Green Environment Problems in Kombolecha

In this study context, green environment referred to the concerns of environmental conservation and improved the health and quality of the environment by balancing the water resource consumption and recycling processes. Environment problems were severely affected people living condition along with Borkena river edges. In the rationality of this study, the green environment is paramount that entails a favourable condition for households to live and work healthily. It was investigated that factories and households were keenly disrupting the green environment status by inefficient water consumption and recycling processes. To elaborate on this issue, 338 households participated and in answering whether the green environment problems were existed or not. Accordingly, out of the total households in Table 4.2, 236(68.9%) respondents agreed about the presence of the green environment problems. However, the remain106 (31.1%) respondents were not agreed about the existence of the green environmental problems in Kombolecha.

In every activity, respondents reported that groundwater depletion was not considered during consumption as well as its adverse effects on the living green environment. This study green resilience disclosed Almedom &Glandon, (2007); Kim-Cohen, (2007) and Smolka *et al*., (2007),who renowned that a resilience should be studied psychologically, biologically, socially and involved an interaction of individual and environmental characteristics. The major green environmental problems were thus classified and discussed in Table4.1.

Table 4.1: Green Environmental Problems in Kombolecha

Environmental problems	Respondents	Percent
Borkena river/water/ pollution	139	41.1
air pollution	118	34.9
living environment pollution	70	20.7
working environment pollution	11	3.3
Total	338	100.0

Source: Survey Results, 2017

Environmental problems were categorized into river, air, living and working environment pollution in Table 4.1.Among mentioned environmental problems, out of 338 sample populations, 139(41.1%) respondents agreed that the water resources, particularly, the Woreqa and Borkena rivers, which pass via the centre of a city, were polluted by factories and household's waste discharges. Despite waste quantities were varied across the consumer's emission, none of them was treated the liquid waste to protect the living and working environment. Out of the total population, nevertheless, 118(34.9%) and 70(20%) respondents agreed that the living and air pollution were major environmental problems respectively. The federal government of Ethiopia clustered 75 hectares of land and launched a new industrial zone in Kombolecha (Kombolecha communication office, 2017). However, there was no, yet, projected groundwater consumption and waste recycling regulatory procedures that reduce the river's pollution and make the living and working condition healthy.

It was found out that factories were not, yet, paying money for the groundwater consumption and discharged wastes to the nearby Woreqa and Borkena river without treatment. Meanwhile, farmers were consumed these polluted rivers for samll irrigation, washing clothes and for cattle drink regularly. As a result, respondents revealed that they felt sick and spent high cost for medicationand buying medicines. This was due to, Kombolecha water supply and sewerage enterprise, households, factories and the municipal offices were not collaborated to curtail the water consumption and waste recycling inadequacies. In addition, households were not self-conscious about the groundwater and ownership possession to restore its source and retain the green environment. According to respondents interviewed, there were no groundwater fortification and management practices in Kombolecha and in Ethiopia also, which would be improved the water consumption and recycling inefficiencies. This study finding was traced to Lovins and Hawken (2011) illustration on the green sustainability or ecological concerns that permeated throughout the business. As a solution, experts in the field argued that consumers have to reimburse the groundwater payment per m^3 of water use. Otherwise, the green environment would be continuously loss its nature parallel to industry consumption growth.

However, respondents debated that the existing environment has lost its green nature by inefficient groundwater consumption and recycling processes. This study, therefore, questioned the respondents whether the green environment was losing its quality or not. Accordingly, out of the total population, 233(68.9%) respondents replied that the existing environment was lost its green nature and hence not comfortable for the living and working condition. However, out of the total population, 105(31.9 %) respondents were argued that the existing environment was maintaining its green nature. Respondents revealed that a wide tradeoff between the water resource consumption growth and environment problems scoured the household's living and working condition.

Table 4.2: Did the Green Environment Loss its Nature?

Response: Yes /No	Number of Respondents	Percent
No	105	31.1
Yes	233	68.9
Total	338	100.0

Source: Survey Results, 2017

Table 4.2 indicates the respondent's green awareness and perception, which portrayed the nature of environment status whether it suits for the living and working condition or not. Accordingly, out of the total sampled households, 68.9% respondents perceived that the existing environment was lost its green nature by factory's non-ethical groundwater consumption and their waste discharged to the Borekna and Woreka rivers. In addition to this, consumers were not aware of reducing the groundwater consumption and recycling inefficiency, which placed an adverse pressure on the green environment. Particularly, except the Kombolecha Textile factory, all sampled factories were discharged non-treated wastes to Borekan and Woreka rivers without treatment. As a consequence, the household's, who lived at the river's edge, were used non-treated water for cloth wash, cattle drinks and food preparation, urban small irrigation agriculture and etc activities. As a result, households were usually reported sick by factory's toxic wastes emitted in the rivers.

Respondents, company's experts, and municipal officers were commending those rivers pollution were required serious attention so as to ensure the green growth and health problems alleviation. This study shared Orsato (2009) contention that is greening as the strategy whereby businesses engage in environmental education and put in place systems to reduce waste. It was, nonetheless, probed that there was no green tax levied on consumer's over- groundwater use and waste discharge to the rivers in Kombolecha. As a result, it was resulted a wide tradeoff between the water consumption growth and green environmental problems.

4.2 Consumption Growth and Green Environment Tradeoffs

The tradeoffs between resource consumption growth and the green environment were measured by using five-point Likert scales: wide, moderate, narrow, and little and no gaps. According to respondents, the water consumption growth and green environmental tradeoff (COENVTRD) was a renowned environmental problem in Kombolecha industrial zone. According to respondents, this tradeoff was mainly caused by factory's groundwater consumption and recycling inefficiency. Factories were working to attain optimal profit but did not worry about the environmental problems. This was due to respondent's social indicators, such as beliefs, culture; consumer behaviour, poverty etc and were shaped the water consumption and recycling processes. In addition to this, consumer's economic and environmental attentions were distorted the groundwater consumption and waste recycling efficiency. Respondents were not found sensitive and emotional to protect the groundwater compared to the tap water consumption. After consumption, none of the respondents reflected a sense of ownership to recycle wastes. Furthermore, the household's beliefs were influenced by the water consumption and recycling efficiency and in turn, altered the consumption growth and green environment tradeoffs.

Table 4.3: Household's Beliefs about Water Loss in Kombolecha

Respondent's response /Yes/No/	Number of Respondents	Percent
No	33	9.8
Yes	305	90.2
Total	338	100.0

Source: Survey Results, 2017

The households believe about water resource was determined the consumption growth and green environment tradeoffs. The respondents believe about water was varied across their birth-place, ethnic and cultural background in Ethiopia. Similarly, the respondent's perceived water consumption and recycling efficiency were varied across their beliefs. For example, out of the total households, 305(90.2%) respondents believed that water is gifted by God and hence they were not worried about water loss. However, 33(9.2%) respondents believed that water is gifted by God but they worried about the water loss.

According to FDRE, (2017) report, hitherto, there are above 80 ethnic populations in Ethiopia. As a result, the household's water consumption was highly interlinked across their diverse believes, heterogeneous consumption culture and behaviours. This study finding was similar to Shcherbakova (2010) that marked water is among affected resource in cities where dense population and factory's consumption demand attaining growth.

In Ethiopia, there were traditional proverbs in rural areas, where people believed that 'there is no dirty mother and water'. This proverb literary revealed that consumers were believed to use any water resources for cooking and drinking purposes without further treatment. However, exceptionally in cities, the household's consumption believes was broadening the consumption growth and the green environment gaps. This gap was measured by using five-point Likert scales such as wide, moderate, narrow, too narrow, and no gap response. Accordingly, out of the total population, 127(37.6%) respondents agreed that there was a wide gap between water resource consumption growth and green environment problems. Outstandingly, factory's groundwater consumption was widening this gap and affected the green living and working environment. Nevertheless, it was computed out of the sampled households, 117(34.6%) respondents agreed that there was a moderate gap but they bothered the groundwater consumption growth and green environment problems.

Table 4.4: Consumption Growth and Green Environment Gaps

Gaps	Number of respondents	Percent
Wide	127	37.6
Moderate	117	34.6
Narrow	63	18.6
too narrow	25	7.4
no gap	6	1.8
Total	338	100.0

Source: Survey Result, 2017

Table 4.4 shows the resource consumption growth and green environment gaps in Kombolecha. This study found out of the total population, 63(18.6%) respondents believed that there was narrowed gap between the resource consumption growth and the green environment problems. In extreme cases, 25(7.4%) and 6(1.8%) respondents argued that there was a too narrow and no gap between the consumption growth and green environmental problem respectively. This showed that there was a diverse consumer believes that could be widen the water resource consumption and recycling inefficiency and produced a detrimental negative effect on the living and working environment. This inefficiency also caused by the diverse household's awareness to adopt the green mind, market, technology use, jobs searches and consumption activities.

4.2.1 Green Awareness Inequality

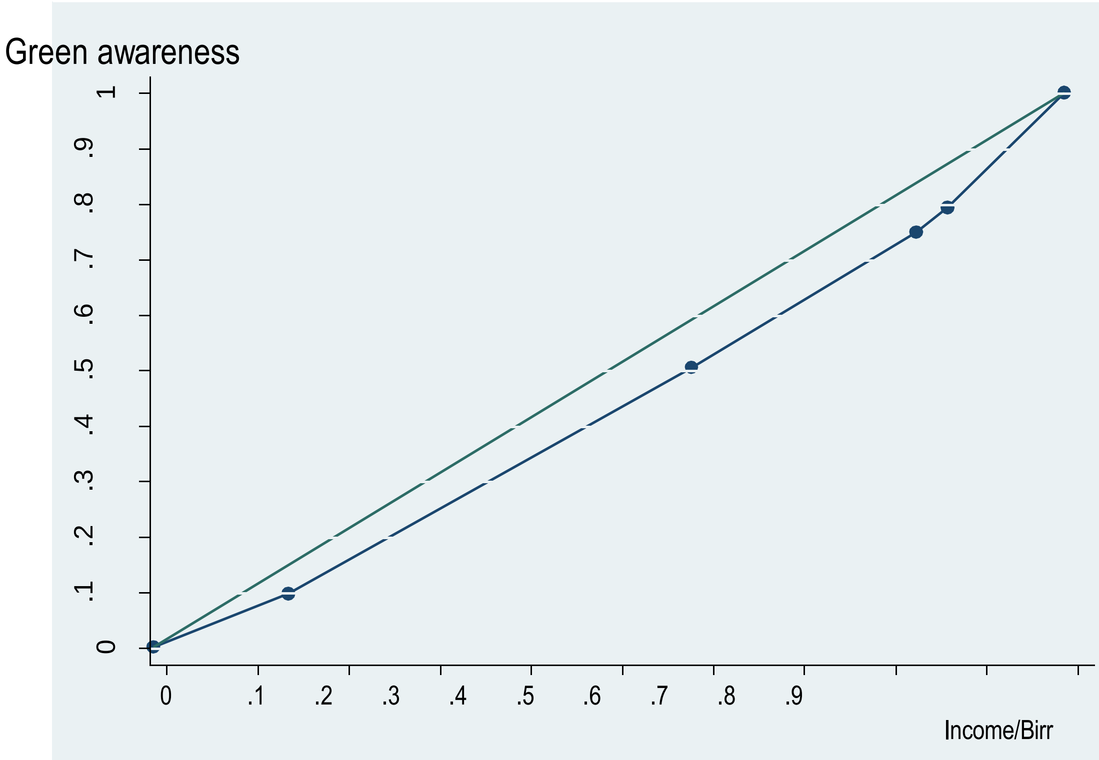
Green awareness in this study was described as consumer's ability and state of knowing or to be cognizant of practicing green mind, technology and job use in the period of water consumption and recycling processes. The household's green awareness inequality to practice the green mind, technology use and consumption processes were altered the tradeoffs between consumption growth and green environment problems. The consumer's green awareness inequality was computed by using environmental Koznets model (logistic regression) Kuznets (1955). This study found a substantial green awareness inequality between water consumers in Kombolecha. However, the respondent's green inequality was found at different and diverse across their socio-demographic and socio-economic characters. It was computed that there was wide green awareness inequality between poor and non-poor respondent's water consumption and recycling efficiency. There was also a wide green awareness inequality which was reported between female and male headed households to adopt the green technology use and practice green consumption activities. Female headed were aware to practice environmentally friend consumption compared to male headed respondents.

It was found that the respondent's green awareness determined their water consumption efficiency. Regards to this study finding, greening mind was defined as respondent's consciousness and know how to include the full costs of living and working environment by reducing water consumption and recycling inefficiencies. In the study areas, despite the respondents have the same level of income, their green awareness inequality on green mind (i.e. environmentally conscious), technology use, marketing exchange and jobs practices affected the consumption growth and the green environment tradeoffs. Contextually, in this study, green jobs described the respondent's decent jobs that contributed to restore and sustain the green environment in the course of water consumption and recycling activities. Substantially, the respondent's consumption culture and behaviours were put forth a green inequality during the water consumption and recycling activities.

In computing inequality between respondents, the household's expenditure and money purchasing power were calculated by USA dollar and Ethiopia Birr exchange rate. This study assumed that consumers were rational and thinks to the margin (i.e. balances the marginal satisfaction gets from water consumption is equal to its price)in order to obtain their optima benefits. Using Logistic regression and Environmental Kuznet's model discussed so far, this study computed the respondent's green awareness inequality based on their monthly income in Ethiopia Birr. By holding the household's accessibility of green technology constant, the respondent's green awareness inequality (i.e. ability to understand environmental protection and restoration difference) measured along with their monthly income and computed 12.6 percent. This green awareness inequality revealed respondent's different concerns and ability to understand environmental protection and restoration or resilience. Green awareness inequality also reflected differences between the respondents' consciousness about the environment (green mind adoption); knows new technology and jobs use, and practiced environmentally friend consumption activities that could recover the living environment. This study found that that respondent's monthly income inequality was created by significance difference on their consciousness to understand environment protection in the course of water consumption and recycling processes.

The household's green inequality and income poverty was extensively calculated based on $1.90 daily income poverty line (WB, 2009). Based on this, the household's green awareness inequalities were determined by the monthly income and poverty status. Accordingly, out of the total population, 122(36%) respondents were below income poverty line (poor) in Kombolecha. It was assumed that there was a significant green awareness inequality between the poor and non- poor respondent's practices for green mind adoptions and technology use. This study environment Kuznet's curve model (lorenze curve and Gini coefficient) computed 16.7 percent green awareness inequality between households. This study confirmed that there was a green awareness inequality between the poor and non- poor households, who consumed water resources for different purposes.

Figure 4.2: Green awareness Inequality



Source: Survey Results, 2017

Figure 4.2 consists of household green awareness in Y- axis and monthly income in the X-axis. According to respondents, green awareness inequality between households to adopt the green mind, product, market, technology use and job searches were found different along with their monthly income. This difference was measured using a Gini coefficient and logistic regression and STATA 15 software version. The household's green awareness Gini coefficient regards to water consumption was found 12.6 percent. This inequality shows there was 12.6 percent green awareness inequality to practices green water consumption (i.e understanding to restore and keep water resources) and recycling processes. This inequality was created a different household's consumption behaviours and perception that altered the water consumption and recycling efficiency.

In Ethiopia, income inequality was measured between household's and found 33.3% (MOFED, 2009). As far as this study completed, however, household's green awareness inequality was not measured and computed associated with water consumption and recycling processes in Ethiopia. For the first time in the country, this study calculated 12.6 percent green awareness inequality between household's, who intended to attain water consumption and recycling efficiency. Moreover, there was a 12.6% green awareness inequality between poor and non-poor households to use the green jobs. This result in general depicted there was 12.6 percent green awareness inequality between consumers. This respondent's green awareness inequality was distorted their water consumption and recycling efficiency and thereby affected the green environment.

4.2.2 Consumption Behaviours Inequality

This study assumed that consumer's water consumption behaviours inequality was depleted the green environment. It was investigated that water is a necessity, economic, social and environmental good, which is gifted by God. Due to this case, household's consumption behaviour was found different across their income level. However, the household's consumption behaviours and inequality was upshot perceived groundwater degradation. According to Kombolecha water supply enterprise office (2016), consumers especially, factories were consumed 85 percent of water from the groundwater sources. Experts in the field reported two cases why factories were largely consumed groundwater sources. In the first case, municipality could not supply the required quantity of water for factor's production. In the second case, groundwater was economical and least costs for factories due to the fact that the groundwater was not charged payment and restricted by the municipal, water supply and sewerage enterprise office as well as federal offices. As a result, factories were choosing to use groundwater sources in order to reduce their production costs.

According to the factory and municipal experts' responses, factories were not obliged to pay the money per groundwater quantity by law. As a result, the industrial zone and its environment was losing its green nature by over groundwater consumption and non-recycle wastes. This environment problem perhaps, continued along with the non-integrated household's consumption behaviours and inequality prevailed in the course of water consumption and recycling processes. The respondent's consumption behaviours and green inequality was creating a wide gap between the tradeoffs between resource consumption growth and the green environment.

Figure 4.3: Green Consumption Inequality in Kombolecha

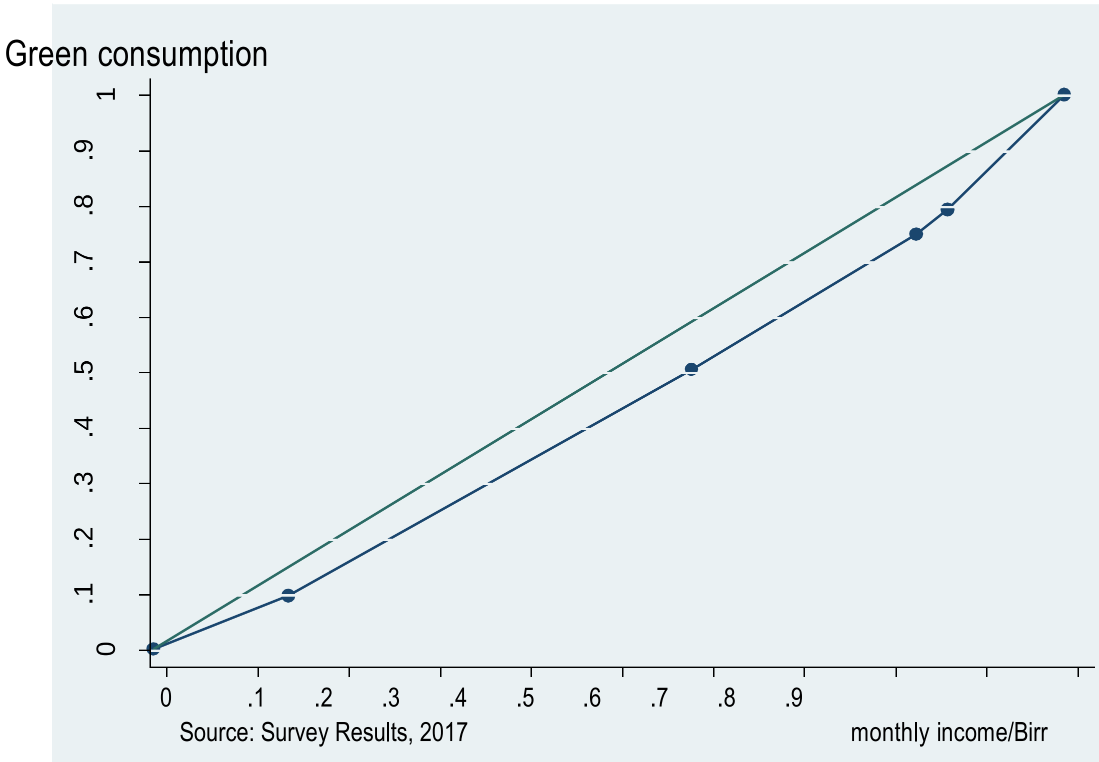


Figure 4.3 describes the household's groundwater consumption behaviours in Y-axis and monthly income in the X-axis. It was investigated that the resource consumption inequality between households was interconnected with their complex social, economic and environmental characters. According to respondents, household's behavioural inequality was created consumption inequality and vice versa to adopt the green mind, technology use and jobs look for. In order to compute the association between household's consumption inequality and their socio-demographic characters, this study used two major factors. The first factor was the dependent factor, which is the tradeoff between water consumption growth and the green environmental problems. The second factor was independents, such as household's sex, age, family size, income, and consumption behaviours. Among mentioned factors, the household's green consumption behavioural inequality, or Gini coefficient was calculated 16.9 percent. This showed that the respondent's water resource consumption and recycling processes were changed by their immersed consumption behaviours inequality.

According to respondents, this green consumption inequality was distorted the groundwater resources. For instance, out of the total households, 311(90.2%) respondents were replied that the consumption behaviours inequality was widening the gap between consumption growth and the green environmental problems. However, only 27(9.8%) respondents disagreed that the consumption behavioural inequality was affected the consumption growth and green environmental tradeoffs. However, factory's water consumption behaviours and water quantity along with per sectors were substantially altered the tradeoffs between consumption growth and the green environment. This study microeconomic (household inequality) described specified elements of Stefan (2009) macroeconomic conclusion that is the current global development is characterised by an increasing resource use and growing inequalities between the rich and poor parts of the world population.

4.3 Factors Associated to Resource Consumption Growth

This study included various factors, which were associated with respondent's water resource consumption processes. For instance, the household's age, sex, education level, family size, attitude, awareness, perception, behaviours, willingness to pay and etc have associational effect on the consumption growth and green environment tradeoffs. These factors were calculated and described by using descriptive statistical values and SPSS20 software version.

4.3.1 Age

The household's age was associated with the resource consumption growth and green environment tradeoffs. According to respondents, despite there was lack of green production and marketing in Ethiopia, the household's consumption perception and behaviours to practice the green mind, technology use and job searches were varied across their age category. This revealed that respondent's age was associated with the household's green perception, awareness and consumption behaviours that ensured the water resource consumption and recycling efficiency and thereby affected the green environment. The respondent's age was altered their concern for green mind, product choice, marketing exchange, and technology and jobs use. In order to explore more about this issue, this study categorized respondent's age into three main groups. The first group consisted of below 35 years; the second group comprised from 35-65 years, and the third group was found above 65 years of old. Based on this, descriptive and binary logistic regression computed the effect of household's age on water consumption growth and green environment tradeoffs.

This study found that the household's age was negatively associated and in turn affected the water consumption growth and green environmental tradeoffs. Whereas, the descriptive statistical values indicated that 185(54.7%); 141(41.7%) and 10(0.03%) respondents were belonged below 35, 35-65 and above 65 years old in order. it was found that respondents who were belonged in each age category were not aware of adopting the green mind and job use during their resource consumption. Among households, nonetheless, respondents on top of 65 years were sensitive and emotional to reduce economic costs (water payment and related charges) compared to the rest age category. Besides to this, the respondents, who belonged from 35-65, and above 65 years, were sensitive and emotional to reduce the resource consumption growth and green environmental tradeoffs compared those, who belonged below 35 years of old.

Table 4.5: Descriptive Statistics of Respondent's Age

Age category	Number of respondents	Percent
Less 35years	187	55.3
35-65years	141	41.7
Above 65years	10	3.0
Total	338	100.0

Source: Survey Results, 2017

Table 4.5 describes household's age effect on the resource consumption growth and green environment tradeoffs. This study found that households, who were 187 (55.3%) below 35 years and 141(41.7%) between 35 - 65 years old, were not conscious to fix the green mind at some point in resource consumption processes. Moreover, out of the total households, 329 (97.3%) respondents, who were found above 65 years old, were not aware to experience a green mind so as to keep the working environment. Nevertheless, 9(2.7%) households, who were above 65 years, were not aware of resilienting the green environment compared to the rest age category. Old respondents have lacked a green awareness on the subject of adopting the green mind, technology and jobs use compared to young respondents, who were belonged below 65 years. Respondents were, nonetheless not aware of balancing the groundwater consumption and recycling activities and in turn reduced the consumption growth and green environment tradeoffs. This was due to the groundwater resource was freely consumed by household's without restriction.

This study showed that old aged respondents were perceived green during water consumption to lessen the social and economic costs than environment costs. However, households, who belonged from 35-65 years old, were well professed about the green consumption than household, who were below 35 and above 65 years old. In the context of green industrial environment and its resilience, this study identified that respondent's family size was keenly also determined the gaps between the water consumption growth and green environment tradeoffs.

4.3.2 Family Size

This study found that the household's family size was coupled with the water consumption growth and its tradeoffs on the green environment. In other words, the rise of the household's family size was increased the quantity of water consumption and waste discharges that altered the quality of green environment, hold other factors constant. For this study, the average family size was 4.5 members per head, which is taken from the Ethiopia Ministry of Finance and Economic and Development (MOFED) (2006 & 2009) threshold line. Based on this, the household's family size was categorised into two groups. The first group consisted small family size households, who have less 4.5 members, whereas, the second group was large family size households, who have above 4.5 members. Except the quantity of water used by the households, there was no significant difference between small and large family size respondent's green mind adoption in the period of water consumption and recycling process.

However, it was computed that large family size households were consumed more quantity of water compared to small family size households. This household's family size was positively associated and widens the tradeoffs between water resource consumption growth and green environment problems. In other words, large family size respondents were consumed more water quantity and then discharged more wastes to Borekena rivers compared to small family size respondents. The rise of the household's family size was increased the resource consumption growth and green environment tradeoffs, ceteris paribus. It was, however, found that there was no a significant difference between small and large family size household's water consumption and recycling efficiency for the sake of green environment protection.

Table 4.6 Descriptive Statistics of Respondent's Family Size

Family size	Respondents	Percent
below 4.5	266	78.7
Above 4.5	72	21.3
Total	338	100.0

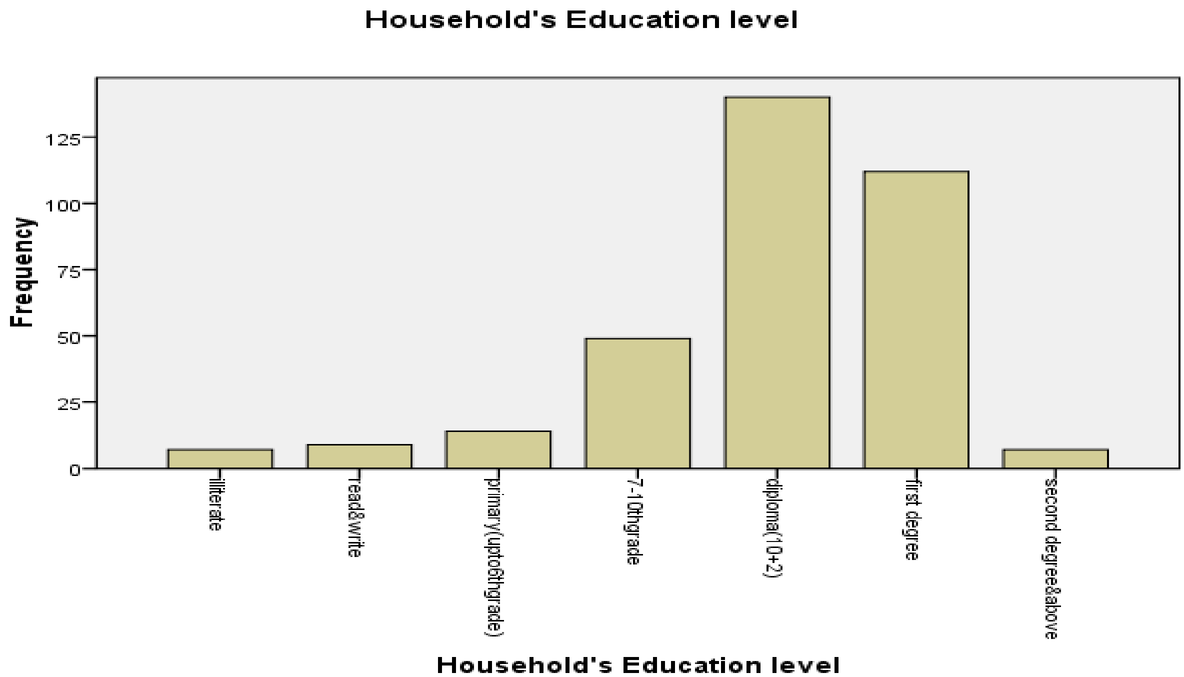
Source: Survey Results, 2017

Table 4.6 shows household's family size effect on the water consumption growth and green environment tradeoffs. In this regard, out of total households, 266(78.7%) and 72(21.3%) respondents have small and large family size respectively. Large family respondents were faced to purchase green products and experience green consumption compared to small family size respondents. In addition to this, large family respondents were attempted to cover their family food expenditures instead of buying green technology (i.e environmentally friend technology) and looking for green jobs (i.e environmentally friend jobs), which is safe for working condition) compared to small family sized respondents. This study finding showed that the household's family size was negatively affecting the green environment resilience in Kombolecha and at large in Ethiopia. For instance, when the household's family size was increasing leads to raise the water quantity consumption and in turn, decreasing the green environment resilience at the 5 percent significance level.

4.3.3 Education Level

This study depicted that household's education level was associated and affected the water consumption and recycling efficiency. In Kombolecha and Ethiopia at large, there was lack of education services that triggered consumers to practice green resources consumption as well as protecting the green environment. In other words, household's education level was influenced the tradeoffs between resource consumption growth and green environment tradeoffs. Importantly, this study categorized the household's education into six levels: illiterate, read and write, primary (up to16th grade), (10+2) diploma, first degree and above level. This study investigated that the household's education level was tied with their green perception and consumption behaviours experiences. For instance, it was computed a positive association between the respondent's education level and green awareness to resilient the green environment at the 95 percent confidence level. This depicted that when the respondent's education level was increased by a single level, their green awareness, perception and behaviours were positively improved the water resource consumption growth. In other words, the respondent's higher education proxies were negatively altered and narrowed the gaps between water resource consumption growth and green environment tradeoffs in Kombolecha.

Figure 4.4: Descriptive Statistics of Household's Education



Source; Survey Results, 2017

Figure 4.4 showed that 140(41.4 %) and 112(33.1%) respondents have a diploma (10+12) and bachelor degree respectively and they were aware of practicing the green consumption better than the rest education category. In addition to this, higher education level respondents were not aware of adopting the green mind and increasing their green water consumption that could be reduced the green environment tradeoffs. Descriptive result indicated that out of the sampled households, 73(21.6%) respondents, who have below diploma education level, were not experience the green resource consumption process. Particularly, low education level households were not conscious to adopt the green technology during water resource consumption and recycling processes. However, higher educated respondents were behaved well to use the green technology that settled the gaps between water consumption growth and green environmental tradeoffs.

Out of the total households, 123 (36.39%) households, who have below diploma level, have a little green perception towards improving their water consumption and recycling efficiency. However, 23 (6.8%) households, who have the reading and writing skill, were not practiced the green water consumption. Most of respondents signified that the green consumption behaviours were seriously interconnected to their economic, social and environmental costs. For instance, out of the total households, 213(63.2%) respondent's consumption activities were green behaved and designed to reduce an economic cost compared to the environment and social costs. Out of the total households, nonetheless, 57(16.7%) and 68(20.1%) respondents were behaved and practiced a green consumption so as to cut their environment and social cost respectively.

According to interviewed experts and professionals in the field, households, who have read and write skill as well as primary education level (up to 6th grade), water consumption behaviours were not only affected their living and working environment but also it contributed negative externalities on the neighbour's environment. However, household's, who have read and writing skills, were not green behaved water consumer to reduce the neighbour's environment pollution compared to respondents, who have above diploma (10+2 grade). It was strong-minded that households, who had higher education level, were worried about water consumption growth. However, this study described that respondent's attitudes towards the green mind adoption and technology use were altered the water resource consumption growth and the green environment tradeoffs.

4.3.4 Attitude

The household's green attitude was associated with the resource consumption growth and the green environment tradeoffs. In this study, green attitude was described in the context of the household's feelings towards balancing the water consumption and recycling; minimising the consumption growth and green environment tradeoffs and optimize the green environment resilience in general. This study green attitude was consistent explanatory factor in predicting consumers' willingness to pay the money for water resources. This study, thus, investigated that the household's green attitude was associated with the resource consumption growth and green environment tradeoffs. Particularly, the respondent's green attitude measured in the context of reflecting either pessimistic or optimistic attitude to adopt the green mind, product, market, technology use. Respondents green attitudes measured by using five-point Likert scales consistent to their water consumption growth and green environment tradeoffs. To processes result computation and description, attitude validity was measured by using a Cronbach alpha value. Based on this, it was calculated 0.84andpresents valid.

Accordingly, Table 4.6 indicates that 165(48.8%) households were found pessimistic to adopt a green mind, technology, consumption, market, and jobs look for. In essence, respondent's green attitude was found the worst was negatively expressed (pessimistic) to stable the consumption growth and green environment tradeoffs in Kombolecha and at large in Ethiopia. This study shared the notion of green environment resilience in Gert (2007) suggestion that focused and needs that alters people's attitudes towards ecological behaviour and understands of how they construct such attitudes. This study found that the worst would be likely existing unless the household's greens attitudes would not be integrated into their economic, social and environmental decisions.

Table 4.7: Household's Attitude towards the Green Environment

Response	Number of respondents	Percent
Optimist	60	17.8
Pessimist	165	48.8
Neutral	75	22.2
i don't know	38	11.2
Total	338	100.0

Source: Survey Results, 2014-2017

Table 4.7 shows, out of the total households, 165(48.8%) respondents have a pessimistic attitude to adopt a green mind, technology and consumption that could resilient the green environment in Kombolecha. However, 75(22.2%) respondents have a neutral attitude, which referred to neither optimistic nor pessimistic, to recover the green environment. Then again, 60(17.8%) respondents were reflected an optimistic attitude towards balancing the consumption growth and green environment tradeoffs. Pessimistic respondents were argued that factory's quantity of water consumption were depleted the nature of green environment. However, Beer producer factory was consumed more quantity of water compared to other factories.

In addition to this, this study respondent's green attitude was negatively associated with their family size. For instance, out of the total households, 104(30.7%) and 27(7.9%) respondents, who have small and large family size respectively, have an optimistic attitude to keep the water resources for future generation. This revealed that, large family size respondents were optimistic to protect the green environment compared to small family size. Exceptionally, respondent's green attitudes were tied to their belief: "water is gifted by God" or not. For instance, respondents, who did not worry about groundwater use, contended that "water is naturally gifted and its loss in the hands of God". These households were consuming the groundwater without worrying about the consumption and recycling efficiency. In addition, they were not worried about water loss for future consumption.

However, across gender in this study, male respondents have reflected pessimistic attitude compared to female headed respondent's, who attempted to attain water consumption and recycling efficiency. This study, nevertheless, investigated the household's green attitude, which was gender sensitive but highly associated with their consumption culture. Male households, who have pessimistic attitudes, argued that groundwater consumption should be controlled by government. It was, nevertheless, found that female respondents were reflected an optimistic attitude to minimize their tap water consumption and recycling gaps compared to male respondents. This study was, however, determined that both male and female respondents were not worried about groundwater degradation and the green depletion. This study also described the household's green awareness influence on the water resource consumption growth and green environment tradeoffs.

4.3.5 Green Awareness

This part assessed the household's green awareness association with the consumption growth and green environment tradeoffs. As like attitude, household's green awareness was describing in the context of adopting a green mind, product, market, technology and jobs use during their consumption and recycling processes. Accordingly, it was found that the households' sex, family size, consumption culture and etc were associated with their green awareness. Above all, out of the total households, 156(46.2%) male and 182 (53.8%) female respondents were not aware of adopting a green mind to balance the resource consumption growth and green environment tradeoffs. In general, out of the total households, 203(60%) respondents were not aware of the notion of green environment. Out of this, 124(76.8%) and 79(23.2%) male and female respondents were not aware of resilient the green environment respectively. Particularly, out of them, 99(34.9%) female and 185(65.1%) male respondents were not aware to balance the wide gaps between resource consumption growth and green environmental problems. In the study area, male respondents were found more aware of the green environment than females. This was due to female households have lack of TV, radios and other alternative medias to accesses information about the green environment.

Table 4.8: Respondent's Awareness about Green Environment Resilience

Response	Number of respondents	Percent
No	284	84.0
Yes	54	16.0
Total	338	100.0

Source: Survey Results, 2017

In this study context, green environment resilience described the respondent's concerns to bounce back or restore the nature of green environment by narrowing the gaps between water consumption growth and green environment tradeoffs. It is, therefore, Table 4.8 describes the household's awareness about the green environment resilience in Kombolehca. This green environment awareness was described regarding the household's green mind adoption, technology use in the period of water resource consumption and recycling processes. Accordingly, it was computed that out of the total households, 284(84.2%) respondents were replied "No'' response that revealed respondents were not aware about the green environment resilience. In Table 4.8, respondents reported that they were not aware of purchasing green technology that ensured the water resource consumption and recycling efficiency subject to the minimum cost of production. However, out of the sampled respondents, 103 (36.3%) and 181(63.7%) female and male respondents, respectively, were not aware of experiencing the green technology use in the period of consumption and recycling processes.

Moreover, this study described the household's green awareness association along with their poverty status. It was found that poor respondents were not aware of the greening environment compared to non-poor. Previously, out of the total population, 122(36%) respondents were poor (below the poverty line) and not conscious about the green environment in Kombolecha. This study poverty exceeded the national poverty incidence, which is 30 percent in Ethiopia. This might be the cause that Kombolecha is amongst industrial zone that attracted many migrants and unemployed people, who wanted to get shanty infrastructure and jobs. Moreover, poor households were not able to purchase television, radio and other tools that could be helped them to accesses the green information. Poor respondents were strived to fill the minimum food subsistence for survival instead of reducing the water degradation and recovering the depleted environment. In addition to this, poor respondents were not aware to purchase the green technology that optimized the water consumption and recycling efficiency. This was due to poor respondents were faced financial problems to practice the green consumption and production, technology and jobs use, which maintain the equilibrium between the water consumption growth and green environment tradeoffs.

Table 4.9: Household's Awareness about Green Consumption

Response: Yes/No	Number of respondents	Percent
No	249	73.7
Yes	89	26.3
Total	338	100.0

Source: Survey Results, 2017

Table 4.9 describes household's awareness about green consumption. The household's awareness was described by 'Yes' or 'No' discrete responses. Accordingly, out of the total households, 247(73.7%) were not aware of practising ('No' response), the green consumption. However, 89(26.3%) households were aware of practicing (replied 'Yes') green consumption that could be recovered the green living environment. However, the household's awareness of greening consumption that aimed at protecting the neighbour's and industrial environment was not worth mentioned. According to respondents, their inefficient water consumption and waste recycling was resulted a vicious circle problem on their living and working conditions. Moreover, poor household's, who resided at slum and squatter areas around Borekna river edges, were not aware of ensuring the water consumption and recycling efficiency. Poor respondents were used polluted Borekena river for their cloth washing and small irrigation activities that resulted an economic, social and environment distortion.

Table 4.10: Household's Awareness about Green Market and technology

Respondents response	Number of respondents	Percent
No	203	60.1
YES	135	39.9
Total	338	100.0

Source: Survey Results, 2017

According to trade and industry office (2017) and interviewed experts, Ethiopia economy is an import dependent due to factories were faced financial problems to purchase an advanced technology, produce green product, exchange at green market and create the green job opportunities. This study, therefore, incorporated the household's consumption trends whether they were aware of green technology use, market and green jobs. Out of the total population, 203(60.1%) respondents were not aware to use the green technology, market and green jobs, which are environmentally friend and safe for their health. In Table 4.10, the household's green awareness concerning the green technology use, marketing exchange, and job use were influenced the quantity of water consumption and waste discharge to environment. Green aware respondents were relatively consuming and recycling liquid wastes than non-aware households. However, 135 (39.9%) respondents were aware of the green technology, market and jobs that could be kept the living environment. This study found respondents, who were confused about the green environment resilience in general. According to respondents, the green environment was understood like planting tree across the road edges.

In this study data collection, the green jobs searches were assumed insignificant in the mind of households. Accordingly, 203 (60.1 %) were not aware about green mind adoption at some point in consumption. This household's awareness towards seeking the green jobs was associated with their level of education, income, family size and etc. For instance, it was identified that household's education, income and age were positively associated and influenced their green awareness to embrace the green mind, market, technology and job use at the 5 percent significance level. Out of the total households, 135 (39.9%) respondents were aware of using technology; exchange in green market and searching the green jobs. It was comprehended that female respondents were looking for jobs that might not be green for working condition compared to male respondents.

This study identified that large and small family size respondent's awareness to exchange at the green marketing was found different. For example, out of the total households, 284 (84%) respondents were not aware of purchasing the green goods due to the lack of green market opportunities in the study area. However, 54(15.9%) respondents were aware bout green market exchange at all. In the study area, particularly, large family size respondent was unconscious to purchase green goods compared to small family size. Most large family size households were willing to spend the money to cover the family food subsistence. Nonetheless, small family size households were willing to exchange in the green markets and relatively made resource consumption and recycling processes efficient. It was resolute that large family size respondents were not given due attention to purchase green goods and services than small family size.

This study also found out that employed households in government and non-government organisation were aware of exchanging the green marketing and showing willingness to purchase green goods than unemployed. Since Kombolecha is an industrial zone, there were many unemployed people, who seek jobs. For instance, out of the total households, 289 (85.5%) respondents were not apparent to find the green jobs. Green jobs were insignificantly available in Kombolecha. As a result, unemployed respondents were looked for jobs whether it is green or not. According to micro and small enterprise office (2016), the unemployed and poor households have lack of green job opportunities and purchased the green goods and services. As result, households were obliged to purchase the non-green goods in order to get the food subsistence. Similarly, there was lack of green market opportunities in Ethiopia cities including Kombolecha, this study noted that the respondent's awareness and perception to adopt the green consumption and technology use would be keenly played a role to balance the water consumption and recycling efficiency.

4.3.6 Green Perception

As like other factors discussed so far, the household's green perception towards green market and environment resilience was measured by using five-point Likert scales: very well, well, not well, little and not at all responses. This resilience was consistent to household's resource consumption and recycling efficiency attainments. The household's green perception and its validity was checked by a Cronbach alpha value and found 0.84, which presents valid. This study identified that the household's green perception was varying along with their socio-demographic characters and consumption demand. Importantly, the household's diversified ethnic, behaviours and consumption cultures were associated with their green perception.

Table 4.11: Household's Perception about Green Market

Response: five-point Likert scale	**Number of respondents**	**Percent**
very well	21	6.2
Well	73	21.6
not well	152	45.0
Little	91	26.9
i don't know	1	.3
Total	338	100.0

Source: Survey Results, 2017

Table 4.11 shows that respondent's green perception about green market in Kombolecha industrial zone.In this study, out of the total households, 152(45%) respondents were not perceived well about participating at green market. However, 91(26.9%) respondents have the little perception to engage in the green markets. In the survey area, 73(21.6%) respondents have a well perception about the green market. According to trade and investment office (2017), there were no green market opportunities that could address the green market demand and supply equilibrium at Kombolecha. This was due to the fact that factories in

Kombolecha city were in a hurry to use new technology that could produce the green products, which are environmentally friend.

This study assessed the green marketing strategies between water consumer (households and factories) and the supplier (water supply and sewerage enterprise office). Whereas, households and factories were water consumers and depicted that stakeholders were not evaluated the water consumption growth and green environment tradeoffs. Particularly, water supply and sewerage enterprise office was merely collected tap water payments. However, groundwater was not, yet, considered as a resource. As result, all sampled factories were over-consumed the groundwater sources to curtail their economic costs. This over-consumption activity tied to the household's green perceptions was widening the tradeoffs between consumption growth and green environment problems. In addition to this, the consumer's perception about the green environment was measured good, bad, fair, confused and not good at all. Accordingly, out of the total household's perception, 156(46.4%) respondents were confused about the green environment resilience.

Table 4.12: Household's Perception about Green Environment

Perception	Number of respondents	Percent
Good	19	5.6
Bad	76	22.5
Fair	86	25.4
Confused	157	46.4
Total	338	100.0

Source: Survey results, 2017

In this study context, green perception was described by the household's insight to build a safe living and working environment all through the water consumption and recycling processes. Table 4.12computeshousehold's green perception towards the green environment. Based on this, the household's responses were calculated good 19(5.6%), bad 76(22.5%), fair 86(25.4), and confused

157(46.4%). According to this result, most respondents were found indifferent to say whether the existing environment was good or bad for living and working condition. This respondent's green perceptions were created a difference to protect the green environment. Exceptional to this, factory employee respondents were perceived green better to stay poised the economic or environmental issues compared to other respondents. Whereas, other non- factory employees were perceived green to optimise their economic and social benefits. This revealed there were disintegrating households and factory's optimal attainments in their water consumption and recycling processes.

Moreover, out of the total household's, 255(75.4%) respondents were not perceived well and had the little perception to resilient the green environment. This statistical result showed that the green environment was depleted by non-green perceived consumers. However, out of the total sampled population, 129(38.2%) and 209 (61.8%) male and female households were not perceived well about the green environment by experiencing the green consumption. Similarly, large family size respondents were not perceived good to green the environment compared to small family size households. However, household's perception about the green consumption was determined by the quantity demand and the market prices of goods. It was found that large family respondents were not showing and willing to purchase the green products compared to the small family size.

Table 4.13: Household's Perception about Green Product Consumption

Response	Number of respondents	Percent
very well	14	4.1
Well	36	10.7
Not well	203	60.1
Little	84	24.9
I don't know	1	.3
Total	338	100.0

Source: Survey Results, 2017

Table 4.13 shows the household's perception concerning green consumption in Kombolecha. It was calculated that respondent's green perception was measured very well 14(4.1%), well 36(10.7%), not well 203(60.1%), little 84(24.9%) and I do not know 1 (0.3%). It was found that the household's green perception was influenced the green living and working environment protection. However, the respondent's green product consumption was negatively associated with family size but positively related with their monthly income. For instance, out of the total households, 84(24.8%) and 17(0.05%) respondents, who have large and small family size respectively, have little perception about the green product consumption. However, relatively, small family size respondents have good perception to practice the green product consumption compared to large family size households. However, in sum, out of 338 households, 247(73%) respondents have the little perception to adopt the green product consumption and recycling process.

4.3.7 Green Behaviours

Out of the total households, 149(44.1%) respondent's water consumption processes were not green behaved to keep their living and working environment. In Ethiopia, there are above 80 ethnic populations (FDRE, 2016). Consecutively, population diverse religious, ethnic, culture and habits were created heterogeneous behaviours that widen the consumption growth and green environment tradeoffs. This study, therefore, proved that the household's green consumption behaviours were varied across their culture and habits. This consumption behaviour was a subjective detrimental effect on the resource consumption growth and green environment tradeoffs. Particularly, the household's consumption behaviours have a negatively relation to the tradeoffs between consumption growth and green environment problems at the 5 percent significance level. This study result shared Raghubir and Menon (2005) conceptual model, which depicts environmental behaviours that lead to under estimating the extent to which past behaviour was pro-environment. However, this study was different from Gert, *et al.* (2007) findings, which underlined common displayed environmental behaviours are somewhat ambiguous with respect to their ecological nature.

The household's green behaviour, however, was referring in the milieu of behaving to practice a green mind, product consumption, technology use and jobs searches and water protection, which were means to balance the water resource consumption growth and green environment tradeoffs. The household's consumption behaviours were explored different to adopt the green mind, market exchage, technology and jobs use. These respondent's behaviours were measured by using five- point Likert scale: very well, well, not well, little and not at all behaved. This study finding was supported by Smith (2013) suggestion that noted it is important for people to practice green behaviour so as to conserve the environment and its scarce resources.

Table 4.14: Household's Green Consumption Behaviours

Responses	**Number of respondents**	**Percent**
very well	21	6.2
Well	52	15.4
not well	149	44.1
Little	116	34.3
Total	338	100.0

Source: Survey Results, 2017

In Table 4.14, out of the total households, the respondent's, who have green consumption behaviours and practices, replied very well 21(6.2%), well 52(15.4%), not well 149(44.1%), little 116(34.3%). It was pointed out that household's consumption was not well-behaved green during consumption and recycling processes that could balance the consumption growth and green environment tradeoffs. This study calculated that out of total households, 173 (51.2%) and 35(10.4%) male and female households did not behave well during water consumption process. Particularly, female households were greenly behaved in the course of the water consumption process compared to male households. Besides, female respondents were found sensitive and emotional to reduce economic costs (water payments) than male respondents. However, the respondent's family size was inversely associated with their green consumption behaviours. For instance, large family size respondents were non-green consumers compared to the small family size respondents.

Across the gender analysis, female households were green behaved to limit water quantity and recycle wastes compared to male households. Besides, female respondents were sensitive and emotional to reduce social costs (social expenditures) than male households. However, household's family size was inversely associated with the household's green consumption behaviour but directly increased environmental problems.

In the study area, it was found that households, who have above (10+2) or diploma education level, have relatively green behaved consumption compared to households, who have below diploma education level. This study finding was analogous to Teharani, *et al.* (2010), which confirms that education creates a difference in student's awareness and behaviours on the green environment. Nevertheless, in this study, the household's consumption behaviours were influenced by their diversified culture and habit at the 5 percent level of significance. Out of the total sample households, 123(36.4%) respondents agreed that consumption behaviours were trapped from their elder families and, yet, practiced as like their consumption patterns. As a result, water consumption and recycling inefficiencies were continuing and affecting the nature of the green environment.

Table 4.15: Household's Consumption Behaviour to Keep the Environment

Response: five-point Likert scales	**Number of respondents**	**Percent**
SA	31	9.2
A	213	63.0
Indecisive	37	10.9
D	46	13.6
SD	11	3.3
Total	338	100.0

Source: Survey Results, 2017

Table 4:15 shows the household's green consumption behaviours regarding to keep their green environment. However, it was found that respondents were considered to reduce their economic costs. According to the respondents green behaviours and practices, they were replied strongly agreed 31 (9.2%), agreed213(63.0%), indecisive 37(10.9%), disagreed46(13.6%, and strongly disagreed11 (3.3%) to reduce an economic cost (water payments). In the study area, out of the total respondents, 213 (63%) household's consumption behaviour was targeted to minimize the economic costs than social and environmental costs. This implies that the household's consumption processes were not-environmental friend to make keep the living and working environment.

On the other hand, the respondent's consumption behaviours varied across their family size. For example, out of the total households, 206(60.9%) and 62(18.3%) respondents, who have large and small family size respectively, consumption behaviours were not an environmental friend. However, 67 (19.8%) and 3 (8.9%) respondents, who have small and large family size in order, were green consumers. According to respondents, large family households were giving due attention to cover their family food and non-expenditures, such as school fees, health, cloth and etc. Respondent's consumption behaviours were also found subjective and different across their monthly income. In Kombolecha, out of the total households, it was found that 213(63%) respondents' consumption behaviours were seriously interlinked with the level of income.

Table 4.16: Consumption Behaviour to Keep the Living Environment

	Frequency	Percent
SA	59	17.5
A	141	41.7
Indecisive	72	21.3
D	66	19.5
Total	338	100.0

Source: Survey Results, 2017

Table 4.16 depicts the household's green consumption behaviour to protect their living environment. In this regard, the household's responses were strongly agreed 59 (17.5%), agreed 141(41.7%), indecisive 72(21.3%), disagreed 66(19.5%, and none of them said strongly disagreed. This revealed that out of the total household's, 141 (41.7%) respondents were agreed to keep their living environment compared to the working environment. These respondent's behaviours were elucidating in the context of practicing the green mind, water consumption, markets, technology uses and green job searches. With this respect, 72(21.3%) households have indecisive responses about their green consumption practice. Nevertheless, 66(19.6%) respondents disagreed to experience the green consumption behaviours. This showed that consumers attempted to reduce an economic cost in the resource consumption and recycling processes compared to environmental costs.

On the other hand, respondent's family size determined their green consumption behaviour. This study investigated that large family size households eroded the green environment than small family size households. However, consumption behaviours were affected the green environment, 155 (45.9%) and 44 (13.1%) large and small family size households, respectively, agreed to alter their water consumption behaviours and recover the green environment. However, large family size respondents were disagreed to change their consumption behaviours that would be protected the neighbour's environment. This study finding was the reversal of Williams and Dair (2007), whodescribedthat without changes to the built environment some sustainable behaviour cannot take place.

This study also assessed the household's behaviours regards to water quantity limit and waste recycles during groundwater consumption. For instance, out of total sample respondents, 201(59.5%) households were disagreed to limit the water quantity consumption that could be maintained environment depletion. In the extreme case, 114(33.7%) respondents were strongly disagreed to limit water quantity that reduces the groundwater degradation. This study revealed that households were worried to reduce water payments and charges instead of depleting the water resource and green environment. This survey results also revealed that the households were green behaved well for living and working environment than an industrial environment protection. In this regard, industrial environment is an industrial zone where that consisted of different types of clustered firms per sector. Out of the total households, only 74(21.8%) and 23(0.06%) households, who have small and large family size, respectively, were agreed to limit the water quantity consumption so as to protect the living environment.

4.3.8 Household Poverty

This study proved that the household's poverty has association with perceived water consumption growth and the green environmental tradeoffs. It was examined the poor and non-poor household's green behaviours that maintained consumption and recycling efficiency. The household's poverty measured using WB (2009) income poverty line. Households, whose daily income exceeds 1.29 dollars, were non-poor. Otherwise, poor. It was identified that poor respondents were not experiencing the green mind instead they strived to fill the daily food subsistence. Out of the total households, 124(36.7%) respondents found poor (below the poverty line) in Kombolecha. This poverty caused a vicious circle problem on the living and working environment depletion. Particularly, poor respondents were powerless and voiceless to protect the groundwater sources compared to non-poor. In the study area, poor respondents have reflected a pessimistic attitude towards the green environment.

This study also found that the household's consumption behaviour was varied along with their poverty status. For instance, poor respondents were not green behaved during water resource consumption compared to the non- poor respondents. This might be the case that poor respondents were residing at the edge of Borkena river and lived at slum and squatter areas. As a result, poor households were depriving to access the clean living and working condition compared to non- poor respondents. In Kombolecha industrial zone, particularly, lacks of environmental services accessibility were prevalent problems that increased the non- green living and working environment problems. In the study area, the household's poverty was negatively affecting their decision to guard their living and working environment. It was, therefore, included the household's social aspect (poverty level) into economic and environmental indicators in order to balance the water consumption growth and green environment tradeoffs. This study finding was consistent to Mbata (2006) results that imply that poor households may not make payment for water a priority, as they may have to make choices to spend the limited financial resources for subsistence needs.

Table 4.17: Households Poverty Status in Kombolecha

Poverty status	Number of respondents	Percent
Non-poor	214	63.3
Poor	124	36.7
Total	338	100.0

Source: Survey Results, 2017

The household poverty was indirectly influenced by their green consumption behaviours. Table 4.17 showed that 214(63.3%) and 124(36.7%) were found non-poor and poor households respectively in Kombolecha. This study identified that non-poor households were sensitive, and emotional, able and willing to pay the money to evenhanded the consumption growth and green environment tradeoffs. On the other side, non-poor households were found confident and reflected an optimistic attitude compared to the poor households regarding poise the resource consumption growth and green environment tradeoffs. It was also found that poor were not worried about practicing the green consumption and exchanging in the green market. In addition, poor respondents were not bothered to cuddle green consumption behaviour that resilient the green environment.

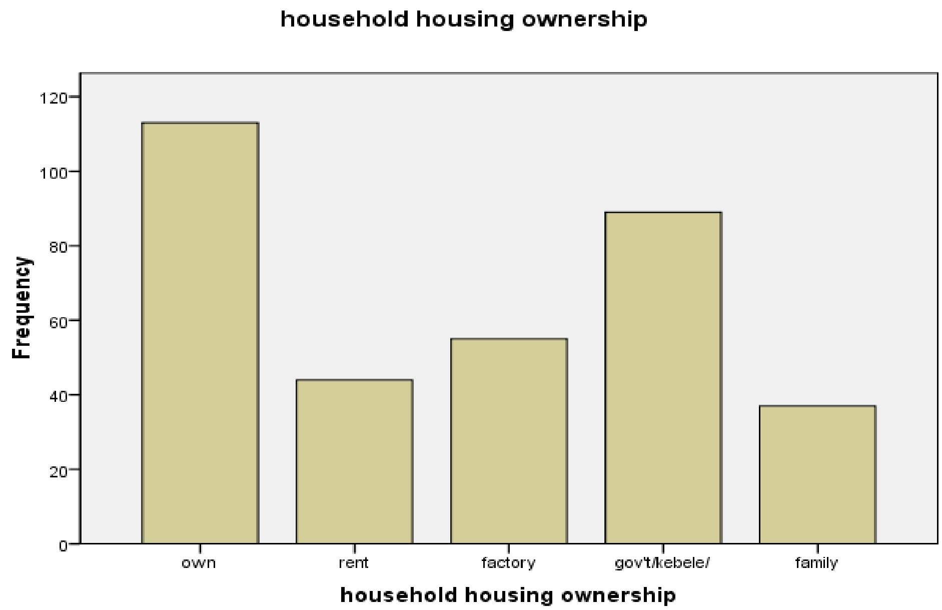
Since poor households were deprived of economic, social and environmental benefits, they were not found sensitive and emotional to balance the consumption growth and green environment tradeoffs. Holding other factors constant, poor households were concerned to reduce an economic cost (water payment and good's prices) than environment costs. However, non-poor households were relatively sensitive and emotional to safeguard their living environment and groundwater protection. Non-poor respondents were questioned the municipal office and voiced against the factory's excess water consumption growth and the green environment problems. They were also argued that green resilience has to be government duty. According to respondents, alleviating household's poverty of money would not be self-sufficient to resilient the green environment. Instead, poverty of green environment and accessibility alleviation has to be taken into account in policies and programs that could narrow the tradeoffs between consumption growth and green environmental problems.

4.3.9 Housing Ownership

In this study, the respondent's housing ownership was substantially influenced the environment protection and green resilience. In Kombolecha and Ethiopia as a whole, housing ownership was served beyond shelter, it used as a source of income. This was the fact that the housing ownership was taken as a main factor in this study. This housing ownership was categorized into three: the households, who lived in own house, rented and lived at Kebele or factory's houses. This housing ownership positively associated with the green living and working environment protection. As a result, the housing ownership determined the resource consumption growth and green environmental tradeoffs. It was found that the households, who lived in their own house, were sensitive and emotional to resilient the green environment than respondents, who lived at a rented house.

In addition to this, the respondent, who lived in their own house, were willing to pay the money to resilient the green living environment compared to those rented and lived at factory's houses. In other words, the respondent, who lived in own their house, were sensitive and emotional to reduce groundwater consumption and recycling inefficiencies. However, the respondents, who lived at a rented and kebele houses, have a lack of sense of ownership about the green living environment protection and its resilience. They attempted to reduce the economic cost of water consumption and payments than environmental costs.

Figure 4.5: Household's Housing Ownership



Source: Survey Results, 2017

Figure 4.5 shows respondent's housing ownership descriptive statistics and water resource consumption in Kombolecha. This study renowned that the respondent's housing ownership was strongly determined the tradeoffs between consumption growth and the green environment problems by 0.013 values at the 5 percent significance level. The household's elasticity demand to protect their health, clean the houses and ownership were significantly affected the water consumption and recycling efficiency by 0.027 values at the 5 percent significance level. According to Kombolecha mayor office (2017), 52 percent residents were migrants and lived in rented houses. This study respondent has a lesser amount of housing ownership and in turn, has a less sense of ownership to resilient the green environment via balancing the consumption and recycling efficiency.

This study proved that there was a negative association between the housing ownership and the tradeoff between consumption growth and green environment. In the words, the rise of the respondent's housing ownership and possession was reduced the water growth consumption and green environment tradeoffs. This study result was consistent to Shan et al, (2010) that illustrates home owners were played an important role in requiring green homes as they are the real driving force for buildings to achieve a better sustainability.

4.3.10 Consumption Culture

This study described the household's consumption culture and its effect on consumption growth and green environment tradeoffs. In pursuit of this, consumption culture was measured using five-point Likert scales starts from strongly agree up to strongly disagree including the neutral responses (indecisive). The data validity was computed using a Cronbach alpha value and found 89.6% that reveals valid. Since the households have different ethnic groups in Kombolecha, the resource consumption culture was found diverse and heterogeneous during their consumption and recycling activities. Accordingly, Table 4.18, out of the total households, 123 (36.4%) respondents agreed that consumer's culture was affected the resource consumption growth and green environmental tradeoffs. This was due to the household's consumption culture was created difference on their green behaviours to experience the green mind, product, market and technology use.

Table 4.18: Household's Consumption Culture

Response: five-point Likert Scales	**Number of respondents**	**Percent**
SA	10	3.0
A	123	36.4
Indecisive	114	33.7
D	75	22.2
SD	16	4.7
Total	338	100.0

Source: Survey Results, 2017

In Table 4.18, out of the total households, 114(33.7%) respondents were indifferent (have an indecisive response) whether the consumer's culture was affected the consumption growth and environmental tradeoffs or not. However, 75(22.2%) and 16(4.7%) respondents disagreed and strongly disagreed respectively that the consumer's cultures were influenced the water consumption growth and the green environment tradeoffs. This study binary logistic regression was proved and computed that the consumer's culture was negatively altered the tradeoffs between water consumption growth and green environmental tradeoffs. In other words, the household's consumption culture was indirectly influenced the gaps between the groundwater consumption and recycling intensity.

In addition to this, an instrumental variable model (two stages least square estimation) determined that the consumption culture and monthly income were exogenous and endogenously changed the water consumption and recycling efficiency at the 95-confidence level respectively. In other words, the household's consumption culture showed sign of an inverse relationship between the consumption growth and green environment tradeoff sin Kombolecha. It was, particularly, computed that the consumer's culture was affected their green perception and behaviours to adopt the green mind and technology use by 0.023 values at the 5 percent significance level. According to respondents, their consumption culture directly determined the quantity of water use and waste recycling limit butit was indirectly influenced and resilient the green environment. Kim-Cohen (2007) argued that it is important to study resilience at levels of analysis ranging from the molecular to the behavioural to the cultural. This study, nonetheless, explored that that the household's culture and behaviours were interconnected and altered the water resource consumption activities.

For instance, the household's green behaviours were endogenously and significantly affected by their consumption culture by 0.055 values at the 95% confidence level. The household's consumption behaviours, which shared from the elder families, aimed at minimising their economic cost (water payment). However, it was found that the household's consumption culture was exogenously and strongly affected the consumption growth and green environment tradeoffs by 0.000 values at the 5 significance level. This was due to the household's culture was determined the sensitive and emotionality to experience the green mind and technology use. That is the household's consumption culture was endogenously affected their sensitive and emotionality to adopt a green mind and technology but exogenously and strongly determined the consumption growth and green environment tradeoffs by 0.000 values at the same level of significance. The respondents, nevertheless, were sensitive and emotionality to change the consumption culture in order to reduce health problems. This study, in sum, found that the household's consumption culture was positively associated and strongly affected the green environment restoration by 0.000 values at the 5 percent significance level.

4.3.11 Willingness and Ability to Pay

This study household's ability to pay the money was not self-sufficient to recover the greener environment without including their willingness to pay. As like other factors, household's ability and willingness to pay the money was inversely associated with the water consumption growth and green environment tradeoffs. However, the respondent's willingness and ability to pay was determined by their family size. In addition to this, it was renowned that the respondent's willing to pay the money was depending on their economic, social and environmental attentions. Descriptively, this study computed that 151(44.7%) of the households were willing to balance the consumption growth and green environment tradeoffs in Kombolecha. This study finding was persistent to James (2007) that pinpoints 'behind differences in willingness to pay lie differences in ability to pay' the money. However, in Kombolecha, respondents were not begun to pay the money for the green environment.

However, the household's willingness and ability to pay the money was associating with the water consumption and recycling intensities that maintained the living and working environment. Out of the total households, 117(34.6%) respondents have an indecisive response to set of scales the consumption growth and green environment tradeoffs. This tradeoff was changed bythe respondent's willingness and ability to pay the money to run-through the consumption and recycling efficiency. In spite of this, the household's willingness and ability to pay the money concerning the green mind, technology use and green consumption activities were found different. The respondent's willingness and ability to pay the money was found different across their sex and family size. For example, male respondents were more willing to pay the money and reduce the green environmental problems compared to female headed respondents. However, this study result was dissimilar to Bhandari, *et al.* (2007), who explored there was no significant relationship between the people's genders, age or economic status.

Table 4.19: Ability and Willingness to Pay Money

Response	Number of respondents	Percent
SA	47	13.9
A	151	44.7
Indecisive	117	34.6
D	23	6.8
Total	338	100.0

Source: Survey Results, 2017

Table 4.19 indicates the household's ability and willing to pay the money that poises the consumption growth and green environment tradeoffs. Along with this, out of the total households, 117(34.6%) respondents were not willing to pay the money that could be balanced the water consumption and recycling efficiency and in turn reduced the consumption growth and green environment tradeoffs. Out of the total respondents, 84(25%) and 157(46.5%) female and male households respectively were not willing to limit water and recycle wastes. In addition, 23(6.8%) respondents were not willing to pay the money that improved the green consumption behaviours and often evenhanded the consumption and recycling efficiency. This study factory's water consumption finding was similar to Reyers (2011), who depicted that companies are responding to climate change only where the business case prevails. In this study, however, 47(13.9%) households strongly agreed to pay the money used to balance the gaps between consumption growth and the green environment.

This was due to the household's family size was resolute their willingness and ability to pay the money in order to optimise the consumption growth and the green environment tradeoffs. For example, out of the total households, 120(35.5%) respondents who have small family size were able and willing to pay the money, which used to convalesce the water resources degradation and the green environment depletion. In doing so, however, respondents were willing to establish a green association that would drive the green environment resilience.

In view of that the household ability to pay the money was not by itself sufficient. This study, therefore, incorporated the respondent's willingness to pay the money to adopt a green mind, green technology, consumption, market exchange and jobs use. According to respondents, there was no green environment association despite it is a key pillar to resilient the green industrial zone in Kombolecha. In the study area, out of the total respondents, 241(71.3 %) households were willing to pay the money that used to establish the green environment protection members that would be aimed at balancing the future water resource consumption growth and green environmental tradeoffs. However, 97(28.7%) respondents were not willing to pay the money that resonates the consumption growth and green environment tradeoffs. In addition to this, the household's sensitive and emotionality was also contributing a significant influence on the water consumption growth and green environment tradeoff.

4.3.13 Sensitivity and Emotionality

This study found that consumer's sensitive and emotionality were different for economic, social and environmental aspects during the water consumption and recycling processes. For instance, out of the total household's, 216 (63.9%) respondents were sensitive and emotional to minimise their economic costs (water payment and charges) all through their consumption and recycling processes. Accordingly, respondent's sensitive and emotionality for economic aspects changed the water consumption and waste recycling efficiency. On the other hand, consumers were sensitivity and emotionality to protect the living environment (home) compared to the working environment. In addition to this, the household's sensitive and emotionality to balance the resource consumption growth and green environment tradeoffs were altered by their socio-demographic characters, such as sex, family size, education level, income, and etc.

Moreover, the household's sensitivity and emotionality to resilient the green environment was pretentious on their poverty status. For example, poor consumers were not found sensitive and emotional to balance the resource consumption growth and the green environmental tradeoffs compared to the non-poor respondents. Poor household's sensitive and emotionality were attempted to fill their daily food subsistence instead of worrying about the living and working environment protection. On the other hand, household's sensitivity and emotionality to adopt a green mind, technology use and consumption processes were strongly allied to their perception, consumption behaviours, culture and income at the 95 percent confidence level. As a result, the household's sensitivity and emotionality to adopt the green mind, consumption, technology use and jobs searches were varied along with their economic, social and environmental concerns and were substantially interconnected to the living and working environment resilience.

Table 4.20: Household's Sensitivity and Emotionality

Response	Number of respondents	Percent
SA	49	14.5
A	216	63.9
Indecisive	39	11.5
D	23	6.8
SD	11	3.3
Total	338	100.0

Source: Survey Results, 2017

In Table 4.20, out of total households, 49(14.5%) respondents strongly agreed, 216(63.9%) agreed, 39(11.5%) indecisive, 23(6.8%) disagree, and 11(3.3%)strongly disagreed regarding their sensitive and emotional to practice the green consumption and recycling efficiency. This illustrated that the households were not strongly sensitive and emotional to protect the green environment. This was due to consumer's sensitive and emotionality were underlined the economic reasons instead of the environmental aspects that enlarged the gap between resource consumption growth and the green environment problems. This was due to the respondent's sensitivity and emotionality of attaining consumption and recycling efficiency was varying across their sex, poverty status, culture, family size, health and etc. For instance, large family, poor and female respondents were found sensitive and emotional to reduce an economic cost (water payments and charges) compared to environment costs. However, the consumers (households and factories) were not considered the groundwater consumption growth and environment restoration costs at Kombolecha industrial zone.

This study, specifically, investigated that the respondent's sensitivity and emotionality to limit the water consumption and waste recycling inefficiency efficiency was affected by their family size. For example, out of the total sample population, 158(46.7%) and 41(12.1%) respondents, who have small and large family size, respectively, were found sensitive and emotional to limit the water consumption so as to keep the living environment. However, they were not sensitive and emotional to protect the working and surrounding environment. For example, out of the total households, 50(14.8%) and 13 (0.04%) respondents, who have a small and large family size respectively, were sensitive and emotional to limit water quantity consumption and ensure waste recycling efficiency that kept an industrial environment. In sum, 280 (82.8%) respondents were become sensitive and emotional to limit water consumption and recycling efficiency so as to reduce the health problems. Out of them, 175(51.7%) and 41(12.1%) respondents, who have small and large family size respectively, were sensitive and emotional to make the water consumption and recycling efficient.

Table 4.21: Respondent's perception on Factory's Sensitivity and Emotionality

Response	Number of respondents	Percent
SA	28	8.3
A	121	35.8
Indecisive	28	8.3
D	122	36.1
SD	39	11.5
Total	338	100.0

Source: Survey Results, 2017

Table 4.21 shows the respondent's perception on factory's sensitivity and emotionality to poise the groundwater consumption growth and green environment tradeoffs. Accordingly, respondent's perception on factory's sensitivity and emotionality were reflected that factories gave due attention for tap water consumption. Respondents tap water consumption sensitivity and emotionality were rated strongly agree 28(8.3%), agree 121(35.8%), indecisive 28(8.3%), disagree 122(36.1%) and strongly disagree 39(11.5%). However, this study surveyed data indicated that factories were not sensitive and emotional to cut the groundwater consumption growth. Instead, factories were choosing the groundwater consumption so as to earn profit due to its devoid of payment. According to respondents, factories were not sensitive and emotional to incur an extra cost to recycle groundwater instead they were discharged the liquid waste to Borkena and Woreka rivers.

In other words, factories were sensitive and emotional to balance the water consumption and recycling efficiency that maximise the economic profit instead of protecting the social and environmental benefit. According to respondent's interview, however, factories were excessively consuming groundwater without further recycling processes. Factories were used the groundwater sources without making payments in Birr per unit consumption. The researcher asked the respondents: "do factories are sensitive and emotional to balance the groundwater consumption and environmental tradeoffs?" Out of the total households, 122 (36.1%) respondents disagreed that factories were sensitive and emotional to reduce water consumption inefficiencies but not the groundwater.

4.4 Determinants of Water Consumption and Green Environment Tradeoffs

The descriptive statistic calculations were not identified significant effects of factors on the water resource consumption growth and green environmental tradeoffs. This study, thus, determined the major significant factors that have an effect on water consumption growth and green environment tradeoff in Kombolecha. Guajarati (2004) and Greene (2011) procedures were followed and variable determination was significant when a p-value is less than 0.05 at the 95 confidence level. To begin this study analysis, the water resource consumption growth and green environment tradeoff was a dependent factor. It was assumed that the consumer's environment, economic and social aspects (independent factors) were coupled with the resource consumption growth and green environment tradeoff (dependent factors). The dependent and independent factors association and determination were measured by using a binary logistic regression, instrumental variable model, and simultaneous equation model and propensity score matching estimations.

4.4.1 Binary logistic Regression Result

This study, primarily, assessed whether the resource consumption growth and green environment tradeoff existed or not existed at Kombolecha. Consistent to this analysis, the respondent's binomial responses were categorized by either 'Yes' or 'No' discrete choices, which are presented by 1 and 0 values, respectively. In other words, household's, who said 'Yes', revealed existence of the tradeoffs between consumption growth and the green environment and presented by one. Otherwise, 'No' response. However, the household's green attitude, awareness, perception, behaviours, sensitive and emotional, ability and willingness to pay the money and embrace the green mind, consumption, market, technology use and job searches were independent factors.

Meanwhile, each independent factor was measured using five-point Likert scales starting from Strongly agree up to strongly disagree including indecisive responses. This study hypothesized that each mentioned independent factor would have no effect on the source consumption growth and green environment tradeoffs. Each mentioned independent factor's validity would be checked using Cronbach alpha values and computed 0.87, which shows valid.

The association between independent and dependent factors was formulated as;

Independent factors   Dependent Factor

Household's green awareness, perception, behaviours,
Sensitive and emotionality, ability and willingness to adopt:

- green mind
- green product
- greenmarket
- green technology
- green jobs
- green environment

⇒ consumption growth and green environment tradeoff

- Y_i = resource consumption growth and green environment tradeoffs (CONVETRD),

- X_i = household's green perception, behaviours, sensitivity and emotionality, ability and willingness

In other words, Y_i = 1 value is the probability that households replied 'Yes' that revealed an existence of tradeoffs between resource consumption growth and green environment problems. Otherwise, 0 and presents 'No' response. Based on these assumptions, this binary logit model was regressed the household's awareness, perception, behaviours and etc impacts on the water resource consumption growth and green environment tradeoffs. It was hypothesized that there was a workable association between the dependent and independent factors in the consumption and recycling efficiency.

4.4.1.1 Green Awareness

Respondent's green awareness about green mind (Awgrnmin), product consumption (Awgrnprco), buying goods (Awgrnbuy), technology (Awgrntech), job (Awgrnjob), and environment (awgrnenv) were independent factors whereas the eroded environment factors (Enverode) was dependent factors. This study found an association between the explained and explanatory factors mentioned in Table 4.22.

Table 4.22: Household's Awareness Effect on Eroded Environment (Enverode)

Enverode	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Awgrnmin	.9702457	.318214	3.05	0.002*	.3465577	1.593934
Awgrnpco	-.3368781	.4021661	-0.84	0.402	-1.125109	.4513529
Awgrnbuy	-.1041898	.4647268	-0.22	0.823	-1.015038	.806658
Awgrntec	-1.548705	.5414858	2.86	0.004*	.4874127	2.609998
Awgrnjob	.7695648	.5074346	1.52	0.129	-.2249887	1.764118
Awgrnenv	-1.104727	.2702974	-4.09	0.000*	-1.6345	-.5749535
_cons	.5935632					

NB: * indicated factor significant values at the 95 confidence level

Source: Survey Results, 2017

Table 4.22shows the household's awareness about adopting a green mind by 0.002 values, technology by 0.004 and environment resilience by 0.000 values were found statistically significant and altered the eroded environment (Enverode) at the 95 percent significance level. In other words, the household's, who were not awareness's in the period of water resource consumption and recycling processes were strongly aggravated the green environment problem in Kombolecha industrial Zone. For instance, when the consumer's awareness for the better green mind practice (Awgrnmin) was positively increased by one unit, the consumption growth and green environment tradeoffs was improved by 97.2 percent. Nevertheless, the consumer's awareness to carry out the green product consumption (Awgrnpco) was negatively affected the green environment depletion at the 95 percent confidence level. In other words, when the household's awareness about the green product consumption (AWgrnpco) was increased by one unit, the green environment depletion was reducedby35.9 percent, holding other factors constant.

In Kombolecha and Ethiopia at large, moreover, the household's awareness in relation to green environment resilience (AWgrnenv) was found statistically significant and negatively affected the water consumption growth and green environment tradeoffs by 0.000 values at the 5 percent significance level. For example, when the consumer's green awareness was increased by a unit, the green environmental depletion was decreased by110 percent, ceteris paribus, at the same level of significance. The household's awareness about green technology use was also negatively shaped the green environment depletion but it was positively affected the tradeoffs between water consumption growth and the green environmental problems.

This study found that the household's green awareness to adopt the green mind by 0.002; environment by0.000 and technology use with 0.004 values were statistically significant and negatively influenced the resource consumption growth and green environment tradeoffs at the 5 percent significance level. This revealed that the household's green awareness was strongly affected and portrayed to put into practice the green mind, technology use and job searches in the water consumption and recycling processes. However, the household's green awareness concerning the groundwater consumption and recycling efficiency was not found proactive to resilient the green environment. According to respondents, consumers (both household's and factories) were not worried to protect the groundwater consumption growth and the green environmental tradeoffs.

This study binary logistic regression showed that the household's awareness to practice the green mind (Awgrnmin) was positively improving the tradeoffs between consumption growth and green environmental problems. In other words, the household's awareness to adopt the green mind was among the key factor that predisposed the tradeoffs between consumption growth and green environmental problems. In addition to this, the household's awareness headed of green buying (AWgrnbuy) and technology use (AWgrntech) were positively affected the consumption growth and green environment tradeoffs. For the most part, in Table 4.23, consumer's awareness to use a green technology (AWgrntech) was drastically altered the consumption growth and green environment tradeoffs by 0.004 values at the 5 percent significance level. However, the respondent's awareness about the green product consumption (AWgrnpco) and jobs look for (Awgrnjob) were not principally affected the consumption growth and green environmental tradeoffs at the same level of significance.

Table 4.23: Green Awareness effect On Consumption Growth and Green Environment Tradeoffs (COENVTRD)

COENVTRD	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Awgrnmin	3.41829	.5883349	5.81	0.000*	2.265174	4.571405
Awgrnpco	-1.903145	.6648474	-2.86	0.004*	-3.206222	-.600068
Awgrnbuy	-.7616682	.4676024	-1.63	0.103	-1.678152	.1548157
Awgrntec	-1.862999	.752474	-2.48	0.013*	-3.33782	-.3881765
Awgrnjob	.7726067	.4415615	1.75	0.080	-.092838	1.638051
Awgrnenv	1.424179	.300324	4.74	0.000*	.8355544	2.012803
_cons	.5935632					

*indicates significant factors at 95 confidence level

Source: Survey Results, 2017

Table 4.23 exemplifies the household's green awareness and its effect on water consumption growth and green environment tradeoffs. Successively, the household's awareness to adopt a green mind (Awgrnmin) by 0.000; consumption (Awgrnprco) with 0.004; technology (Awgrntech) with 0.013 and environment (Awgrnenv) with 0.000 values were found statistically significant and influenced the consumption growth and green environment tradeoffs at the 5 percent significance level. However, this study found that the household's awareness about adopting the green mind were strongly affecting the tradeoffs between consumption growth and green environment tradeoffs (COENVTRD) with 0.000 values at the 5 percent significance level.

In addition to this, the household's socio-demographic characters were associated and coupled with the tradeoffs between resource consumption growth and the green environmental problems. For example, this study binary logistic regression depicted that thehousehold's birthplace by 0.003 values; housing ownership with 0.045 and health status with 0.000 values were statistically significant and influenced their awareness to practice the green mind at the 5 percent significance level. However, the household's age by 0.045, education level with 0.046 and housing ownership with 0.038 values were statistically significant and importantly created a difference to practise the green consumption and recycling processes. Moreover, the household's employment status by 0.000; types of working sectors with 0.011 and health status with 0.000 values were calculated statistically significant and strongly shaped their awareness and experience to the green consumption.

4.4.1.2 Green Perception

The household's green perception was measured in the context of their conscious understanding the green environment resilience subjects to the green mind adoption, product consumption, market exchange, technology use, and job searches. This study investigated that the respondent's green perception was found subjective and varied along with their diverse socio-demographic characters, such as sex, family size, education status, and etc. The household's green perception and its validity were measured by using a Cronbach alpha value. Accordingly, it was calculated 0.84, which presents valid. This study binary logistic regression pointed out that the household's green perception, in general, was keenly influenced the water consumption growth and green environment tradeoffs at the 95 percent confidence level. However, this household's green perception was strongly determined by their monthly income and poverty status, holding other factors constant. For example, poor respondents were not well perceived to practice the green mind, and technology use in their consumption.

Furthermore, the household's perception towards practising the green living environment (HHPGlivenv), consumption (HHPgrncon), production (HHpPgrnpro), marketing (HHPgrnmkt), technology (HHgrntech) and green industrial zone (HHgrnindu) were affected on the water consumption growth and green environment tradeoffs (COENVTRD). Among these factors, HHPlivenv, HHPgnpr, HHpgrntech and HHPgrnindu were negatively associated and affecting the consumption and green environment tradeoffs at the 5 percent significance level. For instance, hold other factors constant, a unit improvement of the household's perception to green the living environment (HHPLivenv) was negatively prejudiced the consumption growth and green environment tradeoffs by 63.4 percent. However, the household' perception about a green consumption (HHPgrnco) and market exchange (HHpgrnmkt) experiences were positively changed the consumption growth and green environment tradeoffs.

This study found out that the green consumption practices were negatively altered the resource consumption growth and green environment tradeoffs. In other words, it was computed that a unit improvement of the household's perception to adopt a green consumption was reduced the consumption growth and green environment tradeoffs by 85.7 percent. However, the household's perception towards a green market was not statistically significant and affected the water consumption growth and green environment (COENVTRD) tradeoff. This might be the cause that water supply was government provided services in Kombolecha.

Table 4.24: Household's Perception regression on COENVTRD

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHPLWENI	-.6335702	.2717764	-2.33	0.020*	-1.166242	-.1008982
HHPGrnco	.745936	.2937399	2.54	0.011*	.1702164	1.321656
HHPgrnpr	-.8574688	.3074394	-2.79	0.005*	-1.460039	-.2548986
HHPgrnMk	.0615853	.2636859	0.23	0.815	-.4552295	.5784001
HHPGTECH	-.4822763	.2521824	-1.91	0.056*	-.9765448	.0119922
HHPGindu	-.469131	.2546109	-1.84	0.065	-.9681591	.0298972
_cons	7.549852					

NB: * indicates significant factors at 95 confidence level

Source: Survey Results, 2017

Table 4.24 illustrates the household's perception effect on resource consumption growth and the green environment tradeoffs (COENVTRD). Based on this, the respondent's perception to protect the green living and working environment (HHPLWENI) by 0.02, production (HHPgrnpr) with 0.005, consumption (HHPGrnco) with 0.011, and technology (HHPgrnMk) use by 0.05 values were statistically significant and affected the resource consumption growth and green environment tradeoffs at the 5 percent significance level. However, the household's perception to exchange at the green market was not found statistically significant and affected the consumption growth and green environment tradeoffs. Nonetheless, the household's green perception to resilient the green industrial zone (HHPGindu) was negatively allied with the water consumption growth and green environmental tradeoffs. For example, when the household' perception to green an industrial zone (HHPGindu) was increased by a unit, the resource consumption growth and green environment tradeoffs was reduced by46.9 percent at the 5 percent significance level.

In addition to this, the household's perceptions were measured by good, bad, fair, not good and unfair response. The household's, who have a bad perception about the green environment, was significantly interconnected to their poverty status by 0.043,working sector types with 0.000 and health problems with 0.008 values at the 5 percent significance level. In other words, the respondent's poverty; working types and health status were determinant factors that lead them to have a bad perception about the green environment. The respondents, who have health problems, worked in the factory, and became poor, have a bad perception to resilient the green environment. However, non-poor respondents have a good perception to resilient the green environment. Poor respondents were found psychologically deprived; lacked confident and became voiceless to protect groundwater degradation and resilient the depleted environment in Kombolecha.

4.4.1.3 Green Behaviours

This study binary logistic regression measured the effect of household's consumption behaviours on resource consumption and green environment tradeoffs. The Households consumption behaviours were assessed in the context of their economic, environment and social orientation and concerns; living and working environment protection; future generation demand and environmental resilience. Out of the total sampled population, 244(72.2 %) household's consumption behaviours were targeted to reduce economic costs (water payments and charges) compared to the environmental costs. In order to run the binary regression, the household's water consumption behaviours were shortly presented by (HHBWgrnc); economic reasons and costs, (HHBWeco); living environment protection, (HHBlivp); neighbour's, (HHBWNip); working, (HHBworkig); future generation, (HHBWfutg) and environment protection by (HHBWenvp). Accordingly, the binary logistic model proved that respondents were differently behaved during water consumption and has a diverse relationship with the consumption growth and green environment tradeoffs.

The respondent's consumption behaviours were mainly associated and aimed tominimise theeconomic costs of resources. Despite consumers were not yet practiced the green consumption processes in Kombolecha, out of the total households, 228(67.5 %) respondents were willing to maintain the water consumption and recycling efficiency that minimised economic cost. Especially, female households were green behaved to reduce the economic costs of tap water compared to environment costs. However, male households were showed the willingness to pay the money that could resilient the green environment than female respondents. This study finding was supported by Smith (2013) that suggested people to practice green behaviour are an important reason, such as recycling so as to conserve the environment and its scarce resources.

Table 4.25: Household's Green Behaviours Effect on CONVETRD

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHBWgrnc	1.391093	.4142593	3.36	0.001*	.5791599	2.203026
HHBWeco	-.4847289	.3498434	-1.39	0.166	-1.170409	.2009516
HHBwlivp	-.0568422	.3695872	-0.15	0.048*	-.7812197	.6675354
HHBwNip	1.384769	.375413	3.69	0.000*	.6489733	2.120565
HHBwrkig	-.9832376	.3191808	-3.08	0.002*	-1.608821	-.3576547
HHBwfutg	-.5949729	.299767	-1.98	0.047*	-1.182505	-.0074403
HHBwenvp	-.0590846	.2898647	-0.20	0.838	-.627209	.5090397
_cons	1.274535					

NB: * indicates significant factors at the 95 percent confidence level

Source: Survey Results, 2017

Table 4.25 illustrates the household's consumption behaviours that attempted to reduce an economic aspect (HHBWgrnc) but increase the living environment protection (HHBWlivp) were negative and notably coupled with the tradeoffs between water consumption growth and the green environment problems. Accordingly, the binary logistic regression revealed that the household's consumption behaviours aimed to reduceeconomic costs (HHBgrnco) with 0.001; neighbour's environment (HHBwNip) with 0.000; living environment (HHBlivp) with 0.048, and the working environment protection (HHBwrking) with 0.002 values were statistically significant and importantly influenced the consumption growth and green environment tradeoffs at the 5 percent significance level. However, the household's consumption behaviours, which concerned the nieghbours environment protection, were strongly affected the water consumption and recycling efficiency. Nonetheless, this study result was not similar to Makower (2009), who argued that consumers may be interested in greening, but cannot identify it. This study found that consumer's green consumption behaviour was different to protect their living, working and the surrounding environment.

Table 4.26: Water Consumption Behaviours Effect on COENVTRD

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHBGNCOF	-.855952	.2564686	-3.34	0.001*	-1.358621	-.3532827
HHBWORY	.7734017	.2250477	3.44	0.001*	.3323163	1.214487
HHBWatLO	1.050137	.1965207	5.34	0.000*	.6649631	1.43531
HHBWagft	.087821	.1597219	0.55	0.582	-.2252283	.4008702
_cons	-1.425148					

NB: * indicates significant factors at 95 % confidence level

Source: Survey Results, 2017

Table 4.26measures the household's behaviours and effects in lieu of the water consumption and green efficiency (HHBGNCOF); worrying about the green environment (HHBWORY); fear about water loss (HHBWatLos), and save water for future generation (HHBWagft). In addition to this, it consists of the main determinate factors of the resource consumption growth and green environment tradeoffs (COENVTRD) at the 95confidence level. For instance, the household's green consumption behaviour efficiency (HHBGNCOF) by 0.001and worries about the green environment depletion (HHBWORY) by 0.001 values were statistically significant and changed the water resource consumption growth and green environment tradeoffs in Kombolecha. However, the household's threats about the water loss (HHBWatLO) were statistically significant and strongly affected the water consumption growth and green environment tradeoffs by 0.000 values at the 5 percent level of significance.

In addition to this, the household's consumption behaviours were all for concerning an economic reason by 0.000; working environment with 0.000; the living environment with 0.007 and environmental pollution with 0.000 values were subjective and importantly influenced the consumption growth and green environment tradeoffs at the 5 percent significance level. Moreover, the household's green behaviours regarding the water consumption efficiency by 0.001; neighbours pollution reduction by 0.000; working environment protection with 0.002 and keeps the future generation demand with 0.047 values were statistically significant and influenced the water consumption growth and green environment tradeoffs at the same level of significance. However, the household's consumption behaviours that pinpointed the green environmental resilience, was not identified as a significant factor of consumption growth and the green environment tradeoffs. It was, nonetheless, calculated that consumers were behaving and contemplating the economic costs (tap water payments) than environmental costs. This study was different from Jenkins & Yakovleva (2006) who pinpointed the businesses should indicate the impact of green initiatives on business performance.

4.4.1.4 Sensitivity and Emotionality

As like other factors described so far, the household's sensitive and emotionality for an economic, social and environmental benefits and costs were influenced the resource consumption growth and green environment tradeoffs. This household's sensitive and emotionality were measured by using the five-point Likert scales. The respondents have a diversified sensitive and emotionality in favor of their economic, social and environmental benefits and costs despite they were belonged in the same level of sex, family size and income category. Based on this, this study computed the household's sensitive and emotionality effect on the consumption growth and green environment tradeoffs by using a binary logistic regression model.

Along with this, the household's monthly income (economic factors), health status (social factors) and water quantity limit and waste recycles (environmental factors) were associated with their sensitive and emotionality to balance the consumption growth and green environment tradeoffs. Based on this, the binary logistic regression model was measured the respondent's sensitive and emotionality for economic, social, and environmental aspects that were substantially affected the consumption growth and green environment tradeoffs at the 5 percent level of significance. According to experts interviewed in the field, despite the green environment resilience required financial resources, yet, consumers were not correspondingly found sensitive and emotional to balance the groundwater consumption growth and its tradeoffs on the green environment.

Table 4.27: Sensitivity and Emotionality Effect on COENVTRD

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHSSEco	.0809355	.2230931	0.36	0.717	-.3563189	.5181899
HHSSLIV	1.104056	.4754861	2.32	0.020*	.1721205	2.035992
HHSSHLTH	-.9077366	.4251212	-2.14	0.033*	-1.740959	-.0745143
HHSSNIB	-.1578458	.2202587	-0.72	0.474	-.589545	.2738533
_cons	1.886986					

NB: *indicates significant factors at the 95% confidence level

Source: Survey Results, 2017

In Table 4.27, the household's sensitive and emotionality for economic costs (HHSSEco), living environment protection (HHSSLIV), health protection (HHSSHLTH) and Neighbour's environment protection (HHNIB) were altered the tradeoffs between consumption growth and green environment problems (COENVTRD). Accordingly, the household's sensitive and emotionality for the living environment (HHSSLIV) by 0.02 and health protection (HHSSLTH) by 0.033 values were statistically significant and affected the consumption growth and green environmental tradeoffs (CONVETRD) at the 5 percent significance level. Addition to this, the respondent's sensitive and emotionality for economic aspects (HHSSEco) by 0.004; living environment (HHSSLIV) with 0.000 and health protection (HHSSLTH) with 0.000 values were statistically significant and crucially affected the consumption growth and green environment tradeoffs at the 5 percent significance level. However, the respondent's sensitive and emotionality for neighbour's environment (HHSSNIB) was not found statistically significant and determined the water consumption growth and green environment tradeoffs. This study result was consistent to Moisande (2007) that depicted people decisions on practical environmental or ethical solutions often result in trade-offs between conflicting issues.

However, since households have a diverse culture, ethnics and religious in Kombolecha, respondent's sensitivity and emotionality to resilient the green environment was found different. This study logistic regression proved that the household's consumption culture was statistically significant and strongly determined their sensitive and emotional to practice the green consumption by 0.000 value at the 5 percent significance level. In other words, the household's consumption culture considerably altered the water consumption and recycling efficiency that minimise the wide tradeoffs between consumption growth and the green environment problems at the 95 confidence level. This study, therefore, integrated this significant household's consumption culture (social indicator), which is remarkable for eco-efficiency, to establish a socio-eco efficiency framework. The household's sensitive and emotionality for an economic cost by 0.000; the living environment by 0.032; health aspects by 0.032 and neighbour's pollution by 0.003 values were statistically significantand determined the water consumption and recycling efficiency at the 5 percent significance level.

In addition to this, the household's socio-demographic characters were differently affected their sensitive and emotionality of balancing the consumption growth and green environment tradeoffs. For example, this study identified that the household's age was positively and significantly influenced their sensitivity and emotionality to balance the tradeoffs between consumption growth and green environment by 0.08 values at the 5 percent significance level. When the household's age was increased by a year, holding other factors constant, their sensitive and emotional to balance the water consumption growth and green environment efficiency was increased compared to the rest age category. On the other hand, the household's sensitive and emotionality in the working environment by 0.000 values and health protection by 0.045 values were altered the water consumption and recycling efficiency at the 95 percent confidence level. Employed respondents, who felt sick, were sensitive and emotional to resilient the greener living environment.

Well thought out this, the household's sensitivity and emotionality were significantly determined by their level of education and religious by with 002 values at the 5 percent significance level. However, large family size households were often sensitive and emotional to reduce economic costs than environment and social costs. This study finding was different from Chyong, *et al*. (2006) findings that many people have high ecological concern but have the sentiment that the preservation of the environment is the prime responsibility of the government. These study respondents were exceptionally contemplated that groundwater restoration activities have to be enforced an integration between the households, factories and municipal duties.

Table 4.28: Socio- Demographic Effects on Sensitivity and Emotionality (HHSSLIV)

HHSSLIV	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
HHage	-.148636	.2215096	-0.67	0.502	-.5827869	.2855149
HHsex	.6338286	.2622534	2.42	0.016*	.1198214	1.147836
HHmarst	.335173	.2029657	1.65	0.099	-.0626325	.7329785
HHeduc	.3739473	.1229388	-3.04	0.002*	-.614903	-.1329916
HHfamsi	-.3340336	.2975407	-1.12	0.262	-.9172026	.2491354
HHEmp	.8013698	.3288405	2.44	0.015*	.1568542	1.445885

***Indicates significant factor at 95 % confidence level**

Source: Survey Result, 2017

Table 4.28 predicts household's socio-demographic characters' association and effect on their sensitivity and emotionality to resilient the green living environment (HHSSLIV). For example, the household's education level and employment status were directly associated with their sensitive and emotionality to resilient the green living environment. However, the household's sex was indirectly associated and influencing their sensitive and emotionality to enhance the water consumption and recycling efficiency. Above all, female respondents were prone sensitive and emotional to green the living environment. This let anyone see that household's head sex determined the green environment resilience in Kombolecha industrial zone, where households and factories were alarmingly speeding up the groundwater consumption without quantity restriction.

In addition to this, this study identified that the respondent's family size by 0.000 values was meaningfully determined their sensitive and emotionality for economic costs (water payments). Similarly, the respondent's employment status by 0.000 and health aspects by 0.017 values was statistically significant and influenced their sensitive and emotionality to protect the neighbour's environment. Likewise, the household's sensitive and emotionality to keep their health issues were extensively affected by their age with 0.008 and religious with 0.038 values at the 5 percent significance level. Respondents, who were highly religious followers, were sensitive and emotional to stay poised the water consumption and waste recycling gaps.

Table 4.29: Socio- Demographic Effect on Health Protection

HHSSHLTH	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
HHage	-.5359872	.2170976	-2.47	0.014*	-.9614906	-.1104837
HHsex	.6380551	.2634123	2.42	0.015*	.1217766	1.154334
HHmarst	.483575	.2027026	2.39	0.017*	.0862853	.8808647
HHeduc	-.1871865	.1196355	-1.56	0.118	-.4216678	.0472949
HHfamsi	-.69758	.2945661	-2.37	0.018*	-1.274919	-.1202409
HHEmp	.0538734	.3184143	0.17	0.866	-.5702071	.677954

***indicates significant factors at 95% confidence level**

Source: Survey Results, 2017

Table 4.29shows the household's socio-demographic effects on their sensitivity and emotionality for health protection and in turn, ensured the green resilience. Accordingly, the household's sensitive and emotionality for health protection (HHSSHLTH) was remarkably altered by their age (HHage) by 0.014, sex (HHsex) by 0.015, marital status (HHmarst) by 0.017 and family size (HHfamsi) by 0.018 values at the 5 percent significance level. In other words, all through the water consumption and recycling processes, the respondents, who were educated (above 12 grades) and became female, were found sensitive and emotional to keep the green environment so as to keep their health. Similarly, married and large family member respondents were sensitive and emotional to protect the green environment so as to keep their family's health. When the household's education level was increased by a unit, the water consumption and recycling efficiency was increased by 18.7 percent. However, when the household's age was increased by one year, their sensitive and emotionality for water consumption and recycling efficiency was increased but reduced their health protection by 53.6 percent. In Kombolecha, however, the household's ability and willingness to pay the money also determined the resource consumption growth and green environment tradeoffs.

4.4.1.5 Ability and Willingness to Pay

This study explored that household's ability and willingness to pay the money (qualitative characters) were associated and affected the consumption growth and green environment tradeoffs. Respondent's ability and willingness to pay the money was measured by using five-point Likert scales and binary logistic regression model. For further analysis, the resource consumption growth and green environment tradeoff (CONVETRD) was a dependent factor. Whereas, the household's ability (HHablity), willingness to pay (HHwiling), water consumption limit (watrconl) and consumption culture (HHRcult) were assumed independent factors. This study logistic regression computed that the household's ability to pay (HHability), water consumption limit (watrconl) and consumption cultures (HHcult) were significantly determined the consumption growth and green environment tradeoffs at the 95 percent confidence level. However, the household's willingness to pay the money was negatively prejudiced the CONVETRD at the same level of confidence. In other words, when the household's willingness to pay the money was increased by $1 (27.27Birr), the tradeoffs between resource consumption growth and the green environment was decreased by 31.4 percent.

The household's ability and willingness to pay the money was dependent and different across the respondent's sex, family size, age, and education level. In addition to this, the respondent's ability and willingness to pay the money was also determined by their green attitude, perception, awareness, and consumption behaviours. According to James (2007) findings, 'behind differences in willingness to pay lie differences in ability to pay.' However, in this study, it was found that the respondents, who were able to pay, were not willing to pay the money to balance water consumption growth and the green environment tradeoffs.

Table 4.30: Household's Ability and Willingness Effect on COENVTRD

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
HHablity	.4656368	.2169348	2.15	0.032*	.0404523	.8908213
HHwiling	-.3139389	.271906	-1.15	0.248	-.8468648	.218987
watrconl	.6537209	.1753818	3.73	0.000*	.3099789	.9974628
HHFRcult	1.302826	.3207633	4.06	0.000*	.674142	1.931511
_cons	-3.042286					

NB: * indicates significant indicators at the 95 % confidence level

Source: Survey Results, 2017

Table 4.30computes the household's ability and willingness effect on the resource consumption growth and green environment tradeoffs (COENVTRD). Accordingly, household's ability to pay money (HHability) by 0.32 values, water consumption limit (HHWatrconl) by 0.000 values and consumption culture (HHFRRcult) by 0.000 values were statistically significant and determined the tradeoffs between water consumption growth and green environment tradeoffs. Above all, this study identified that respondent's ability to pay the money was altered by their green consumption with 0.012 values and production with 0.021 values at the 5 percent significance level. This study, nonetheless, identified that the respondent's consumption culture (HHFCULT) and water quantity limit (Watrconl) by 0.000 values were stronglyaffected their willingness to pay the money and in turn, influenced the consumption growth and green environment tradeoffs. The household's sensitivity and emotionality for economic costs (HHSSEco), living environment (HHSSLIV), health (HHHLTH) and neighbour's environment protection (HHSSNIB) were influenced their willingness to pay the money.

Table 4.31: Household's Sensitive and Emotionality effect on Willingness to Pay

HHwiling	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHSSEco	.1539342	.1127015	1.37	0.172	-.0669567	.374825
HHSSLIV	1.230283	.223767	5.50	0.000*	.7917074	1.668858
HHSSHLTH	-.4806796	.1712834	-2.81	0.005*	-.816389	-.1449703
HHSSNIB	.1854156	.1652914	1.12	0.262	-.1385495	.5093808

NB:* indicates significant factors at 95 confidence level

Source: Survey Results, 2017

Table 4.31 consists household's sensitivity and emotionality for economic cost reduction (HHSSEco), living environment (HHSSLIV), health protection (HHSSHLTH), and neighbour's environment protection (HHSSNIB)effects on their willingness to pay the money that used to balance water consumption growth and green environment tradeoffs. This willingness to pay the money was measured in the attempt of balancing the consumption growth and green environment tradeoffs (green resilience). The respondent's sensitive and emotionality for the living environment (HHSSLIV) by 0.000 values and health protection(HHSSHLTH) by 0.005 values were statistically affected their willingness to pay the money, which used to balance the water resource consumption and recycling efficiency at the 5 percent significance level. The respondent's sensitive and emotionality to protect their health was negatively affected their willingness to pay the money. For instance, when the household's medication and medicine costs, which recover their health, were increased by one Birr, their willingness to pay the money for the green environment resilience was decreased by 48 percent.

Table 4.32: Household's Green Awareness Effect on Willingness to Pay

HHwiling	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Awgrnmin	2.999994	.9482209	3.16	0.002*	1.141515	4.858473
Awgrnpco	-.4207218	.7344062	-0.57	0.567	-1.860132	1.018688
Awgrnbuy	-1.053619	.8176895	-1.29	0.198	-2.656261	.5490228
Awgrntec	-19.33869	1.449714	-13.34	0.000*	-22.18008	-16.4973
Awgrnjob	5.183009	1.384342	3.74	0.000*	2.469749	7.896269
Awgrnenv	3.252163	.9304756	3.50	0.000*	1.428464	5.075862
_cons	5.913674					

NB: * indicates significant factors at 95 % confidence level

Source: Survey Results, 2017

Table 4.32 reveals the diverse green awareness effect on the household's willingness to pay the money, which reduced the consumption growth and green environment tradeoffs in Kombolecha. With this respect, this study binary logistic regression proved the household's green awareness was determined their willingness to pay the money. For example, the respondent's awareness to practice a green mind (Awgrnmin) by 0.002, technology (Awgrntech)by 0.000, job (Awgrnjob)by 0.000, and environment resilience (Awgrnenv)by 0.000 values were statistically significant and importantly changed the willingness to pay the money at the 5 percent significance level. In other words, when the household's green awareness about environment (Awgrnenv) was improved by one unit, holding other factors constant, their willingness to pay the money was increased by 3.25coefficient values and hence reduced the gaps between water consumption and recycling inefficiency. Nonetheless, the household's awareness about the green product purchase and consumption were not statistically significant and influenced the willingness to pay the money. This might be the case that consumers have lack of green production and markets opportunities in Ethiopia cities including Kombolecha.

The household's willingness to pay the money was predisposed by the consumption behaviours and activities. This study binary logistic regression computed that the household's willingness to pay the money that could recover the green environment was extensively determined by the consumption behaviours by 0.000; worries about water loss by 0.000 values and keeps the future generation demand by 0.000 values at the 5 percent significance level. The respondent's indecisive response about willingness to pay the money was significantly consistent to their indecisive consumption behaviours, which exclusively focused on economic cost by 0.005 and culture by 0.000 values at the 5 percent significance level. It was fortified that respondent's willingness to pay the money was ardently affected the water consumption growth and green environmental tradeoffs.

Table 4.33: Household's Socio-demographic Effects on Willingness to Pay

HHwiling	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHeduc	.6552057	.2854028	2.30	0.022*	.0958266	1.214585
HHEmp	-1.089109	.4032474	-2.70	0.007*	-1.879459	-.2987586
HHealth	-1.131754	.4458894	-2.54	0.011*	-2.005681	-.2578264
HHfamsi	-.8354908	.5529413	-1.51	0.131	-1.919236	.2482543
HHrelg	-.5039554	.2550126	-1.98	0.048*	-1.003771	-.0041399
_cons	2.352089					

NB:* indicates significant factors at the 95 % confidence level

Source: Survey Results, 2017

Table 4.33describes the household's socio-demographic effect on their willingness to pay the money that balanced the water consumption growth and green environment tradeoffs. Based on this, the household's education level was positively affected the willingness to pay the money, which could weigh scales between water consumption growth and the green environment tradeoffs. For example, when the respondent's education level was increased by one grade, their willingness to pay the money was also increased by 65.5 percent at the 95 confidence level, citrus Paribus. There were indirect association between the respondent's family size, religious, health, and the willingness to pay the money. In general, the respondent's education level (HHeduc) by 0.002 values, religious (HHrelg) by 0.048 values, employment status (HHEmp) by 0.007 values and health status (HHealth) by0.011 values were significantly influenced their willingness to pay money and poise the water consumption growth and green environment tradeoffs at the 5 percent significance level.

The household willingness to pay was dynamically interconnected along with the diverse household's socio- demographic characters. In other words, there was no linear association between respondent's socio-demographic characters and the willingness to pay the money that used to change the consumption growth and green environment tradeoffs. Among included factors in Table4.34, the household's family size was not statically significant and affected the respondent's willingness to pay the money that used to balance the tradeoffs between water resource consumption growth and green environment problems. Table 4.33 depicts that when the household's family size was negatively associated with their willingness to pay the money at the 5 percent level of significance. The respondent's religious also inversely affecting their willingness to pay the money. In other words, most respondents, who were highly concerned their religious, were willing to pay the money so as to balance water consumption growth and green environment problems Kombolecaha.

4.5. Water Consumption and Tariffs

This study assessed consumer's water consumption intensity and payments (tariff) imposed per m^3 use per Ethiopia Birr. This study investigated that households and factory's water consumption, particularly groundwater, were put an immense pressure on the green environment. According to respondents, and the factory's expert interviewed, none of the factory was used rainwater for consumption and production activities. Instead, both factories and households were used pipe and groundwater source for consumption and production processes. However, consumer's water consumption was varied across their business types and activities.

Ethiopia water policy in 1999 states: "ensures that the exploitation of groundwater shall be based on the abstraction of the maximum amount equal to the sustainable yield as determined by the competent authorities, who establish the regulatory norms". This study, however, investigated that both households and factories were consumed groundwater without payment and rehabilitation costs. As a result, over-consumption of groundwater source was eroding the biodiversity and water ecosystem in drought affecting Kombolecha. This study respondent claimed that groundwater consumption and recycle intensity regularly altered the nature of the green environment. Undeniably, water policy in Kombolecha recognized that water is an economic good for people and firms, nonetheless, there were no groundwater management practices that restrict over–consumption processes. FDRE government land policy dictates that land should be given for investors per lease along with the land size and its productivity". However, the groundwater was not yet, considered to minimise over degradation by firms despite it could aggravate the continuous drought and starvations.

This study found the same concerns with Global (2000) findings, which pinpointed there is no systematic monitoring of groundwater quality across Africa, or nationally in most countries, and there are large regions where little or no data are currently available. Ethiopia groundwater was not exceptionally studied in detail to lessen over-exploitation. There was no a significant difference between the factory and non-factory respondent's water consumption and recycling intensity. Both consumers, in other words, were used tap water for food, wash, bath, toilet and other domestic production activities but they were discharged wastes to the nearby environment. According to respondents, the diversified consumption culture was widening the gap between water consumption and recycling intensity. Even though consumers were willingness to pay the money for groundwater, the municipal and water supply office were not banned over-water consumption.

Kombolecha water supply rate was among the lowest compared to other industrial cities in the world. For instance, it was computed that water supply and sewerage enterprise office has rated a 285 litre per second delivery capacity. This study, however, found that 120 litre water per second rate supplied to customers. This rate was not included the groundwater consumption in Kombolecha. According to Kombolecha water supply and enterprise office (2017) there were 11,844 private households, 734 commercials, 207 governments, 43 factories, 69 bono regular, and 17 bono contract water consumers. However, experts and managers interviewed in this study replied that the enterprise office was concerning about groundwater sources, which was used by the factory's and household's consumption Out of sampled factories, textile, beer, and tannery factories were the highest groundwater consumer without making payment. Kombolecha water enterprise office has to set rules to develop a sense of balance the groundwater consumption and recycling process.

Kombolecha water supply and enterprise office (2017) indicated that there were 11,610 actives, 124 disconnect and 110 pending tap water customer's services. Moreover, the household's average water consumption intensity per Ethiopia Birr per year was calculated 3,410,374.32 Birr; factory's pipe water consumption 1,207,784.86 Birr; government 1,924, 325.51 Birr and public water consumption 1,208,784.86 Birr. These consumer's water consumption intensities were including groundwater consumption payments. According to respondent's, though groundwater could be a source of revenue, however, it was not considered and included in Ethiopia, particular to Kombolecha city tax category. In its place, investment and industry office provided the land subject to lease, which is not, yet, precisely incorporated the water sources in the industry policy. The factories were consumed the groundwater as much as they could use for optimal production.

According to the respondents, factories were excessively used groundwater and discharged wastes to Worka and Borkena river without recycling. The groundwater consumption and waste discharges were varied along with the factory's production type. The consumption intensity was measured using the quantity of water consumed per output. Procedure conducted to compute water consumption intensity was followed along with the factory's production process. It was found that there were no standards set for groundwater consumption efficiency. As much as factories were consumed groundwater, water supply and sewerage enterprise office were not restricted over-water consumption. This study explored that factory's water consumption intensity and recycling was one of the evident challenges of maintaining the consumption growth and green environment tradeoffs.

Table 4.34: Water Consumption Tariff in Kombolecha

Consumption/m^3	Water consumer per types of services				
	Private	Bono	Government	Factory	Commercial
0.5	3.0	1.50	4.5	5	4.50
5.1-10	3.25	1.50	5.00	5.50	5.00
10.1-15	3.75	1.50	5.50	6.50	5.50
15.1-25	4.25	1.50	6.00	7.50	6.00
25.1-40	5.50	1.50	6.50	8.50	6.50
Above 40	6.00	1.50	7.00	9.00	7.00

Source; Kombolecha Water supply and sewerage enterprise office, 2016

Based on the tariff rates in Table 4.34, Kombolecha water supply and sewerage enterprise office was collected 2,392,615.25 Birr from private (household) consumers; 1,052,942.5 Birr from commercial, 1,916,698.2 Birr from government; 1,206,734.5 Birr from factory; 105,657.5 Birr from public, and 4336.7 Birr from Bono users. The average annual water sold, in sum, was calculated 6,718,015 Birr. This indicates that the households were consuming 35.6 percent of pipe water. However, the factories were used 75 percent groundwater sources. The groundwater value adds on the social, economic and environmental indicators were not, still, calculated during consumption process. This study, thus, integrated and identified social, economic and environmental indicators effects on water consumption and recycle efficiency using econometric models.

This study calculated the water value adds of product per Birr from Kombolecha water supply and enterprise office. However, the water value adds of groundwater was not incorporated as a source of revenue in the water supply and sewerage enterprise office. As a result, continuous drought and rainfall variability manifested people's livelihoods in Ethiopia and specific to Kombolecha rural kebeles. In addition to this, the household social aspects (poverty and consumption cultures) were not considered and integrated to the their economic and environmental aspects (eco-efficiency). This study, therefore, formulated a socio-eco efficiency framework by identifying the social, economic and environmental indicators in water consumption and recycling efficiency. This study shared Mark, *et al.* (2002), who described the sheer size of the increase in the world's industrial consumption still leads to an increase in total industrial water demand'.

4.6 Indictors Effect on Water Consumption and Recycling Efficiency

This study investigated the economic, social and environment indicators effect on the water consumption and recycling efficiency. It was assumed that each mentioned indicator has sub indicator. These Indicators have assumed a heterogeneous covariance due to the existence of instrument's continuous variance. Instrumental variable model and two stage least square estimation techniques were used to test the heterogeneous covariance. This was due to the ordinary least square was violated its basic assumption along with Guajarati, (2004) and Greene, (2011) criterion. This study recruited suitable instrumental variable model regression that would be applied a two stage least square estimation techniques to measure and identify the significant indicator's effect on the water consumption and recycling efficiency and in turn resilient the green environment.

4.6.1Indicators Effect on the Green Environment (ENVISTAt)

The green environment status was described in the notion of achieving green resilience via changing the consumer's water consumption and recycling efficiency. This was due to the households were consumed and recycled water resource in a different way to carry out the economic, social and environmental achievements. This study established the endogenous (economic & environmental indicators) and exogenous indicators (social aspects) during investigation. Accordingly, this study instrumental variable model (IVM) was regressed the social, economic and environmental indicators effect on the water consumption and recycling efficiency. In other way round, the household's social indicators (consumption culture and behaviours) were exogenously related with the water consumption and recycling efficiency. However, the household's economic aspects (monthly income) and environmental indicators (water quantity and waste limit) were endogenously associated with the water consumption and recycling efficiency. As a result, the household's social, economic and environmental indicators were adversely determined the green environment status (ENVISTAt) by altering the water consumption and recycling efficiency.

Table 4.35: Socio- Demographic Effects on Green Environment (Envistat)

ENVISTAt	Robust Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHEmp	-1.458395	1.432333	-1.02	0.309	-4.265716	1.348925
HHincom	.5087591	.8866146	0.57	0.566	-1.228973	2.246492
HHwiling	-1.161162	.5414679	-2.14	0.032**	-2.22242	-.0999049
HHousing	3.018785	1.748892	1.73	0.084	-.408979	6.44655
HHsex	.3599964	.8506045	0.42	0.672	-1.307158	2.027151
HHage	-.9628701	.4511674	-2.13	0.033*	-1.847142	-.0785983
HHeduc	-.0285049	.2379373	-0.12	0.905	-.4948534	.4378436
HHfamsi	.4575423	.4264858	1.07	0.283	-.3783544	1.293439
_cons	4.548989					

** indicates significant factor at 5% significance level

Instrumented: HHEmp HHincom HHwiling HHousinG.

Instruments: HHsex HHage HHeduc HHfamsi HHFRcult HHSSEco HHSSLIV HHSSHLTH HHSSNIB

Source: Survey Results, 2017

Table 4.35 illustrates the instrumented and instruments factor's impacts on the green environment status (ENVISTAt). In this study context, theinstrumented factors (endogenous)were comprised of household's sex (HHsex), age (HHage), education level (HHeduc), family size (HHfamsi), employment (HHemp) and monthly income (HHincom). Whereas, the instruments (exogenous factors)were consisted the household's consumption culture (HHRCULT), sensitive and emotionality for economic cost (HHSSECO), sensitive and emotionality for the living environment (HHSSLIV), sensitive and emotionality for health protection (HHSSHLTH) and sensitive and emotionality for neighbours environment (HHSSNIB). Based on this, this study instrumental variable model and two stages least square calculated that the household's willingness (HHwiling) by 0.032 values and age (HHage) by 0.033 values significantly influenced the green environment at the 5 percent significance level.

Moreover, this study identified that respondent's housing ownership, ability to pay the money and employment status were strongly influenced the green environment status at the same level of significance. The exogenous effect of household's awareness and its association with endogenous factors such as, employment status, ability, willingness, housing ownership, and monthly income were regressed by using instrumental variable model regression. This study instrumented or exogenous factors were respondent's awareness about the green mind (Awgrnmin), product consumption (Awgrnpco) buying goods (Awgrnbuy), and technology use (Awgrntec), resilient green environment (Awgrnenv). These factors were partly associated with the endogenous factors in Table 4.35 and in turn, changed the green environment status (ENVISTAt).

Table 4.36: Exogenous and Endogenous Indicator's Effect on ENVISTAt

ENVISTAt	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
HHEmp	-6.492766	2.522378	-2.57	0.010*	-11.43654	-1.548997
HHincom	.9632918	1.669307	0.58	0.564	-2.30849	4.235073
HHablity	1.200356	.5037952	2.38	0.017*	.2129353	2.187776
HHwiling	.96256	.7621231	1.26	0.207	-.5311738	2.456294
HHousing	-4.718186	2.645914	-1.78	0.055*	-9.904083	.4677105

***indicates significant factors at 95% confidence level**

- **Instrumented:** HHEmp HHincom HHablity HHwiling Housing.
- **Instruments:** HHsex HHage HHeduc HHfamsi Awgrnmin Awgrnpco Awgrnbuy Awgrntec Awgrnenv

Source: Survey Result, 2017

Table 4.36 consists of instrumented and instrument factor's effect on the green environment status (ENVISTAt) in Kombolecha. Instrumented factors were independent factors, which were associated with the green environment status. However, instruments factors were endogenous and exogenous factors. In this study, household's sex (HHsex), ages (HHage), education level (HHeduc) and family size (HHfamsi) were endogenous factors, which determined in the model. Whereas, the exogenous factors that consisted of the household' awareness to adopt the green mind (HHgrnmin), product consumption (Awgrnpco), buying (Awgrnbuy), technology (Awgrntech) and environment resilience (Awgrnenv). In this study, among factors regressed by in IVM and two stage least square estimation, it was assumed that some part of the exogenous factors, which partly associated with endogenous factors, were indirectly affected the green environment status (ENVISTAt).

In addition to this, respondent's employment status (HHemp) with 0.01 values was significantly changed the nature of green environment. This was due to Kombolecha consisted an industrials zone, which increased population density and unemployment rate. This employment rate was inversely associated with the green environment problems. For example, it was calculated that when the household's employment rate was decreased by a unit, holding other factors constant, the green environmental status was increased by 64.9 percent, citrus paribus.

The respondent's ability to pay the money (HHability) was also significantly influenced the green environment status (ENVISTAt) by 0.017 values at the 95 percent level of confidence. In other words, when the household's ability to pay was increased by one Birr (equivalent $27.57), holding other factors constant, and the green environment status was positively increased by 120 percent. On the other hand, the household's housing ownership (HHousing) by 0.055 values was significantly affected the green environment status (ENVISTAt) at the 95 percent confidence level. Respondent's, who lived at their own house, were showed willingness to resilient the green environment compared to those who lived at a renting house. This revealed the housing ownership was negatively influenced the green environmental problems. For example, when the household's housing ownership was increased by a unit, the water consumption and green environment tradeoffs was increased but the green environment problem was decreased by 47 percent, ceteris paribus.

4.6.2 Socio - Eco Efficiency Effect on Water Consumption and Recycling Efficiency

This study built that socio- eco efficiency, which integrated the consumer's economic (monthly income), social aspects (behaviours, culture, and poverty) and environmental indicators (water limit and waste recycles).It was identified and determined that these indicators were changing the water consumption and recycling efficiency (WCORECF) and in turn, impelled the green environment resilience. This study socio-eco efficiency was consisted of the social, economic and environmental sub-indicators. The average indicators voting scores were calculated by using SPSS24 software version. For example, the respondent's social, economic and environmental indicator voting scores were calculated8.5, 8 and 7.5 respectively that allowed to further regression. In pursuit of this regression, this study used instrumental variable model regression (IVM) that consisted of the household's economic indicator (monthly income); social indicator (household's poverty) and environment indicator (water limit and waste recycles). Finally, this study integrated these indicators to drive the socio-eco efficiency framework by using two stage least square regressions.

Within this respect, this study two stage least square estimation illustrated that the household poverty was exogenously pretentious to water consumption and recycle efficiency. However, respondent's monthly income in Birr, water quantity and waste discharges per m^3were endogenously associated with the water consumption and recycling efficiency. This study instrumental variable model regression (IVM), in general, identified that the social, economic and environmental indicators were affected the water consumption and recycling efficiency and in turn the green environment. This IVM model was integrating the household's poverty, consumption culture, behaviours, monthly income, and waste discharged to the Borkena river so as to establish the socio- eco efficiency framework. Finally, the IVM proved that the socio- eco efficiency indicators, which consisted the main sub indicators, were guided the water consumption and recycling efficiency.

This study finding was different from BASF (2009) and ESCAP (2014) eco efficiency indicators investigation that commenced in the company's production process. Unlike Sailing, *et al, (*2013) SEE balance analysis, this study was, exceptionally, incorporated the household's social indicator (poverty, behaviours, culture and etc) into economic (monthly income) and environmental indicators (water quantity and waste limit) in the course of water consumption and recycling process. However, this study social indicator, such as poverty, consumption culture behaviours, religious and etc were calculated statistically significant and in sequence regulated the water consumption and recycling efficiency. The social indicator's effect on the consumption and recycling efficiency were integrated and regressed together with the economic and environmental indicators by using a two stage least square regression and STATA 14 software version.

The instrumental variable model (IVM) substantiated social indicators (household's poverty and consumption culture) and exogenously determined the water consumption and recycling efficiency at the 5 percent significance level. This study rationality laid and fitted to the benchmark: social, economic and environmental indicators were the key pillars to guaranty the green environment resilience in Kombolecha and at large in Ethiopia. Then again, indicators were in a different way distorted the consumption and recycling efficiency at the 95 percent confidence level. However, this study socio-eco efficiency indicator were assessed at the household's level, which made different from the WBCSD (2009), ESCAP (2011), ESCAP (2014), Sailing, *et al*. (2013) indicators inquiry on chemical company production. This study two stage least square estimation was not, yet, used by Sailing, *et al.* (2013), who integrated the society, economic and ecological indicators and built the socio-eco efficiency framework. This study consumer's monthly income (economic factors), culture, water quantity and waste discharges were substantially built a socio-eco efficiency framework. The effect of each indicators on the socio-eco efficiency application were computed in Table 4.37.

Table 4.37: Economic Indicators effect on Socio-Eco Efficiency

SOCIECO	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
ECOINDI	.692339	.1980004	3.50	0.000*	.3042654	1.080413
ENVINDI	.1886716	.1447711	1.30	0.192	-.0950746	.4724177

NB: * indicates significant factors at the 95 percent confidence level

Instrumented factor: ECOINDI. Instruments factor: ENVINDI SOCINDI

Source: Survey Results, 2017

Table 4:37 shows socio-eco efficiency framework (SOCIECO) was amongst treated dependent factor that shaped the consumption and recycling efficiency. However, the economic indicator (ECOINDI) and environment indicator (ENVINDI) were endogenous independent factors. Nevertheless, the social indicators (SOCINDI) were indiscernibly associated and affected the socio-eco efficiency application. It was computed that respondent's economic indicators (ECOIND) was strongly determined the socio-eco efficiency framework by 0.000 values compared to the environment (ENVIDI) and social indicators (SOCINDI) at the 5 percent significance level. This entails that economic indicators (consumer's monthly income) were positively contributed to employ the socio-eco efficiency framework that resilient the green environment. Meanwhile, the socio- eco efficiency framework application was improved the water consumption and recycle efficiency (WCORECF).

Table 4.38: Socio-Eco Efficiency Indicators Effect on WCORCEF

WCORECF	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
SOCINDI	-.0326708	.2791134	0.12	0.907	-.5143813	.5797229
ECOINDI	-.3717695	.3042286	-1.22	0.222	-.9680465	.2245076
ENVINDI	-.1022033	.2848839	-0.36	0.720	-.6605655	.456159
SOCIECO	.5920966	.2962712	2.00	0.046*	.0114157	1.172777

NB:*indicates significant factors at the 95 confidence level

Source: Survey Results, 2017

Table 4.38 shows socio eco efficiency (SOCIECO) statistical significance to ensure the water consumption and recycling efficiency (WCORECF) at the 5 percent significance level. The respondent's social aspects (SOCINDI), economic (ECOINDI), environmental (ENVINDI) and socio-eco efficiency (SOCIECO) indicators were differently associated and effected the water consumption and recycling efficiency (WCORCEF). However, the respondent's economic, environmental and social indicators separately were not found statistically significant factors of water consumption and recycling efficiency. However, the integration of social, economic and environmental indicators called socio-eco efficiency, significantly affected the water consumption and recycling efficiency (WCORECF) by 0.46 values at the 5 percent significance level.

However, the respondent's social indicators, particularly, consumption culture and poverty were certainly changed the water consumption and recycling efficiency at the same level of significance. When the household's poverty level was increased by one unit, hold other factor constant, it would be increased the water consumption and recycles inefficiency by 37 percent. By using instrumental variable model regression, it was calculated that the socio-eco efficiency framework (SOCIECO), was importantly altered the water consumption and recycling efficiency by 0.046 values at the 95 confidence level. This implies that the socio- eco efficiency framework was a key tool to recover the green environment by balancing the water consumption and recycling efficiency.

In other words, this socio-eco efficiency framework was positively induced the green environment through maintaining the consumer's water consumption and recycling efficiency. Quantitatively, it was proved that when households were increased the socio-eco efficiency framework (SOCIECO) application by one unit, water consumption and recycling efficiency was improved by 59.2 percent, holding other factors constant, and in turn, increased the green environmental resilience in Kombolecha. Moreover, by using propensity score matching estimation model, Table 4.39 also showed that each significant social, economic and environmental indicators were not sufficient and stastically significant to resilient the green environment. However, socio-eco efficiency, which is key finding of this study, has statistically significant effected to resilient the green environment by balancing the consumer's water consumption and recycling efficiency at the 95 percent confidence level.

Table 4.39: Socio-Eco Efficiency Framework (SOCIECO) Effect on WCORECF

WCORECF	Coef.	AI Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
SOCIECO (yes vs No)	.1695989	.0882477	1.92	0.055*	-.0033634	.3425613

NB:* indicate significant factors at 95% confidence level

Source: Survey Results, 2017

Table 4.39 shows the socio-eco efficiency framework effect on consumer's water consumption and recycle efficiency (WCORECF) in Kombolecha industrial zone. The socio- eco efficiency impact on water consumption and recycling efficiency was computed by using propensity score matching estimation. The three indicators were treated independent factors. That is the water consumption and recycle efficiency (WCORECF) was an outcome factor; socio-eco efficiency framework was a treated dependent factor and respondent's social, economic and environmental indicators were treated independent factors. Accordingly, this study propensity score matching model (PSM) was robust and persistent to evaluate the impacts of a socio-eco efficiency framework on the water consumption and recycling efficiency. Along with this, the socio-eco efficiency framework (SOCIECO) was positively associated with the household's water consumption and recycling efficiency. For example, it was computed that when the consumer's socio- eco efficiency practices were raised by one unit, water consumption and recycle efficiency (WCORECF) was also increased by 16.9 percent.

This study proved that the socio- eco efficiency framework (SOCIECO) was statistically significant and sharply affected the consumer's water consumption and recycle efficiency (WCORECF) by 0.055 values at the 5 percent significance level. This study finding was dissimilar to Sailing, *et al.* (2013) socio- eco efficiency (SEE balance analysis) and BASF (2009) chemical company's product portfolio improvement. This study further evaluated each social, economic and environmental indicator's effect on socio-eco efficiency frameworks and there by water consumption and recycling efficiency by using the propensity score matching model.

4.6.2.1 Social indicators

This study household's social aspects (consumption culture and poverty status) were foremost indicators embraced in the socio-eco efficiency framework analysis. These indicators were key finding of this study. Particularly, the household's consumption culture and poverty status were integrated into eco efficiency indicators and the effects were displayed on the respondent's water consumption and recycling efficiency. In addition to this, the respondent's sex, family size, education, employment status, perception and behaviours were endogenously defined the water consumption and recycling efficiency. Whereas, the respondent's consumption culture and poverty were exogenously determined the water consumption and recycling efficiency. In the study area, the household's consumption culture was certainly affected the socio-eco efficiency framework (SOCIECO) application and in turn, prone to the water consumption and recycling efficiency (WCORCEF).

Table 4.40: Social indicators effect on Socio-Eco Efficiency (SOCIECO)

SOCIECO	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
SOCINDI	-.3065801	.3040656	-1.01	0.313	-.9025378	.2893776
Culture	.2363333	.0839079	2.82	0.005*	.0718768	.4007897

NB: *indicates significant factor at 95 percent confidence level

Source: Survey Results, 2017

Table 4.40illustrates the household's social indicators (SOCINDI) and consumption culture (culture) effects on the socio-eco efficiency (SOCIECO) and in sequence, on the water consumption and recycling efficiency. This study found that the household's poverty was negatively influenced their water consumption and recycling efficiency. That means when the household's poverty was increased by a unit, their socio-eco efficiency adoption and practices was decreased by 35.7 percent at the 5 percent significance level.

Moreover, two stage least square estimated that the respondent's consumption culture was positively affected the socio- eco efficiency framework and increased the water consumption and recycling efficiency. Besides, the consumption behaviours was enlightening the water consumption and recycling efficiency (WCORECF).

However, the respondent's consumption culture was prominently influenced the socio-eco efficiency application that could optimised the water consumption and recycling efficiency subject to the minimum cost. The IVM regression revealed that the consumer's culture was positively marked and significantly determined the socio-eco efficiency framework (SOCIECO) application and distorted the consumption and recycling efficiency by 0.005 values at the 5 percent significance level. However, the household's poverty was negatively coupled with the socio-eco efficiency framework application and determined the water consumption and recycling efficiency in Table 4.41. In other words, poor respondents could notbe integrated the three key indicators. As a result, poor respondent's water consumption and recycling was found inefficient compared to non- poor.

Table 4.41: Consumption Culture Impact on WCORECF

WCORECF	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Culture	.1989832	.0444247	4.48	0.000*	.1119125	.286054
ECOINDI	-.0216573	.1255066	-0.17	0.863	-.2676458	.2243311

NB:* indicates significant factor at the 95 % confidence level.
Instrumented: consumption culture. Instruments: ECOINDI SOCINDI

Source: Survey Results, 2017

Table 4.41 estimates consumer's consumption culture and economic indicators (ECOINDI) effect on the water consumption and recycling efficiency. Accordingly, the household's consumption culture was positively improved the water consumption and recycling efficiency. However, the economic indicator (monthly income) was negatively affected the water consumption and recycling efficiency. That is when the household's income was increased by $1, the water consumption and waste discharges rates was increased by 2.1 percent to Borkena river. However, in Table 4.41, chiefly, the respondent's culture was strongly influenced the water consumption and recycling efficiency (WCORCEF) by 0.000 values at the 5 percent significance level. In other words, when the consumer's water consumption culture was improved by a unit, the water consumption and recycling efficiency was increased by 19.9 percent but the green environment problems were decreased by 9.4 percent. However, Williams and Dair (2007) argued some sustainable behaviour cannot take place without changes to the built environment.

However, the social indicators were exogenously affected the green environmental status in Kombolecha. In the second stage of the IVM regression, respondent's culture was directly affected the consumption and recycling efficiency but directly influenced the green environment resilience at the same level of significance. In other words, the respondent's culture (social aspect) was exogenously allied and considerably apt the household's economic and environmental indicators. As a result, the respondent's economic (monthly income) and social (culture) were calculated statistically significant and hence strongly shaped the green environment resilience by 0.000 and 0.041values respectively at the 95 confidence level. This revealed that the household's consumption culture and economic aspects has to be considered since it was keenly crucial to irrepressible the greener environment in the drought affected industrial cities like Kombolecha.

Then again, this study pointed out that the green environment resilience acutely constrained and fell on the resource consumption and recycling patterns. However, respondents were not, yet, making use of rainwater and other water sources to produce goods and services. This was evidently affecting by respondent's consumption culture. This study computed that the household's consumption culture was importantly affecting by their monthly income by 0.000 and green perception with 0.000 values at the 5 percent significance level. As a result, the household's culture was heterogeneously altering the consumption and recycling efficiency. This study finding was not consistent to Chatzidakis, *et al.* (2007) illustration: consumers use neutralization techniques to justify pursuing their more selfish goals instead of purchasing fair trade products.

In addition to this, social indicators (household poverty) were influenced the water consumption and recycle efficiency (WCORCEF). To proof this, this study used a propensity score matching model (PSM) to evaluate the impacts of household poverty on the water consumption and recycle efficiency. This PSM model used three major factors. The first factor was included as an outcome factor (water consumption and recycling efficiency); the second factors consisted a treated dependent factor (socio-eco efficiency application), and the third factor comprised of the treated independent factors, such as household's poverty, culture, behaviours and etc. Accordingly, the outcome factor has a binomial response, which described whether the household's water consumption and recycling processes was efficient or not. The socio- eco efficiency application has also a binomial response for which the households were applied it or not. Along with this, this study investigated that the household's poverty was an exogenously factor that strongly associated and affected the socio-eco efficiency application and in turn, negatively altered the water consumption and recycling efficiency.

Table 4:42 Household's Poverty Impact on WCORCEF

WCORECF	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
HHpovty						
(Non-poor vs poor)	-.1690687	.0587818	-3.16	0.002*	-.273854	-.0642834

*indicates significant factor at the 5 percent significance level

Source: Survey Results, 2017

Table 4.42shows the household's poverty (HHpovty) impact on the water consumption and recycling efficiency (WCORECF). It was calculated that the household poverty was seriously determined the water consumption and recycling efficiency by 0.002 values at the 5 percent significance level. The respondent's household poverty was negatively determined the water consumption and recycling efficiency (WCORECF) at the 95 confidence level. For instance, when the household poverty was decreased by a unit, water consumption and recycle efficiency was increased by 16.9 percent, hold others factors constant. Poor respondents were practicing inefficient water consumption and recycling inefficiency compared to non-poor. This study supported Mbata (2006) findings: poor households may not make payment for water as a priority instead they may have to make choices to spend their limited financial resources for subsistence needs.

Furthermore, the household's poverty was negatively affected the water consumption and recycle efficiency but positively influenced the socio-eco efficiency framework practices. This study treatment model (logit in PSM) estimated that household' poverty was significantly affecting the water consumption and recycling efficiency with 0.002 values at the 95 confidence level. That is the socio- eco efficiency framework was determining by household's poverty and hence inversely affecting the outcome factors (water consumption and recycling efficiency). This study substantiates to UNEP (2014) that reveals every country faced challenges that are made unique by the distinctive characteristics of its society (including cultural values and institutional arrangements), economy and environment. This study investigated that the household poverty was prominently determined the water consumption and recycling efficiency at the 95 percent confidence level.

4.6.2.2 Economic indicators

This study measured the effects of household's monthly income (economic indicator) on water consumption and recycling efficiency. The respondent's monthly income measured in Ethiopia Birr and USA exchange rate (1 Eth Birr = $27.57). Accordingly, the household's monthly income was positively associated and affected the socio-eco efficiency framework (SOCIECO) application. In other words, when household's monthly income was increased by $27.57, the water consumption and recycling efficiency was also increased by 69.2 percent, holding other factors constant.

Table 4.43: Economic Indicators Impact on WCORCEF

WCORECF	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ECOINDI	.7713936	.2504186	3.08	0.002*	.2805823	1.262205
ENVINDI	.0183374	.1716789	0.11	0.915	-.318147	.3548218

NB: * indicates significant factor at 95 % confidence level

. Instrumented: ECOINDI. Instruments: ENVINDI SOCINDI

Source: Survey results, 2017

Table 4:43 describes monthly income (economic indicators) and environmental indicator (water quantity) influence on socio-eco efficiency framework (SOCIECO). Meanwhile, this study regressed the effect of socio- eco efficiency, which consisted economic and environmental indicators, on water consumption and recycle efficiency (WCORECF). Accordingly, the respondent's economic indicator (ECOINDI) and environment indicator (ENVINDI) was endogenously determined the socio-eco efficiency framework

(SOCIECO). Nevertheless, the respondent's social indicators (SOCINDI) were exogenously affecting the socio-eco efficiency framework. Exceptionally, in Table 4.44, this study IVM computed that economic indicators (ECOIND) was statistically significant and affected the WCORECF by 0.002 values at the 5 percent significance level. This entails that respondent's monthly income was positively contributing to apply the socio-eco efficiency framework. That is the rise of respondent's income was increasing the socio-eco efficiency application and positively changed the water consumption and recycling efficiency by 77.1 percent.

4.6.2.3 Environmental Indicators

This study measured the effect of environment indicators on water consumption and recycling efficiency that in sequence resilient the green environment. The environmental indicator was taken household's water quantity and waste discharge limit in the period of water consumption and waste recycling processes. Despite environmental indicators (ENVINDI) were endogenously affected the consumption and recycling efficiency, yet, respondents were not sensitive and emotional to limit water consumption and waste discharges to Borekna river. Particularly, factory's and household's groundwater consumption determined the water consumption and recycles efficiency (WCORCEF) and consequently resilient the green environment at the 5 percent significance level. For instance, in this study, it was found that a unit of water consumption limit was increasing the consumption and recycling efficiency by 89 percent. This revealed that the groundwater consumption was utterly eroded the nature of green environment in Kombolecha and at large in Ethiopia.

Table 4.44: Environment Indicators Effect on WCORECF

WCORECF	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
ENVINDI	.8903549	.258742	3.44	0.001*	.3832298	1.39748
ECOINDI	-.1287534	.1926736	-0.67	0.504	-.5063867	.2488798

NB: * indicates significant factors at 95% confidence level

Source: Survey results, 2017

In Table 4.44, the social indicators were assumed indiscernible and exogenously determined outside the model. As a result, the economic and environmental indicators were endogenously altered the water consumption and recycling efficiency. Based on this, the instrumental variable model computed that environmental indicators (ENVINDI) were drastically influenced the water consumption and recycling efficiency by 0.001 values at the 5 percent significance level. Especially, water quantity limit was evidently determined the water consumption and recycling efficiency. Similarly, an environment indicator (waste recycling) was changed the water consumption and recycling efficiency and recovered the green environment by 0.001 values at the 5 percent significance level. This study also computed the simultaneous causality between economic, social, and environmental indicators in the water consumption and recycling efficiency.

4.6.3 Indicator's Simultaneous Effect on Consumption and Recycling Efficiency

In this study previously analysis, the simultaneous causal effect of an economic, social and environmental indicators on the water consumption and recycling efficiency could not be measured and computed using IVM. These indicators causation and dimensional effect on water consumption and recycling efficiency were calculated using a simultaneous equation models (SEM) and three stage least square regression based on Gujurati (2004) and Greene (2011). This study indicator has the simultaneous effect on consumption and recycling efficiency. In other words, the study assumed that the household's water consumption and recycling efficiency was simultaneously changing the social, economic and environmental aspects and vice versa. As a solution, this study built a socio- eco efficiency framework, which consisted of the three key indicators, and balanced the gap between water consumption and recycling efficiency. Along with this, this study simultaneous equation model computed the causal effects and association between the socio- eco efficiency indicators.

This study proposed two main cases to find out the simultaneous effect of indicators and socio-eco efficiency indicators. In the first case, the green environment was determined by a socio - eco efficiency frameworks. Conversely, the socio- eco efficiency indicators were affected by household's inefficient water consumption and recycling processes. In the second case, water consumption and recycles inefficiency consecutively increased the green environment problems. This reveals that the socio-eco efficiency framework application altered the green environment and the vice versa. Finally, this study SEM measured the causality between exogenous (social indicators), endogenous indicators (economic and environmental) on the water consumption and recycling efficiency. With this respect, this study three stage least square regression computed that the socio-eco efficiency framework was determined the consumption and recycling efficiency. Moreover, each indicator was affecting the water consumption and recycling efficiency at the 95 percent confidence level.

In order to proof indicator's simultaneous effect, the following null hypotheses were proposed that would be rejected after regression.

> Proposition1: socio-eco efficiency would not significantly affecting the water consumption and recycling efficiency
> Proposition 2: each indicator would have no significant effect on socio- eco efficiency framework
> Proposition 3: indicators would have no simultaneous effect on water consumption and recycling intensity

Meanwhile, this study rejected the proposed null hypothesis. In other words, indicators were simultaneously affecting the water consumption and recycling efficiency. This study simultaneous equation model and the three stage regression calculated that economic, social, and environmental indicators were significantly affecting the socio - eco efficiency framework by 0.000 values at the 95 percent confidence level. This result depicts that the social, economic and environmental indicators were simultaneously and positively determined the socio-eco efficiency framework and in turn influenced the water consumption and recycling efficiency (WCORECF) by the same level of confidence. This study chi square value, which is 0.47 values, revealed that there was valid relationship between the three key indicators and socio-eco efficiency framework.

Table 4.45 Simultaneous Equation Model Result (indicators causation)

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
WCORECF						
SOCIECO	.9818684	.131404	7.47	0.000*	.7243213	1.239416
SOCIECO						
SOCINDI	.3914105	.0903671	4.33	0.000*	.2142941	.5685268
SOCIECO						
ENVINDI	.4437223	.1006534	4.41	0.000*	.2464452	.6409994
SOCIECO						
ECOINDI	.4783064	.1014455	4.71	0.000*	.2794769	.6771358

*indicates indicator significance factors at the 95 confidence level
Endogenous variables: WCORECF SOCIECO ENVINDI ECOINDI
Exogenous variables: SOCINDI culture

Source: Survey Result, 2017

Table 4.45 shows economic (ECONINDI), social (SOCINDI), environmental (ENVINDI) and socio- Eco efficiency indicators (SOCIECO) simultaneous effects on water consumption and recycling efficiency (WCORECF). It was computed that economic (ECOINDI), social (SOCINDI) and Environmental (ENVINDI) indicators were positively and strongly influenced the socio-eco efficiency framework (SOCIECO) and in turn, altered the WCORCEF by 0.000 values at the 5 percent significance level. In other words, a unit of respondent's social, economic and environmental indicators improvement was determined the socio-eco efficiency framework application and hence improved the WCORECF by 39, 44.4 and 47.8 percent respectively.

This study socio-eco efficiency (SOCIECO) was simultaneously and importantly affecting the water consumption and recycle efficiency (WOCRECF) by 0.000 values at the 5 percent significance level. On the other hand, socio- eco efficiency framework was positively and significantly determined by respondent's economic with 0.000, environment with 0.000 and social indicators with 0.000 values at the 95 percent confidence level. As a consequence, through the socio-eco efficiency framework, the water consumption and recycle efficiency was affected the household's economic, environment and social indicators. This study three stage least square estimation, in sum, proved that the socio-eco efficiency indicators were significantly influenced the consumer's water consumption and recycling efficiency in Kombolecha.

4.6.3.1 Water Quantity Limit (Watrconl) Effect on COENVTRD

This study computed the effect of household's water consumption limit on the consumption growth and green environment tradeoffs (COENVTRD). The simultaneous equation model (SEM) was employed to compute the causal effect of water quantity limit on COENVTRD. The household's qualitative characters, such as green attitude, awareness, perception, behaviours, willingness, sensitive and emotionality were altered the water consumption and waste recycling efficiency and in turn affected the COENVTRD. In the first SEM structural model, water consumption growth and green environmental tradeoffs (COENVTRD) was a dependent factor. Whereas, household's water consumption limit (Watrconl) was an endogenous factor. However, household's green awareness, behaviours, sensitive and emotionality, culture, poverty status, willingness and ability to pay were exogenous factors. In purist of the regression analysis, this study formulated the first SEM structural model, which consisted COENVTRD and water consumption limit (Watrconl):

COENVTRD = f(Watrconl, and ,sex, age, family size, culture and etc), ………………………1

Where,

- f = refers a function of
- COENVTRD = consumption growth and green environment tradeoffs
- Watrconl = water consumption limit

This study formulated that the second SEM structural model, which consists the household's green awareness, perception, behaviours, sensitivity, willingness, and COENVTRD. However, the second SEM equation formulated:

Watrconl = f(COENVTRD, green awareness, perception, behaviours, willingness, and ability etc)……..2

Based on the model constructed in equation1&2, the household's characters were assumed exogenous factors and determined outside the model. Nevertheless, water quantity limit was an endogenous factor. Similarly, the water consumption growth and green environment tradeoff was an endogenous dependent factor. The associations between these factors were computed by using a simultaneous equation modelandthe three stage least square estimation. To run the regression and estimations, three main hypotheses were proposed:

Proposition 1: water quantity limit would have no significant effect on the tradeoffs between water consumption growth and green environment problems (COENVTRD)

Proposition 2: awareness, behaviours, perception, sensitivity and emotionality, willingness and ability would have no significant effect on the water consumption limit (Watrconl).

Proposition 3: water consumption and green environment tradeoffs would have no effect on household's water consumption limit

This study endogenous consisted (Watrconl, COENVTRD, sex, family size, and etc) whereas; the exogenous factors included the household's culture, poverty, behaviours, perception and etc). This study SEM estimated the COENVTRD chi square test and model fitness, which found above 50 and revealed sufficient to forecast factors in the regression. Meanwhile, it was computed that the household's green awareness was notably influenced the consumption growth and green environment tradeoffs with 0.058 values at the 95 confidence level. Among included factors in this study, nevertheless, the household's consumption culture was considerably distorted the water consumption and recycling intensity in Kombolecha industrial zone. This might be the fact that respondent's education level was not, yet, created significant difference on the water consumption limit.

On the other hand, the household's sensitivity and emotionality to keep the green living was determined the water consumption limit. This simultaneous equation model was estimated the household's awareness, perception, behaviours, willingness, ability causal effect on their water consumption limit (Watrconl) and later on the water consumption growth and green environment tradeoffs (COENVTRD). Respondent's sensitivity and emotionality for water consumption limit was found different for living and working environment protection.

Table 4.46 Awareness, Behaviours, Perception impact on Watrconl

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
COENVTRD						
watrconl	.3085166	.0072793	42.38	0.000*	.2942495	.3227838
watrconl						
Awgrnpco	-.2323632	.0960458	-2.42	0.016*	-.4206096	-.0441169
HHPGrnco	.1966692	.0567578	3.47	0.001*	.0854261	.3079124
HHBGNCOF	-.3510027	.0534418	-6.57	0.000*	-.4557468	-.2462587
HHablity	.0471017	.0502142	0.94	0.348	-.0513163	.1455197
HHwiling	-.1946609	.0535518	-3.64	0.000*	-.2996205	-.0897013
HHSSEco	.1752043	.0516206	3.39	0.001*	.0740298	.2763788
HHSSLIV	.1802845	.0854788	2.11	0.035*	.0127492	.3478198
HHSSHLTH	-.0732735	.0810105	-0.90	0.366	-.2320513	.0855042
HHSSNIB	-.1858844	.0542988	-3.42	0.001*	-.2923081	-.0794606
_cons	3.202193					

*** indicates significant factors at the 95 % confidence level**

- **Endogenous variables:** COENVTRD watrconl
- **Exogenous variables:** Awgrnpco HHPGrnco HHBGNCOF HHablity HHwiling HHSSEco HHSSLIV HHSSHLTH HHSSNIB

Source: Survey Result, 2017

Table 4.46 shows SEM regression results, which consisted of endogenous factors: COENVTRD and Watrconl association and the casual effects one up on the other. However, this study SEM also computed the effects of respondent's awareness (Awgrnpco), perception (HHPgrnco), behaviours (HHBGNCOF), ability (HHability) for green consumption, sensitive for living environment (HHSSLIV), sensitive for health (HHSSHLTH), sensitivity for neighbour's protection (HHSSNIB) on the water consumption limit (Watrconl) and (COENVTRD). However, the water consumption limit (Watrconl) was endogenously independent in the first structural model but it was dependent factor in the second structural model. The household's awareness regards to green consumption (Awgrpco), perception (HHPgrncon), consumption behaviours (HHBgrnco), ability (HHablity), willingness to pay the money (HHwiling), sensitivity for economic reasons (HHSSEco), sensitivity for living environment (HHSSLIV), sensitivity for health protection (HHSSHLTH) and neighbour's environment (HHSSNIB) were exogenous independent factors in the second structural model. These factors association and determinate causal effects were computed by using three stages least square estimation in Table 4.46.

Meanwhile, this study three stage least square regression computed that respondent's green awareness was inversely associated with the water consumption limit (Watrconl) and consumption growth and green environment tradeoffs (COENVTRD). In other words, when the household's awareness about green consumption was improving by a unit, their water consumption limit was increasing by 23.4 percent at the 5 percent significance level. Similarly, the household green consumption behaviours, willingness to pay the money (HHwiling), and sensitivity about health protection (HHSSHTH) were negatively influenced the water consumption growth and green environment tradeoffs (COENVTRD) at the 95 confidence level. However, the household's sensitivity and emotionality for economic reasons (HHSSeco) and ability to pay the money (HHability) was positively associated with the water consumption limit (Watrconl) and later influenced COENVTRD.

Based on this, the households awareness about the green consumption (AWgrnco) by 0.016; perception (HHPgrnco) with 0.001; behaviours (HHBgrnco) with 0.000; sensitivity for economic costs (HHSSECO) with 0.001, sensitivity for living environment protection (HHSSLIV) with 0.035;sensitivity for neigbour's environment protection(HHSSNIB) with 0.001, and willingness to pay the money (HHwiling) with 0.000 values were significantly altered the water consumption limit (Watrconli) in the first structural model and in turn influenced the tradeoffs between consumption growth and the green environment (CONENVTRD) in the second structural model at the 5 percent significance level. However, the household's ability to pay the money (HHability), sensitive and emotionality for health aspects (HHSSHTH) were not significantly identified and affected the water consumption limit and the by the consumption growth and green environment tradeoffs.

In the study area, especially, households were much sensitive and emotional to protect the living environment (HHSSLIV) and importantly affected the water consumption limit (Watrconl) by 0.035 values at the 95 confidence levels. Exceptional to this, the respondent's sensitive and emotionality for practicing the green consumption (HHSSgrnco) were highly interconnected with the green living environment and its resilience. The respondents were showed willingness to pay the money that used to protect their living environment. However, none of the respondents were practiced water consumption and recycling efficiency. The household's consumption behaviours and willingness to pay the money were notably changed the water consumption limit (Watrconl) and well-adjusted the tradeoffs between consumption growth and green environment by 0.000 values at the 5 percent significance level.

In addition to this, the household's willingness to pay the money was strongly influenced the water consumption limit and intensity (Watrconl) by 0.000 values at the 5 percent significance level. On the other hand, the water consumption limit was strongly influenced the consumption a growth and green environment tradeoffs by 0.000 values. In the study area, when the respondent's water consumption intensity improvement was increased by one m^3, holding other factors constant, the water consumption growth and green environment tradeoffs was also improved by 30.1percent at the 5 percent significance level.

4.7 Indicators Impact on Water Consumption and Recycling Intensity

4.7.1 Propensity Score Matching Model (PSM) Result

This study evaluated social, economic and environmental indicator's impact on the household's water consumption and recycling intensity. To do so, it was employed a propensity score matching model (PSM). The tradeoff between water consumption and recycling intensity was caused by the household's economic, social and environmental aspects. Previous simultaneous equation model was not sufficient and robust to evaluate indicator's impact on the water consumption and recycling intensity. This PSM included three main variables. The first variable consisted of an outcome factor (COENVTRD), the second variable comprised of the treated dependent factor (water consumption and recycling intensity) whereas, the third factors were treated independent factors, such as respondent's green awareness to adopt the green mind, technology use, market exchange, water consumption, jobs use and etc. This study propensity score matching estimation evaluated these treated factors impact on the outcome factor though weighing up the water consumption and recycle intensity.

Along with this proposition, PSM estimation found that there was an association between the household's qualitative characters; water consumption and waste recycle intensity (Watrconl), and the tradeoffs between consumption growth and green environmental problems (COENVTRD). The hypotheses were rejected and alternative hypotheses were accepted that revealed the impacts of explanatory factors on the water consumption and waste recycling intensity. In this study, the respondent's green awareness determined the water consumption and waste recycling intensity (Watrconl) and altered the COENVTRD. Table 4.47illustrates household's green awareness impact on water consumption and recycles intensity in Kombolecha.

Table 4.47: Green Awareness impact on Watrcon and COENVTRD

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
COENVTRD						
watrconl	.30688	.0072361	42.41	0.000	.2926976	.3210624
watrconl						
Awgrnmin	-.4470784	.0943832	-4.74	0.000*	-.632066	-.2620909
Awgrnpco	.3998879	.1160009	3.45	0.001*	.1725304	.6272454
Awgrnbuy	-.7292623	.1329257	-5.49	0.000*	-.9897918	-.4687328
Awgrntec	-.3712751	.1390321	-2.67	0.008*	-.643773	-.0987772
Awgrnjob	-.2337193	.1342288	-1.74	0.082	-.4968029	.0293643
Awgrnenv	-.1560404	.086277	-1.81	0.071	-.3251401	.0130593
_cons	3.296841					

***indicates significant factor at the 95 % confidence level**
Endogenous variables: COENVTRD watrconl
Exogenous variables: Awgrnmin Awgrnpco Awgrnbuy Awgrntec Awgrnjob Awgrnenv

Source: Survey Results, 2017

According to Table 4.47, the household's awareness on green mind by 0.000; green consumption with 0.001, product buying with 0.000, and technology with 0.008 values were significantly influenced the water consumption and waste recycling intensity (Watrconl) and determined the consumption growth and green environment tradeoffs (COENVTRD) at the 95 confidence level. This revealed that respondent's awareness on green mind and purchasing the water services were strongly affected the water consumption and recycling intensity at the 5 percent level of significance. In the study area, however, the household's awareness about the green environment was not significantly altered the water consumption and recycling intensity at the 95 confidence level.

In addition to this, the household's awareness about a green mind was inversely associated and influencing the water consumption and recycling intensity. In other words, when the households green mind adoption and practices were increased by a unit, the gaps between water consumption and recycling intensity was decreased by 77 percent, hold other factors constant. However, the respondent's green awareness to search the green jobs were not significantly changed the water consumption and recycling intensity as well as the tradeoffs between consumption growth and the green environment problems at the same level of significance.

The respondent's awareness to green the living environment was inversely associated with the water consumption and recycle intensity. This shows that household's awareness for green living and working environment resilience improvement was balanced the water consumption and recycling intensity and later minimised the consumption growth and green environment tradeoffs by 15.3 percent. A unit of household's awareness improvement to embrace a green mind, product purchase and technology use were decreasing the gaps between water consumption and recycling intensity by 44.7, 72.9 and 37.1 percent in order. As a result, in Kombolecha, household's water consumption limit (Watrconl) to a great extent was predisposed the consumption growth and green environment tradeoffs (COENVTRD) by 0.000 values at the 5 percent significance level.

4.7.2 Poverty Impacts on Water Consumption and Recycling Intensity

This study, previously, calculated that out of 338 sample households, 140(36.7%) percent of households were below poverty line. Particularly, this study identified that respondent's poverty of access, for example, lack of clean water; waste discharges to Borkena River; groundwater and environment depletion were amongst prevalent problems in Kombolecha. In addition to this, groundwater consumption and recycling intensity was widening the tradeoffs between consumption growth and green environment tradeoffs. Along with this, this study evaluated the social indicators (household's poverty) impact on water consumption and recycle intensity. Accordingly, this study computed a significant impact of household's poverty on water consumption and recycling intensity. This intensity was an outcome factor whereas the household poverty was treated dependent factors. In this regard, nonetheless, the treated independent factors were economic indicator (monthly income); social indicators, such as, consumption culture, poverty, family size and etc and finally comprised of environmental indicator that considered respondent's water consumption limit and waste recycling intensity.

Based on WB (2013) income poverty line, respondents, who were earning below $1.25 per day, were poor. Otherwise, they were non-poor. This respondent's poverty status, which includes non-poor, presented 1 value. Otherwise, poor presented 0 values. In this study as described so far, household poverty was a treated dependent factor and affected by treated independent factors, such as monthly income, age, sex, employment status, environment problems and etc. This study PSM computed the expected value of parameters using treated logit model. The disturbance terms were assumed logistically distributed between the probability of poor and non-poor households.

This study propensity score model (PSM) estimated that the household's poverty was negatively associating and significantly determined the water consumption and recycling intensity by 0.001 values at the 95 percent confidence level. In other words, when the household's poverty was improved by one unit, ceteris paribus, the gaps between water consumption and waste recycling intensity was reduced at the 95 percent confidence level. Moreover, this study logistic regression depicted that when the household's income poverty was reduced for instance by 1.25 dollar per day, thus, the water consumption and waste recycling intensity was improved by 17.3 percent, holding other factors constant. Based on this study result, the municipal, water supply and enterprise office and FDRE environmental protection ministry have to be incorporated the household's poverty alleviation programs so as to recover the degraded groundwater resources and recover the depleted environment.

Table 4.48: Household's Poverty Impact on Water Consumption and Recycling Intensity (WCORECI)

WCORECI	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
ATE						
HHpovty						
(Non-poor vs poor)	-.1729416	.0538897	-3.22	0.001*	-.2783675	-.0675158

*indicates significant factor at the 5 percent significance level

Source: Survey Result, 2017

Table 4.48 describes the household's poverty impact on the water consumption and recycling intensity. The household's poverty status was calculated and classified into poor and non-poor. When the respondents were poor and presented by 1. Otherwise, 0 value sat the 95 percent confidence level. Accordingly, it was identified that the household poverty was significantly influenced the water consumption and waste recycling intensity by 0.001 values. However, this household poverty was inversely associated and changed the water consumption and recycling intensity (WCORCEI). Similarly, the household's poverty was negatively and substantially affected the water consumption growth and green environment tradeoffs at the 95 percent confidence level. For instance, when the household's poverty was decreased by a unit, yet, the water consumption and recycle intensity was increased by 17.3 percent and in succession reduced the resource consumption growth and green environmental tradeoffs, holding other factors constant.

4.7.3 Water Life Cycle Assessments

This study investigated that pipe water life cycle assessment was conducted by Kombolecha water supply and sewerage enterprise office. Water consumers, nonetheless, were not undertaken perceived water life cycle assessment at all. According to experts interviewed and respondents, factories were tested the quality of groundwater in order to keep product quality improvement. Similarly, Kombolecha water supply and sewerage enterprise office was tested the tap water quality and passed it through water life cycle assessment. According to experts in the field, indeed water is served as a life blood for survival, groundwater consumption by households was not assessed through water life cycle procedures. Factories waste discharges were polluted the River water sources. Households were then used this waste water for various activities, such as cloth wash, urban irrigation, cattle drinks and etc. Respondents were not piloted the water life cycle assessment and this study evaluated water life cycle during consumption and recycling process.

Accordingly, in the study area, it was found that water life cycle assessment was practiced by Kombolecha water supply and enterprise office and households. However, household's groundwater consumption was not keeping all life cycle assessment in production and consumption activities. For instance, respondents were used Borkena river water, which discharged wastes, without further treatment for social as well as environmental impact reduction. As a result, many of the respondents highlighted that they were infected by toxic wastes.

Accordingly, it was found that inefficient water consumption and recycling was affected the demand of water consumers. Particularly, households were not, yet, measured water consumption and recycling intensity. Superficially, factory's experts argued that waste intensity was not such much perturbed the company instead they were disconcerted about the water quantity available in ground sources. In

Kombolecha, it was found that none of the factories were calculated liquid waste discharges and recycling intensity for further production. Indeed, Kombolecha is drought affected city in eastern African, and faced the water shortages for future consumption, consumers were not adopted the water life cycle assessment during consumption.

This study identified that respondent's economic, social, and environmental indicators were affected water life cycle assessment. It was also working out that household's social aspects, such as consumption culture, behaviour, and habits were interconnected with their economic and environmental aspects. As a result, respondent's water life cycle assessment was not considered in water life cycle assessment. Evaluation of social, economic and environmental indicators impacts on water life cycle assessment were investigated using propensity score matching model (PSM). Along with this it was found that household's consumption culture was statistically significantly altered the water life cycle assessment at the 5 percent significance level.

Moreover, municipal, factory and other experts interviewed during data survey showed that water life cycle assessment has to be government duties. Respondents also pointed out that liquid waste, which discharged by factory and households, was not considered as a resource in Kombolecha and at large in Ethiopia. In addition to this, both factories and households were not, yet, used rainfall for production and consumption purposes. Despite respondents were in a hurry to purchase advanced technology, they were inseparably envisioning efforts to attain equilibrium between water consumption and recycling intensity. Particularly, water life cycle assessment was not experienced before household consumption process. However, factories were testing groundwater before production purposes. An evaluation of indicators on the water life cycle has to be taken into account via clearing the water consumption and waste recycling intensity.

4.7.3.1 Social Life Cycle Assessment

This study assessed the respondent's social indicator (culture) effects on the groundwater consumption and recycling intensity. This was due to water consumption and recycle efficiency was resulted an interpersonal relationship between the household's social aspects, such as wedding ceremony and Idir (defined as people association to help each other during death as well as social disturbance prevalence), culture and health issues and household poverty alleviation. According to experts interviewed in the field, factories were not committed to minimise groundwater consumption growth and waste discharges without treatment to nearby environment. Factory's liquid waste, which discharges to 'Borkena' and 'Woreqa' river, affected the household's health when they used directly for small irrigation. According to respondent's, they were used more water resources for weeding ceremony, Idir and etcand then discharged wastes to the nearby environment.

This study measured respondent's social indicators relationship with water life cycle assessment by using a multiple logistic regression. This model results investigated that the cause-effect relationship between social indicators (consumption culture and water life cycle assessment). To do so, water consumption and waste recycling efficiency was dependent factors. Whereas, the household' weeding ceremony, association for death and related issue (Idir), health, culture, and etc were independent factors. Based on this, the household's social indicators, such as culture, Idir and weeding ceremony and health issues were statistically significant and strongly affected the water life cycle assessment by 0.000 values at the 5 percent significance level.

However, respondent's consumption culture determined their water life cycle assessment and considerably influenced the green environment resilience. Respondents were not makingpayments for groundwater consumption and recycling processesbased on the social, economic and environmental indicators criterion. Along with this, particularly, the social, economic and environmental indicators integration, which fosters a socio-eco efficiency framework on water life cycle assessment, ensured the green environment resilience. According to experts in interviewed in study area, despite environment and social life cycle assessment was not practicedyet at household level, it has to be used as tool to balance and sustain groundwater consumption and recycling intensity. Thefactories were undertaken groundwater life cycle assessment before production processes. However, the social life cycle assessment was not conducting before the water consumption and after waste discharges in order to protect the community and the environment in general.

4.8 Resource Model to Resilient the Green Environment

This study developed a socio-eco efficiency model to resilient the green environment. This model is a conceptual model, which combined significantly identified indicators in previous discussion. This study model consistent to the definition and description by Barry and Marha. (2013). That is a model is a way of trying to show the essential structure and relationships in something without going all of details. This study model consisted of statistically significant social indicators, such as household's consumption culture, poverty, behaviours and etc; economic indicators (monthly income) and environmental indicator (water quantity and waste discharge limit). Using distinct econometric models, previously, these indicators were identified, determined and evaluated on water consumption growth and green environment tradeoffs; consumption and recycling efficiency; consumption and recycling intensity. These indicators, whose p-value less 5 percent, were statistically significant to build a socio-eco efficiency model. This resource model merged statistically significant economic, social and environmental to recover the green environment. This study model was supporting by Stefan, *et al*. (2000), which noted the need to find new models for resource use that ensure a high quality of life for all people.

Among major sub indicators included in this study data, household's consumption culture, behaviours, monthly income and water consumption limit and recycling efficiency were determining a socio-eco efficiency model by 0.000 values at the 5 percent level of significance. Furthermore, this study focused households and factory's water consumption and recycle efficiency in order to build the importance of socio- eco efficiency model. It was investigated that households and factories were differently considered social, economic and environment aspects. As a result, socio eco efficiency model has to be subjective across households and factory's water consumption and recycling process. According to focus group discussion participants, so as to ensure green resilience in growing industrial sites like Kombolecha, households and factories have to adopt green consumption principles to harmonizing groundwater consumption and recycling efficiency.

This study socio- eco efficiency model was keenly developed to value the groundwater consumption and recycling in order to optimise the social, economic and environment benefits. This study finding was different from Hettich (2000), who employed many models dealing with environmental quality or pollution using endogenous growth. This study, however, focused at the micro level analysis (households and factory's) using endogenous and exogenous factors, which were associated with water consumption and recycling efficiency. Moreover, this study developed a socio eco- efficiency model by integrating statistically significant factors, such as consumption culture, poverty, behaviours, perception; economic indicators (monthly income) and environmental indicators (water quantity and waste recycles). Socio-eco efficiency resource models, therefore, combined these sub indicators that enhanced the groundwater consumption and recycling efficiency and recovered the degraded groundwater and green environment at the 5 percent level of significance.

In this study context, resource is an entity, which consists of both tangible and intangible resources, and measured both in monetary and non- monetary values and hence assigned to a workflow activity and is requested at runtime of household's and factor's activities that would be realised the objective of consumption and recycling efficiency. For instance, respondent's consumption culture, behaviours, and poverty and etc were measured using non- monetary values. However, monthly income (economic indicators) was measured using Ethiopia Birr. Moreover, environmental indicators, like water quantity consumption measured in monetary terms for example cubic metre water use per Birr. With this respect, this study socio-eco efficiency model contained resources, which measured in monetary and non- monetary values, and grouped them into economic, social and environment indicators. These indicators were involving in the execution of resource model as workflow consumer's water consumption and recycling efficiency, holding other factors constant.

This resource model was not focusing solely on the workflow in household's but also used in an industrial application, interfacing with production planning and control systems through the resource consumption and recycling processes. In addition to this, this study resource model was exceptionally incorporating household's green perception, attitude, behaviours, culture, sensitivity and emotionality, willingness to pay the money for protecting the living and working environment. Meanwhile, groundwater consumption and recycling efficiency would be a center of attention to resilient the depleted environment. However, this model considered household's poverty level so as to apply the socio-eco efficiency model and optimise water consumption and recycling efficiency. This study model supported Greiner, *et al*. (2005) that focuses on the ongoing growth and positive externalities associated with the formation of human capital, or the creation of a stock of knowledge.

However, this study resource mode was different from Griener (2008) studies, which investigated a growth model where pollution only affects the utility of a representative household but does not affect production activities directly through entering the aggregate production function. this was due to this study model was considered both household's economic, social and environment indicators and statistically identified sub indicators, such as consumption culture, behaviours, family size (social indicators), monthly income (economic indicators) and water consumption and recycling efficiency (environment indicators). These sub indicators impact on the green environment resilience measured using propensity score matching estimation using STATA14 software version. This study estimation shared EEA (2013) indicators analysis, which put attention on the resource use and efficiency that captured in a wide range of statistically significant indicators.

However, this study socio- eco efficiency resource model, which was built on identified indicators, were different from EEA (2013) road maps to resource efficiency. This study focused on water consumption and recycling efficiency at the household and factory consumption by applying the socio-eco efficiency model. However, the EEA (2013) contributes to the development of a suite of resource efficiency indicators and the roadmap that proposed a three-layered pyramid structure comprising: one lead indicator on material use, a dashboard of macro-indicators on water, land and carbon, and a set of theme-specific indicators (EC, 2012c). This study, nevertheless, developed a socio- eco efficiency resource model, which combined statistically significant social, economic and environment sub indicators mentioned in previous discussion on the consumption growth and green environment tradeoffs. For instance, the respondents' awareness, perception, behaviours regarding to adopt a green mind, market, technology use and jobs were part of this socio-eco efficiency model.

This study model, therefore, incorporated consumer's social, economic and environmental indicators during consumption and waste recycling processes. This socio-eco efficiency would be helped to sustain the green growth at Kombolecha and at large in Ethiopia by compromising the social, economic and environmental benefit and costs. This socio-eco efficiency resource model regressed on water consumption and recycling intensity so far and computed using instrumental variable model and two stage least square regressions. This study estimation results indicated that the socio-eco efficiency resource model was strongly affecting the water consumption and recycling efficiency with 0.000 values at the 95 percent confidence level.

However, according to respondents, groundwater consumption was measuring poles apart between the households and factory's consumption intensities. In the study area, Factories were consuming the groundwater sources without payment to attain their optimal profit subject to the minimum costs. Despite the water consumption found subjective across the production types, factories were plagued the economic and environment issues compared to the social aspects throughout the production and consumption process. These economic and environmental indicators were not complete enough to recover the green environment. Relatively, the households were relatively found sensitive and emotional for the economic and social indicators integration. This study resource models thus devised the households and factory's social, economic and environment indicators in the period of groundwater consumption and waste recycling process that could enhance the green environment restoration.

In doing so, environment indicator was assuming and drawing upward sloping across the households and factory's water resource consumption. Then again, this study socio-eco efficiency resource model was constructing on the social vs environmental and economic vs environmental indicators combination. Meanwhile, these indicators combinations were constructed a socio-eco efficiency resource model that would be applied to recover the green environment. This study model shared the concepts of BASF (2009), WBCSD, (2009) eco efficiency and Sailing, *et al*.(2013) SEE balance, which addressed an ecologic, social and environmental indicator in the course of company's production process that could be improved company's product quality.

However, this study model was developing from socio- eco efficiency indicators by incorporating household's social indicators (culture, behaviours, poverty and etc) in to economic (monthly income) and environmental indicators (water consumption and waste recycling efficiency). This study socio- eco efficiency model constructed in figure 4.6 by combining the eco- efficiency indicators (economic and environmental indicators) and socio-efficiency indicators (social and environmental indicators). This socio-eco efficiency model ultimately aimed to resilient the depleted green environment in Kombolecha industrial zone.

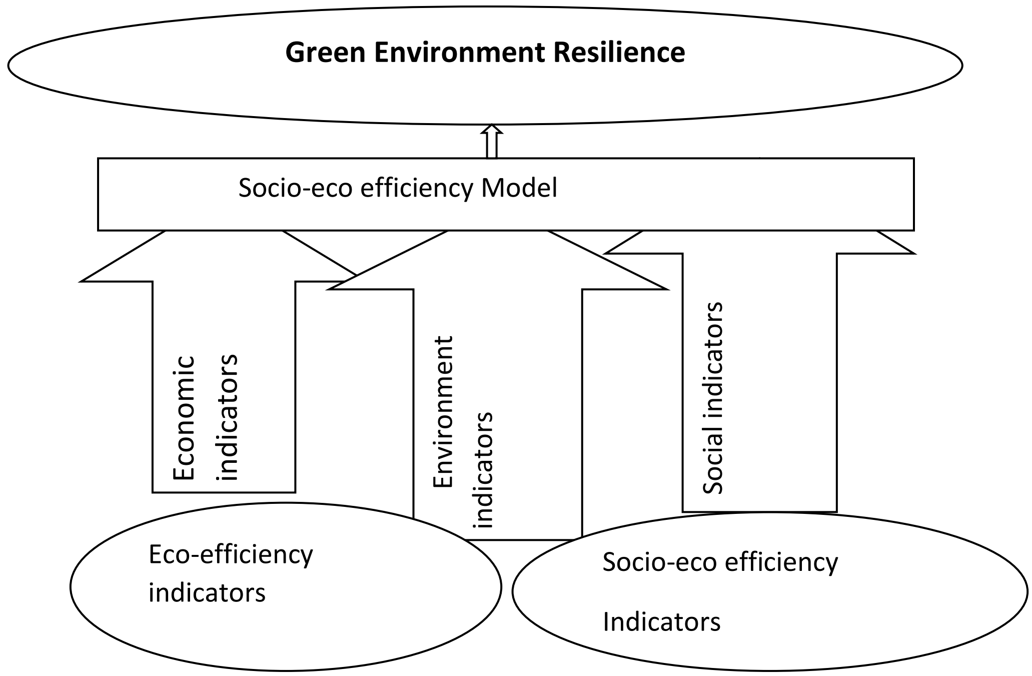


Figure 4.6: Indicators Integration and Roles to resilient green environment

Source: Adopted from BASF, 2005 &2009 and Sailing, *et al*. (2013)

According to figure 4.6, resource model revealed the abstraction of reality that depicted the representation of indictors to resilient the green environment. Figure 4.6 integrates eco efficiency and socio- efficiency indicators to build socio eco efficiency and then resilient he green environment. This socio eco efficiency mode and key indicators were adopting from BASF, (2009), ESCAP, (2011) and WBCSD, (2009) eco efficiency concepts and Sailig, *et al*. (2013) SEE balance(socio-eco efficiency), which comprised of the ecology, environment and economic indicators, used to sustain development. However, BASF (2009) was given equal weight about social, economic and ecology assessment but not quantitatively computed indicators association on production processes. This study socio- eco efficiency was exceptionally merged an exogenous respondent's social indicators; endogenous economic and environment indicators. Among many factors included in this study so far, consumption culture, poverty, family size, behaviours and etc.; economic (monthly income) and environment indicator (water consumption and recycle limit) were statistically significantly and affected the green environment resilience with 0.000 values at the 95 percent confidence level.

In addition to this, this study was taken an environment indicator (water quantity consumption and recycling limit) as a substitute of BASF (2009) and Sailing, *et al*. (2013) ecological indicators. Based on this, significant economic, social and environmental indicators were among main required resources. In pursuit of this, figure 4.7 indicators were shared and supported by WBCSD (2009), ESCAP (2011), BASF (2005 &2009) and Tatari, *et al*. (2016) criterions. Along with line, the socio-eco efficiency framework that aimed to resilient the green environment consisted of the socio-eco efficiency indicators, such as social, economic and environmental sub indicators. Indicators were integrated and constructed along with the socio-environment and eco-environmental framework direction. Meanwhile, the rectangle region formulated a socio-eco-efficiency resource model. This resource model, finally, would be resilient the green industrial zone by balancing the water consumption and recycling efficiency at a regular basis, holding other factors constant.

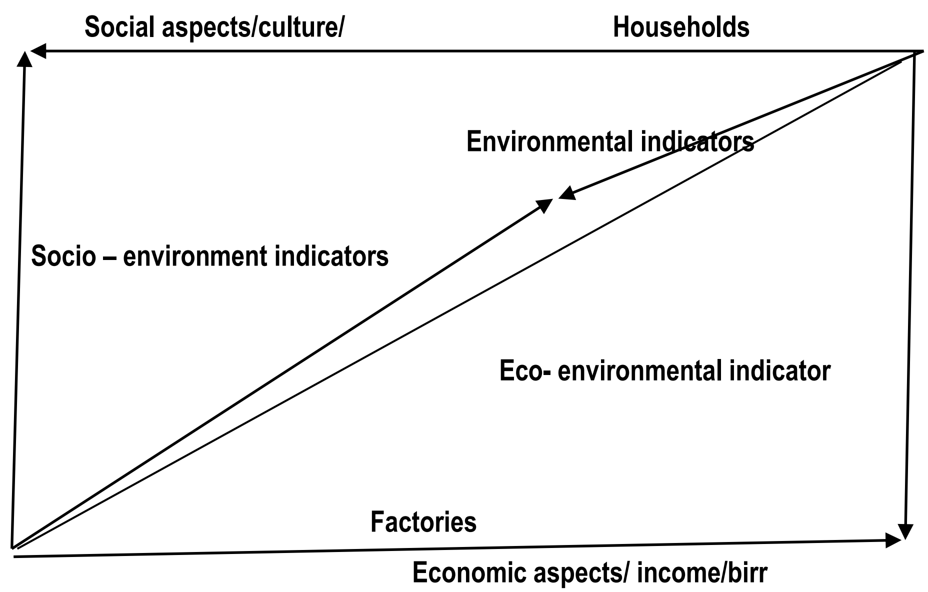


Figure 4.7: Socio- Eco Efficiency Resource Model Formulation

Source: Adopted from WBCSD (2009), BASF (2005&2009) and Sailing, *et al*. (2013)

Figure 4.7 consists of socio-environmental aspects in onside. In other side, it comprises eco- environment. This study used environment (water consumption and recycling efficiency) as a threshold line, which is 45 degrees along with the X and Y- axis in figure 4.7. Households and factories were key participant to establish mentioned key indicators. The rectangular region in figure 4.7 shows the socio-eco efficiency region that could help to resilient the green environment. The socio-eco efficiency model in figure 4.7 was adopted from the WBCSD (2009) and ESCAP (2011) eco efficiency concept. However, this study was developed a rectangular region in figure 4.7 that combined the social, economic and environmental indicators on both the household and factor's groundwater consumption and recycling processes in Kombolecha.

With this respect, the environmental aspect was assumed and continued moved at 45^0 to sustain the living and working environment. Substantial to this, the household's and factor's social and environmental indicators integration was built a socio- environmental model. On the right side, the household's and factories economic and environmental indicators integration was built an eco–environmental model. The combinations of these models established a socio- eco efficiency resource model inside the rectangle region. Prominently, the respondent's consumption culture and behaviours were manifested the socio-environmental and eco–environmental frameworks during water consumption and recycling processes. Particular to this study's intension, groundwater was amongst the common resource that was exposed to sever degradation and hence required the socio-eco efficiency resource model so as to restore at the normal circumstances.

However, this study investigated that the socio- environment and eco-environmental indicators in figure 4.7 were not coupled 100 percent to build a socio-eco efficiency framework and recovered the green environment. In other words, some part of an environmental indicator, which associated with some part of the social and economic indicators, was formulating a socio - eco efficiency framework. This study framework and some part of indicators, such as social, economic and environmental indicators were statistically significant factors that construct the socio-eco efficiency model using instrumental variable model (IVM) in Figure 4.8.

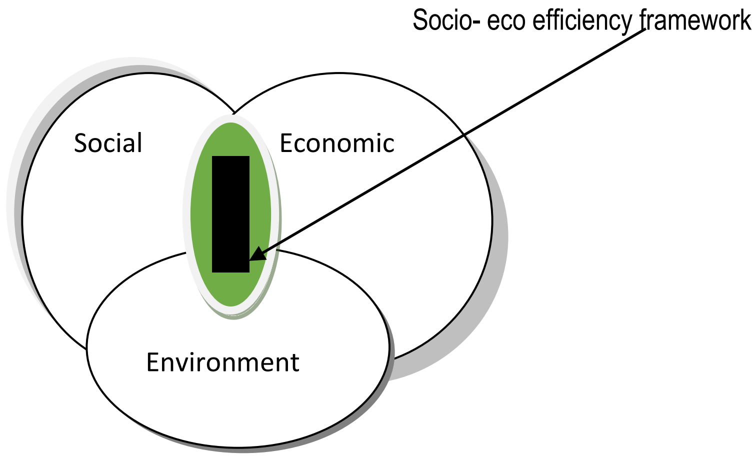


Figure 4.8: Socio-Eco Efficiency Framework and Indicators Integration

Source: Adopted from ESCAP (2011), BAZF (2009) and Sailing*, et al.* (2013)

Figure 4.8 depicts some part of the three key indicators integration and effects on the green resilience. Some part of the three key indicators integration was building a socio eco efficiency that applied to resilient the green environment in growing industrial city. These indicators integration was proved by using instrumental variable model and two stage regression in previous discussion. Particularly, this study socio-eco efficiency framework, which is located at the center of a circle, in figure 4.8 consisted of social vs environment; social vs economic, and economic vs environmental indicators. In other words, this socio- eco efficiency framework was the summation of merged sub indicators. Or else, some part of economic, social, and environmental indicators was built a socio- eco efficiency framework, which confirms that all indicators were not 100 percent coupled to give the socio-eco efficiency and in turn used to recover the green environment.

This study, thus, proved and developed that some part of each indicator integrated in figure 4.8 for example respondent's poverty, culture, behaviours, monthly income, water quantity and waste recycling limit and etc were statically significant indicators, which built socio-eco efficiency framework, and used to recover the green living and working environment. These sub indicators integration revealed causal and non-separable effect between the indicators and the green environment resilience. In other words, the simultaneous causality between sub indicators were regressed and devised a socio-eco efficiency framework, which is a key pillar to resilient the green environment in Kombolecha and at large in Ethiopian industrial cities. This study, therefore, developed a socio-eco efficiency resource model that would be optimized groundwater consumption and recycling efficiency in Kombolecha industrial zone. This framework and resource model were consistent and inter connected each other. This model application nonetheless, was required resources that used to integrate each statistically significant indicator all through the groundwater consumption.

4.8.1 Required Resources for Significant Indicators

This study identified significant social, economic and environmental sub indicators on the resource consumption growth and green environment tradeoffs; water consumption and recycling efficiency and consumption and recycling intensity. For instance, the binary logistic regression model identified that respondent's awareness, perception, behaviours, culture, poverty, sensitive and emotionality, willingness and ability to pay the money were significantly influenced the consumption growth and green environment tradeoffs at the 5 percent level of significance. The instrumental variable model also found that the household's exogenous factors, such as culture, poverty, housing ownership, religious and etc and the endogenous factors (monthly income, family size, sex, and water limit) were significantly associated with the water consumption and recycling efficiency. The propensity scores matching model (PSM) furthermore evaluated that the socio- eco efficiency indicators impact, which consisted the three key indicators, and effect on the water consumption and recycling efficiency with 0.000 values at the 95 percent confidence level.

However, there was simultaneous causality between economic, social, and environmental indicators in the course of consumption and recycling intensities. This study, therefore, employed a simultaneous equation model and hence found socio- eco efficiency framework was significantly influenced water consumption growth and green environment tradeoffs. Nevertheless, respondent's culture, and household poverty were strongly caused tradeoffs between water consumption growth and green environment tradeoffs with 0.000 values at 5 percent level of significance. This study finding was different from BSAF (2009), ESCAP (2011), and Sailing,*et al*. (2013) SEE balance analysis. This study built a socio- eco efficiency model, which consisted of statistically significant social, economic, and environment sub indicators. For instance, household's consumption culture, behaviours, poverty, family size, monthly income, water quantity and waste recycling efficiency per m^3 were statistically affecting the consumption and recycling efficiency and in turn the green environment.

As a result, this study developed a consistent resource for each identified factor that would be recovered the green environment for Kombolecha and at large Ethiopia industrial citers. However, the household's and factories were differently considered their own economic and environmental benefits. The households social aspects, particularly, consumption culture and behaviours, poverty and etc were excluded in previous study, for instance, Sailing,*et al*.(2013). Nevertheless, this study was included these household's social indicators and found that there were lacked a green awareness, perception, behaviours and willingness to pay in order to adopt the green mind, technology use, market exchange and green job searches. This study, thus, identified the household's qualitative characters, such as awareness, perception, behaviours, culture, poverty, family size were major social significant factors to resilient the green environment. This study, therefore, proposed a consistent resource model that could poised the consumption growth and green environment tradeoffs.

Along with this line, this study economic aspect considered household's monthly income and factories profits. However, it was investigated that both households and factory's economic costs for groundwater (water payment and charges per m^3 consumption) was zero. That is according to respondents both households and factors were not paid for groundwater use during consumption and production processes. Indeed, the quantity of water consumption was varied across factory's production types; they were not paid certain fraction of money for groundwater use. As, a result, they exploited and consumed groundwater sources as much as they could to optimise production. As a result, green environment depletion, which is caused by water resources degradation was, yet, increased due to consumer's lack of sensitive and emotionality, ability and willingness to pay the money. Moreover, groundwater use per quantity was not calculated and controlled by Kombolecha water supply and sewerage enterprise office. This study socio-eco efficiency resource model wasplayed a key role to resolve the groundwater consumption growth and green environmental problems tradeoff that would be sustain the future working and living conditions.

In addition to this, this study identified economic, social and environmental indicators in particular required resources, which would be tangible and intangible resources, to resilient the green environment in Kombolecha. For instance, this study was proposing required resources such as capacity building and trainings on green awareness, perception, and behviours to increase green technology and consumption growth; reducing poverty level, providing training to change consumption culture, reducing family size, groundwater management and controlling per quantity use and payment in Birr; green finance and green taxation that would be discouraged excess waste.

According to this study, however, all resources were not measured in monetary values. Instead, it was used non- monetary measures to include resources that would be balanced the consumption growth and green environment tradeoffs. For instances, this study proposed water lease per m^3 quantity/ Birr; water tax; loan or grants; insurance and etc in order to manage and control over use of groundwater resources. These proposed resources used to rehabilitate groundwater sources and depleted green environment. Moreover, this study respondent's green mind adoption to use technology and consumption behaviours during water consumption and recycling was critical to balance the consumption and recycling intensities. Furthermore, this study renowned the household's green membership and its roles to resilient the green environment. Participatory green financing and members have to be practiced during the household's water poverty in Kombolecha.

4.8.1.1 Groundwater payments

In this study context, green environment resilience and water resource protection has to be financed by collecting payments from consumers. Groundwater payments are the money proposed to be collected from the household and factory's groundwater consumption. In Kombolecha, there were no groundwater payments collected from the households and factory's groundwater consumption and recycling process. Consumers were not paid money for groundwater that used to recover the degraded sources and the green environment. According to experts interviewed in the field, Kombolecha water supply and sewerage enterprise office was not collected money from groundwater consumption processes. This leads this study to proposed required groundwater payments that used to rehabilitate the groundwater source. In this study, groundwater payments have to be imposed on the household and factory's consumption and recycling process per quantity use. In other words, groundwater payments, which are charges imposed on groundwater user. This study, therefore, was proposed groundwater payments as a resource in order to integrate the social, economic and environmental indicators that used to rehabilitate the degraded natural resource and environment. Particularly, this study was identified water payments, such as the groundwater lease, tax, loan, insurance fees and water charges per quantity consumption and etc. These water payments would be used limit over- groundwater consumption and excess waste discharges. These sources of groundwater payments would be used to recover the degraded water sources and green environment.

This study argued that collecting the groundwater payments and allocated the money to apply a socio- eco efficiency resource model was not self-sufficient. Instead, household's qualitative characters (green perception, culture, behaviours, poverty, family size and etc) would be changed by delivering continous technical training and capacity building before and after consumer's groundwater consumption and recycling processes.

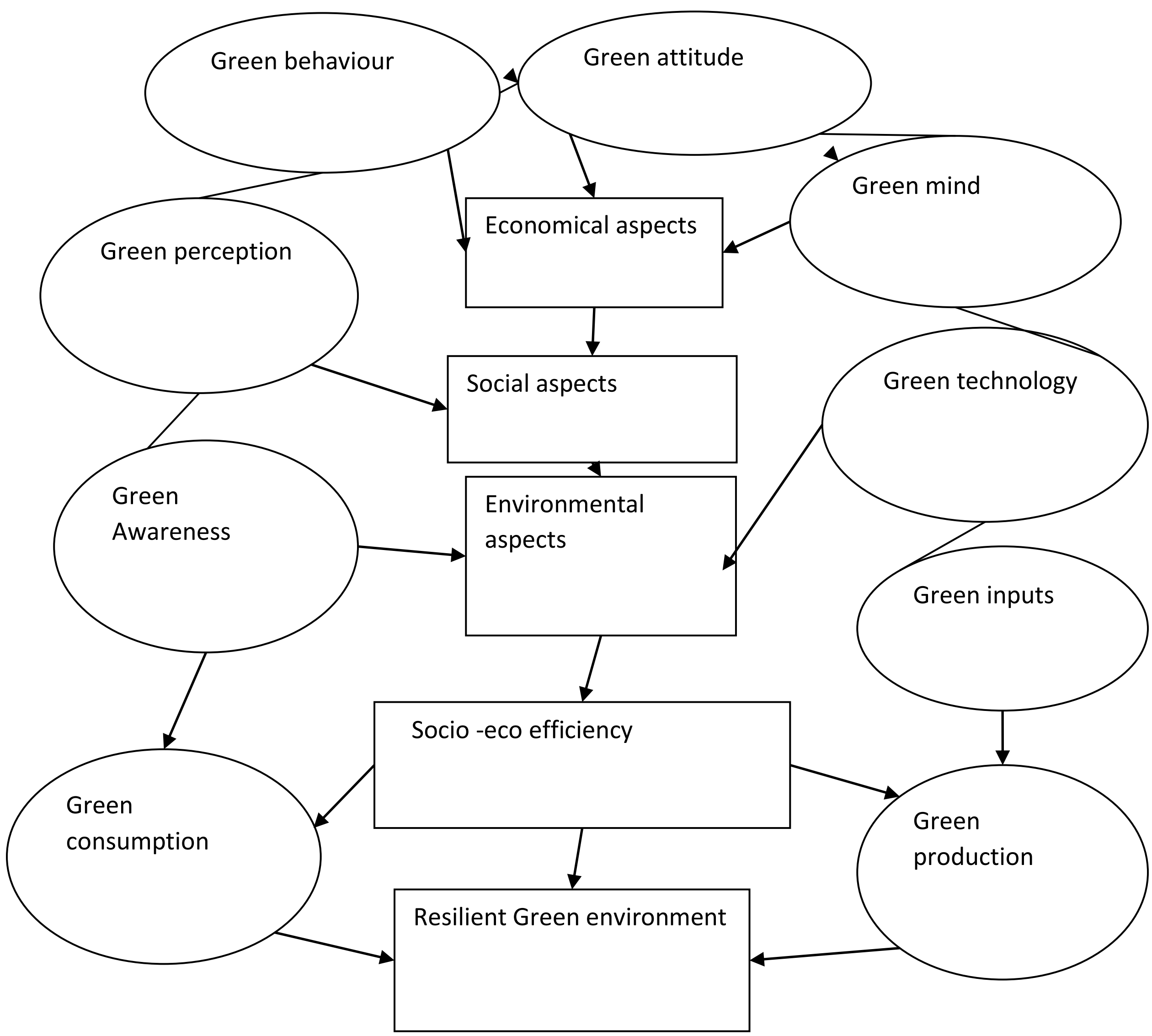


Fig 4.9: Significant and Identified Indicators Integration

Source: Adopted from (2009) and ESCAP (2014)

Figure 4.9 incorporates household's green attitude, perception, awareness, behaviours, sensitivity and emotionality, ability and willingness to pay the money that finally attempt green environment resilience. These respondent's qualitative characters were intertwined with their economic, social, and environmental indicators. To do so, this study socio-eco efficiency framework and resource model used the green finances that would be allocated to balance the water consumption growth and green environment tradeoffs; water consumption and recycling efficiency, consumption and recycling intensity. However, this socio-eco efficiency resource model was consisted social, economic and environmental aspects and sub indicators integration in figure 4.10.

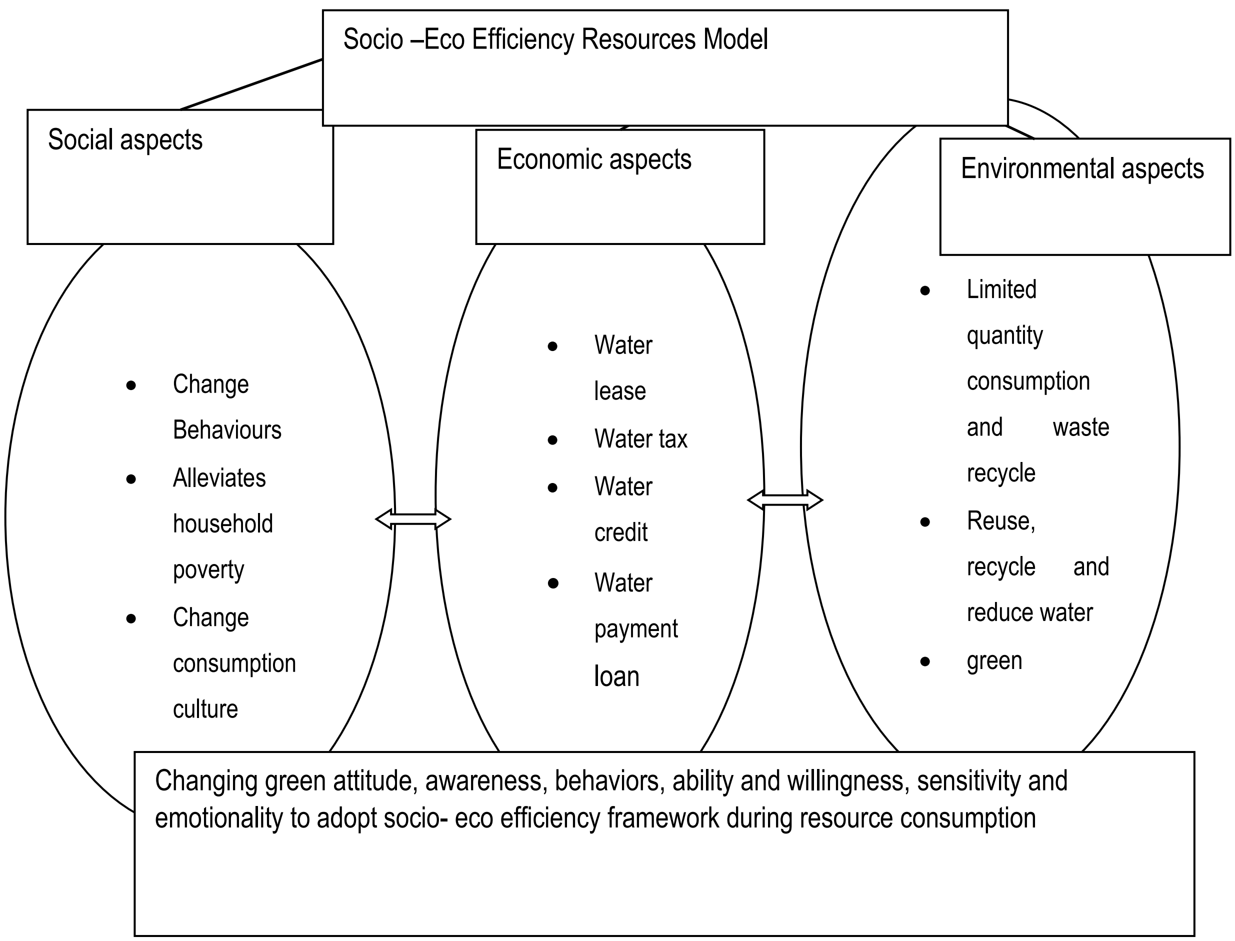


Figure 4.10: Socio-Eco Efficiency Resources Model

Source: Survey Result, 2017

Figure 4.10 illustrates a socio-eco efficiency resource model, which included major significant indicators, that resilient the green environment. Primarily, the household's attitude, perception, behaviours and etc were strengthened the economic, social, and environment indicators, which lately formed a socio eco efficiency resource model. The social, economic and environmental indicators required various resources, which balanced the consumption growth and green environment tradeoffs. This study green finances and taxation during groundwater consumption per quantity was proposed as an economic resource; household's green consumption behaviours, culture, habits, poverty and etc were social indicators but the water quantity and waste recycling limit was an environmental resource. The household's green awareness, perception and behaviours have to be enhanced by providing the capacity building and trainings.

In addition to this, green finance collections such as green tax, water lease, groundwater payment, and green membership were major resource that could be helped to practice the socio-eco efficiency resource during water consumption and recycling balances. Moreover, the respondent's green awareness, perception, behaviours, sensitivity and emotionality, willingness and ability to pay the money for green mind adoption, product consumption, marketing, technology use and jobs has to be integrated into socio-eco efficiency model. The green finances, as a result, would be helped to integrate the social, economic and environmental indicators and established a socio-eco efficiency resource model and later ensure the green environment resilience. These green finances and consistent sub indicators have to be integrated into social, economic, and environmental aspects that would be correspond to the groundwater consumption and recycling efficiency.

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4.9 Chapter Summary

This chapter discussed collected primary and secondary data results pertinent to the green environment issues in Kombolecha. Above all, this study investigated the water consumption growth and green environmental tradeoffs; water consumption and recycling efficiency; determined indicators on water consumption and recycling intensity and finally evaluated the simultaneous causality between economic, social and environmental indicators. In Kombolecha,it was found 16.2 percent green awareness inequality between the households in the course of water resource consumption and recycling process. In addition to this, the household's green attitudes, perception, consumption behaviours, awareness, sensitive and emotionality, consumption culture, housing ownership and the socio-demographic characters were differently associated and adversely affected the water consumption and recycling efficiency attainments.

First and foremost, the binary logistic regression determined that the household's awareness, attitude, perception, behaviours, willingness and ability to pay the money, and sensitive and emotional to experience the green mind, consumption, technology use, marketing exchange and jobs searches were associated and altered the resource consumption growth and green environmental tradeoffs at the 5 percent level of significance. However, the household's consumption culture and behaviours were found to be statistically significant and strongly determined the water resource consumption and recycling efficiency at the same level of significant. Predominantly, the household's housing ownership, and religious were determined the green environment resilience and groundwater restoration.

The household's family size, poverty level, inequality, consumption culture and behaviours were significantly determined the water consumption and recycling efficiency at the 95 percent confidence level. Moreover, instrumental variable model, particularly, computed that social indicators, such as household's consumption culture and poverty were exogenously influenced the water consumption and recycling efficiency at the 5 percent significance level. Similarly, the household's monthly income (economic indicators) and water consumption and recycle limit (environmental indicators) independently and significantly affected the resource consumption growth and green environment tradeoffs at the 95 percent confidence level. However, the socio-eco efficiency framework, which merged the key indicators, was strongly affected the water consumption and recycling efficiency with 0.055 values at the 5 percent significance level.

This study simultaneous equation model investigated the causality between social, economic and environmental indicators and their effect on the consumption and recycling efficiency. Particularly, the three-stage regression regressed found that the socio-eco efficiency framework was statically significant and influenced the water consumption and recycling efficiency. However, this study propensity score matching model evaluated that an economic, social, and environmental indicator (treated independent factors) were influenced the water consumption and recycling intensity (treated dependent factors) and in turn, balanced the resource consumption growth and the green environment tradeoffs (outcome factor) at the 95 percent confidence level. This study, therefore, developed a socio-eco efficiency resource model, which consisted of the various green resources, to balance the groundwater consumption growth and green environmental tradeoffs.

Chapter Five
Conclusion and Recommendation

5.1 Introduction

The main objective of this study was to develop a resource model for greening environmental resilience through applying a socio- eco efficiency framework at Kombolecha industrial Zone. In pursuit of this, it investigated the resource consumption growth and green environment tradeoffs; water consumption and recycling efficiency; water consumption and recycling intensities. Primarily, this study socio-eco efficiency framework emerged as an analytical tool and integrated social, economic and environmental indicators in the household's and factory's consumption but the same sub indicators were identified to resilient the green environment. Socio- eco efficiency framework was found simple and flexible to determine the qualitative and quantitative characters used and regressed in the binary logistic regression; instrumental variable, simultaneous equation and propensity score matching model. SPSS 24 and STATA 15 software version was used measure variable association and effects in the models and computed descriptive statistical results.

A significant conclusion of this study was the importance of socio-eco efficiency framework and its indicators, such as social (consumption culture, behaviours, poverty and etc); economic (monthly income) and environmental indicators (water consumption and recycle efficiency). Particularly, the household's attitude, awareness, perception, behaviours, willingness and ability to pay the money, sensitivity and emotionality to adopt a green mind, consumption, market, technology and jobs were significantly changed the consumption and green environment tradeoffs. As like other economic reform and industry growth programs (GTP 1&2)in Ethiopia, socio-eco efficiency framework has to be mainstreamed into industry growth programs and satisfies optimal balances between the consumption growth and green environment tradeoffs at city level.

The household's and factory's water consumption and recycle efficiency was immensely affected the green environment resilience in Kombolecha. However, the consumer's water resource consumption was showed increasing to gain a completive advantage of the social, economic and environmental benefits and guarantee their green living and working environment. It was investigated that the consumer's culture, behaviours, willingness to pay the money so as to adopt the green mind, consumption, technology, and job use were not practiced so as to ensure the water consumption and recycling processes. The groundwater was importantly determined the consumer's economic and environmental benefits and thus it has to be effectively managed to resilient the green environment. To do so, the respondent's social aspects, such as consumption culture, behaviours, poverty status and family sizeand etc were integrated into the economic (monthly income) and environment indicators (water limit). The integration of these indicators was building the socio-eco efficiency framework that poised the water consumption growth and green environment tradeoffs.

5.2 Findings of the Study

5.2.1 Objective One Findings

This study objective one assessed the household's perception and behaviours effect on the water resource consumption growth and green environmental tradeoffs. In order to do so, a triangulated research method, which consisted both quantitative and quantitative methods, used to investigate the household's perception and behaviours headed for adopting a green mind, technology and water resource use that cleared the water resource consumption growth and green environment tradeoffs. The household's perception, consumption behavior, awareness, attitude, sensitive and emotionality, willingness and ability to pay the money were measured with regards to their experience to adopt a green mind, market exchange, technology and job use during the water consumption and recycling processes. This study devised a binary logistic regression to measure the effects of each factor on the consumption growth and green environment tradeoffs.

The binary logistic regression followed Gujirati (1983&2004) and Greene (2011) post estimation procedures were used during regression and interpretation. Environmental Kuznet Curve Model by Kuznets, (1955) used to calculate the green inequality between the households in regarding perception and behaviours along with their monthly income (economic instrument); poverty (social instrument) and consumption and recycle efficiency (environmental instrument). Based on this, a wide green awareness inequality was found between households in the period of water consumption and recycling process in Kombolecha. There was also a wide green consumption behavioural inequality between households so as to adopt the green mind, technology use, market, and jobs that balanced the consumption growth and green environmental tradeoffs.

This study computed that respondent's perception towards green product consumption was influenced by respondent's family size and income level. For example, it was computed that 247 (73%) households have little perception to practice green product consumption but reduced the green environment tradeoffs. On the other hand, this study found that 173 (51.2%) male and 35(10.4%) male and female households were not behaved well about green technology use. However, 213 (63%) of respondent's consumption behaviours were aimed at reducing the economic cost compared to the social and environment costs. Out of the total households, 268(79.3%) respondents were disagreed that their water resource consumption behaviours were not environmental friend. However, the housing ownership significantly altered the resource consumption growth and green environment tradeoffs by 0.013 values at the 5 percent significance level. This was due to the household's sensitivity and emotionality for their own housing and ownership was significantly shaped the water consumption behaviour by 0.027 values at the same level of significance.

The household's green awareness to adopt the green mind by 0.002 values; living environment with 0.000 values, and technology use with 0.004 values were also positively associated and statistically influenced the consumption growth and green environment tradeoffs at the 5 percent significance level. The household's awareness about the green production was not influenced the consumption growth and green environment tradeoffs in Kombolecha. However, the household's perception towards practicing the green living and working environment (HHPLWENI) by 0.02 values; production (HHPgrnpr) by 0.005 values; consumption (HHPGrnco) by 0.011 values; technology (HHPgrnMk) by 0.05 values were statistically significant and affected the consumption growth and green environment tradeoffs. However, the household's perception about the green market was not affecting the resource consumption growth and green environment tradeoffs.

In addition to this, the household's consumption behaviours, which considered the economic cost reduction by 0.000 value; working environment by 0.000 values; living environment with 0.007 values and neighbour's environment protection by 0.000 values were found statistically significant and determined the water consumption growth and green environment tradeoffs at the 5 percent significance level. The household's consumption behaviour concerning to keeping the future water demand by 0.047 values and health protection (HHSSLTH) by 0.033 values were found significantly determined the water consumption growth and green environmental tradeoffs (CONVETRD) at the same level of significance. However, the respondent's consumption culture was significantly and strongly influenced the sensitive and emotional to behave green consumption by 0.000 value at the 5 percent level of significance. This study, therefore, incorporated the consumer culture (social aspect) into an eco-efficiency and developed a socio-eco efficiency framework. However, the household's willingness to pay the money was statistically significant and determined their sensitive and emotionality to apply the socio-eco efficiency framework by 0.000 values.

5.2.2 Objective Two Finding

This study objective two was concluded by identified the significant economic, social and environmental indicator's effects on the water consumption and recycling processes. It was, chiefly, determined the socio - eco efficiency framework and indicators effects on the water consumption and recycling efficiency. This finding was done by using an instrumental Variable model (IVM) and Two Stage Least Square regression (TSLM)used to determine the significant effect of the social, economic and environmental indicators. Model goodness of fit and correlation status was measured and checked by Pearson chi square along with Guajarati, (2004) and Greene, (2011) assumptions and guidelines during the regressions. Accordingly, the socio-eco efficiency chi square test value was calculated 0.466 that proved a valid association between the three key indicators and the socio-eco efficiency application during water consumption and recycling processes.

This study instrumental variable model was measured the exogenous effect of household's culture on the water consumption and recycling efficiency. Similarly, it was computed the endogenous effect of the economic indicators (monthly income) and environmental water quantity and waste discharge limits) on the consumption and recycling efficiency. Particularly, the consumer's social indicators (SOCINDI) were exogenously altered the socio-eco efficiency framework practices and, influenced the water consumption and recycling efficiency. However, the respondent's economic indicators (ECOIND) were statistically significant and strongly determined the socio-eco efficiency application and the consumption and recycling efficiency by 0.000 values at the 95 percent confidence level. In addition to this, the consumer's water quantity and waste discharged limits were significantly determined the water consumption and recycling efficiency by 0.001 values at the 95 percent confidence. Importantly, the household's sex and cultures were considerably affected the water consumption and recycling efficiency by 0.005 and 0.034 values respectively at the same confidence level.

However, the socio-eco efficiency framework, which consisted the three indicators, was statistically significant and affected the water consumption and recycling efficiency (WCORECF) by 0.046 values at the 5 percent significance level. This socio-eco efficiency application was positively associated with the water consumption and recycling efficiency. In other words, when consumers were applied a socio-eco efficiency framework (SOCIECO) by a unit, the water consumption and recycling efficiency was improved by 59.2 percent, hold others factors constant. This revealed that the socio-eco efficiency, which combines the social, economic and environmental indicators, significantly affected the water consumption and recycling efficiency. This study result was quite different from WBCSD (2009) eco efficiency and Sailing, *et al*.(2013) socio- eco efficiency findings.

The household's consumption culture was positively determined the socio-eco efficiency framework (SOCIECO) application and in turn, affected the consumption and recycling efficiency by 0.005 values at the 5 percent significance level. However, the household' poverty was negatively influenced the water consumption and recycling efficiency by 0.002 values at the 95 percent confidence. That is poor respondents were not integrated the three key indicators and employed the socio-eco efficiency framework. However, the household's awareness about the green consumption (AWgrnco) with 0.016; perception (HHPgrnco) with 0.001; behaviours (HHBgrnco) with 0.000; sensitivity for economic cost (HHSSECO) with 0.001, sensitivity for the living environment (HHSSLIV) with 0.035, sensitivity for the neigbours environment (HHSSNIB) with 0.001, willingness to pay the money (HHwiling) with 0.000 values importantly determined the socio eco efficiency. The household's consumption behaviours were significantly affected the gaps between water consumption and the recycling efficiency with 0.000 values at the 5 percent significance level.

5.2.3 Objective Three Finding

This study objective three was concluded by evaluated the three key indicators impact on the extent of the water consumption and recycling intensity in Kombolecha. This intensity was determined the consumption growth and the green environment tradeoffs that could resilient and then sustain the green environment. This study propensity scores matching model (PSM) was estimated the social, economic and environment indicator's impact on the water consumption and waste recycling intensity (treated dependent factor).It was found that the household's economic indicator (monthly income); social indicators (culture, behaviour, poverty, and family size) and the environmental indicator (water quantity limit) were significantly altered the water consumption and recycling intensity. In addition to this, the household's awareness regarding green mind adoption by 0.000; consumption with 0.001; buying with 0.000 and technology use with 0.008 values were substantially influenced the water consumption and recycling intensity. In other words, when the households were adopted a unit of green mind, the water consumption and waste recycling intensity were increased by 77 percent.

However, among main sub indicators, the household's poverty was negatively and significantly affected the water consumption and recycling intensity by 0.001 values at the 95 percent confidence level. In other words, when the household's poverty was escaped by 1.25 dollar per day, holding others factor constant, the water consumption and waste recycling intensity was improved by 17.3 percent. In the study area, female respondents were sensitive and emotional to optimise water consumption and recycling intensities compared to male respondents. However, poor respondents were facing inefficient water consumption and recycling intensities. Similarly, large family size respondents were not active enough to balance the water consumption and recycling intensities compared to small family sized respondents. Poor respondents were strived to filly daily food and non-food expenditures instead of the green environment resilience by keeping the ground water degradation.

5.2.4 Objective Four Finding

This study objective four was concluded by developing the socio-eco efficiency framework and its consistent socio-eco efficiency resource model. This model was consisted each significantly identified economic, social, and environmental indicators that were proved to balance the gaps between the water consumption and waste recycling intensity. This finding was done by collecting the primary data from 14 factories, 338 households, 50 key purposively selected experts, who were representatives of the municipal, Kebele administration, consumers, suppliers, NGOs, universities, professional unions, individuals, political parties and community leaders in Kombolecha. The various possible significant indicators, which were identified in objective one, two and three, were consistently executed their strength, weakness, opportunity and threats of each indicator in the model. Meanwhile, this study developed a socio-eco efficiency resource model by reducing the weakness and threats but using the strength and opportunities regressions.

This study indicators simultaneous causality and regression were measured by following Guajarati and Maddala (1983 &2004) and Greene (2011) simultaneous equation model assumption and estimation techniques. This chapter proposed the required resource for each significantly identified social, economic and environmental indicators and the built socio-eco efficiency model during groundwater consumption and waste recycling processes. Against to this study, WBCSD (2009) eco efficiency, BASF (2005) and Sailing, *et al. (*2013) moves from the eco efficiency concept to socio-eco efficiency (SEE balance), which consists the social, economic and ecology indicators, to sustain development. However, this study proved the social, economic and environmental indicators integration in order to get the socio-eco efficiency models using the two stages and three stages least square regression. Accordingly, this study framework merged the exogenous (social) and endogenous (economic and environment) indicators on the water consumption and recycling processes.

This study shared WBCSD (2009), ESCAP (2011), BASF (2005 &2009) and Tatari, *et al*. (2016) indicator's criterions. Accordingly, this study was established the socio-eco efficiency resource models and concluded that this model was balanced the gaps between the groundwater consumption and recycling intensity in Kombolecha. Above all, this study was combined the socio-environmental and eco-environmental indicators in the course of both households and factory's water consumption and recycling intensity. Meanwhile, the combination of these indicators was built the socio-eco efficient resource model. However, the simultaneous equation and instrumental variable model proved that the socio- environment and eco-environmental indicators were not coupled 100 percent to build the socio-eco efficiency model. So that some part of each indicator, which was significantly associated and influenced the water consumption and recycling efficiency, was established the socio-eco efficiency resource model. This model optimised to balance the water consumption and waste recycling gaps and in turn, recovered the green environment in Kombolecha.

However, this resource model was required resources to poise the water consumption and recycling gaps. Accordingly, this study, therefore, identified and developed the economic resources (green finances), such as green tax, lease, loan, insurance, pollution tax (pigovian) and groundwater payments per m^3. According to respondents, these green finances could be reduced the degraded groundwater sources and the green environment in Kombolecha and at large in Ethiopia. Moreover, the household's attitude, awareness, behaviours, perception, culture and norms would be shaped by the green trainings and capacity building services. Furthermore, the household's groundwater limit and recycling gaps were included in the consumer's consumption and recycling processes. Other intangible resources, such as entrepreneurial skill, technology incubation, incentives, green association and etc included in the socio-eco efficiency resource models. The household's green attitude, awareness, perception, behaviours, sensitive and emotionality, willingness and ability to pay, culture, housing ownership and habits to practice the green mind, product, marketing, technology use and green jobs were incorporated intothe socio-eco efficiency model.

This study socio- eco efficiency resource model would be combined the social indicators, such as consumption behaviours, culture, poverty, family size and inequality. While, economic indicator was the household's monthly income and the water quantity and waste discharge limit were main environmental indicators. These indicators combination and the required resources mentioned so far integrated in the socio-eco efficiency model that would be resilient the green environment at the 95 percent confidence level. This showed that the socio-eco efficiency resource model, which consists the social, economic and environmental resources, was consistent and relevant to recover the green environment in a drought affected Kombolecha.

5.3 Conclusion

This study concluded that the socio-eco efficiency framework application was keenly played a role and taken the advantage of recovering the green environment. This study green environment resilience was proved by balancing the complex resource consumption growth and green environment tradeoffs; water consumption and recycling efficiency and the water consumption and recycling intensity. In concluding this finding, this study shared WBCSD (2009), ESCAP (2011&2014), BSAF (2005&2009) eco efficiency and Sailing, *et al*. (2013) SEE balance (socio-eco efficiency) conceptual frameworks that targeted to improve the company product quality and manufacturing performance improvement. However, this study attempted to identify and integrate the various significant social, economic and environment indicators to build the socio-eco efficiency framework in the household and factory's water consumption and recycling process in Kombolecha.

Against to the previous studies mentioned, this study employed the binary logistic regression model, instrumental variable model, simultaneous equation model and the propensity score matching estimation (logit model).The latest STATA14 and SPSS20 version was used to compute descriptive statistical results and run regression. Based on this, the binary logistic regression model was identified the significant household's awareness, perception, consumption behaviours and etc on the resource consumption and growth and the green environment tradeoffs. In addition to this binary model measured and significantly identified the household's green consumption inequality, poverty, housing ownership, sensitivity and emotionality; ability willingness to pay effects on the resource consumption growth and the green environment. The respondent's family size and sex were significantly affected the water consumption growth and green environment tradeoffs. For instance, it was concluded that the poor, female and large family size respondents were not worried about water consumption growth and the green environment tradeoffs. This logistic regression also computed that the household' perception and consummation behaviours determined their green mind adoption, consumption, marketing, technology use and green jobs searches.

However, the household's perception and consumption behaviours, which attempted to reduce an economic cost, were strongly determined the resource consumption growth and green environmental tradeoff. Besides, the household's social aspects, such as consumption culture, family size, ability to pay the money, poverty and inequality were strongly influenced the water consumption and recycling efficiency at the 95 confidence level. Particularly, poor households were not behaved green, sensitive and emotional, able to pay the money that optimise the water consumption and recycling efficiency at the same level of confidence. However, female respondents were sensitive and emotional to safe water resource and keep the living environment compared to male respondents.

In addition to this, this study concluded by identifying that the social, economic and environmental indicator's effect on the water consumption and recycling efficiency. To determine these indicators effect, instrumental variable model and two stage regressions were used and computed the significant social, economic and environment indicators on water consumption and recycling efficiency at the 95 percent confidence level. This study I finding was dissimilar to BSAF (2005&2009), ESCAP (2011) indicator and Sailing, *et al*. (2013) SEE balance analysis. In other words, this study instrumental variable model computed the exogenous factors (social indicators) and endogenous factors (economic and environments indicators), which built the socio-eco efficiency framework, effects on both household and factory's water consumption and recycling efficiency. Accordingly, in the two-stage regression, the socio-eco efficiency was significantly shaped the water consumption and recycling efficiency and in consequence resilient the green environments by 0.055 values at the 5 percent significance level. However, the household's culture, behaviours and poverty were significantly altered their water consumption and recycling efficiency. Moreover, the respondent's economic aspects (monthly income) and environmental aspects (water quantity use and waste limit per m^3) regarding the groundwater use have some bearings on the gaps between water consumption and recycling efficiency.

This study, furthermore, computed the simultaneous causality between key indicators and evaluated their impacts on the water consumption and waste recycling intensity by using the simultaneous equation and propensity score matching model respectively. Accordingly, this study concluded that the social, economic and environmental indicators have a simultaneous causation and associated to build the socio-eco efficiency framework. This framework was concluded to be the basis to resilient the depleted groundwater resources and green environment in Kombolecha and over the entire world. This study simultaneous equation model, which run the three-stage least square estimation, calculated the socio-eco efficiency framework was statistically significant and substantially altered the groundwater consumption and recycling intensity by 0,046 values at the 5 percent significance level. However, it was vitally identified that the socio-eco efficiency indicators, such as the consumer's culture, behaviours, monthly income, and poverty were significantly affected the water consumption and recycling intensity and in turn, influenced the green environment resilience in Kombolecha.

This study also concluded by evaluating the socio-eco efficiency indicator's impact on water consumption and recycle intensity gaps. It was identified that both households and factories were sensitive and emotionality for economic factor than social and environmental issues. Particularly, the households were sensitive and emotional to recover the living environment than the working environment at the 95percent confidence level. It was, finally regressed that the green environment resilience was an outcome factor, which substantially altered by the households and factory's water consumption and recycling intensity (treated depend factor) and affected by treated independent factors, such as the household's poverty, monthly income, perception and behaviours, family size, water quantity and waste limit, culture and etc. This study concluded that the treated in dependent factors were created a paradox in the period of water consumption and recycling process. This study socio- eco efficiency resource model, which consists the key significant indicators, were, therefore, changed the groundwater consumption and recycling intensity.

This socio-eco efficiency conceptual resource model, thus, integrated the social, economic and environmental resources to recover the green environment though balancing the tradeoffs between consumption growth and green environment; water consumption and recycling efficiency and groundwater consumption and waste recycling intensity. Otherwise, according to Shcherbakova, (2010), if societies and governments fail to develop economically viable, socially acceptable and environmentally benevolent strategies to stabilize the worsening trends, significant amount of the carrying capacity of earth will be lost, which is expected to cause severe problems worldwide. This study socio- eco efficiency resource model, therefore, was vitally consisted of the groundwater resource, such as green tax, pollution tax, groundwater lease, groundwater payment per cubic metre of water, water quantity and recycles limit, rules and procedures, have to be incorporated in the household's and factory's water resource consumption and recycling processes.

This study concluded that the household's, government and factories should be enhanced the capacity of consumer's green attitude, consumption behaviours, perception, awareness, sensitivity and emotionality, poverty, family size, culture; increased the economic indicators for instance monthly income and water payment abilities during consumption and recycling and finally limited environmental indicators, such a groundwater consumption and waste discharges so as to recover the green environment. To pursuing so, green resources and finances like groundwater lease and payment, green member fees, green tax, and charges have to be lived in the period of consumption and recycling processes. This study concluded that the green member's association and participation have to be undertake to set of scales on the green resilience programs in Ethiopia and in particular to Kombolecha industrial zone. In addition to this, this study socio- eco efficiency framework and the conceptual model should be studied and included in academia curriculum to overcome the continuous drought, variable rainfall dependence, and grey environments resulted by unbalanced resource consumption growth and environment tradeoffs at the drought affected areas in Ethiopia, Africa and over the entire world. Relevantly, this study suggested that socio- eco efficiency further studies along with the ecosystem and biodiversity protection and water resources consumption in multi-disciplinary fields would be ensured the green growth at Ethiopia, Eastern Africa, and in the world.

5.4 Recommendation

This study recommendation was based on the findings and result discussion so far. Primarily, it recommended that it would be keenly vital to study further about the green environment resilience in a different filed and specialization like psychology, hydrology and ecology to addressee the consumer's water consumption and recycling behaviours. As like other green frameworks that seek to capture multidisciplinary study with in a limited time span, this study socio-eco efficiency framework and the identified indicators have parts that require further refinement and studies by researchers from the different behavioural, natural resources management discipline. Despite this study determined that the significant indicators by using an econometric model, technical measurement and test of the socio-eco efficiency resource model would be required and tested during the water resource consumption and recycling process in the laboratories at aggregate industrial level. The water life cycle assessment has to be done in the short run by Kombolecha water and supply enterprise office. However, in the long run, FDRE government of Ethiopia and Amhara regional state have to incorporate the groundwater use and envisage policies that would be considered the groundwater exploitation, consumption and waste recycling processes.

This study found that 68 percent of the respondents agreed that there were green environmental problems in Kombolecha, which, particularly, caused by the water and river pollution. So, in the short periods, the factory's and households have to plan the groundwater consumption and recycling efficiency. This study green environment resilience was determined by the resource consumption growth and green environment tradeoffs; consumption and recycling efficiency; and water consumption and recycling intensity. Since the green resilience was varied across the spatial areas, it would be required further studies in the course of water consumption and recycle intensity, where continuous drought and variable rainfall was prevalent in Kombolecha.

However, the water resource consumption growth and green environment tradeoff was significantly affected by the household's awareness, perception, behaviours, culture regards to adopt the green mind, product consumption, marketing, technology use and job searches. In addition to this, the household's green inequality and consumption behaviours, poverty, family size and housing ownership were strongly determined the tradeoffs between consumption growth and the green environment tradeoffs. It was therefore, recommended that, in short run, Kombolecha municipal and administration office has to assess further technical analysis regarding the groundwater consumption and waste recycling efficiency and provide the green trainings and capacity building for the poor; large family sized households as well as factory. In the long run, the FDRE government of Ethiopia and the Amhara regional state has to study further about the technical groundwater use and rainfall utilization alternatives via including in the national policies and programs. Besides, the green membership associations have to be established and that would enhance the household's green awareness, perception, consumption behaviours but narrow the inequality between poor and non-poor households.

This study found that the household's and factories have different water resource consumption and recycling trends, motives and elasticity demand in order to realize the social, economic and environmental benefits. This study investigated the various factors that were allied with the household's green behaviours and perception and poverty, which is subjective and varied across the spatial and national level. In other words, water poverty and elasticity demand were found subjective across countries, regions, villages and household's level. Komboelecha is among the eastern African rainfall dependent city, where the household's water poverty was significantly influenced the resource consumption growth and the green environment tradeoffs. This study, thus, required further water poverty and green inequality refinement and studies at macroeconomic level by the researchers, academia and water institutions. This household poverty and green awareness inequality was found wide and associated with the various social, economic and environmental indicators, and thus would require further technical industry analysis to resilient the green environment and climate change.

In the course of this study, the households were differently reacted to adopting the green mind, consumption, production, marketing, technology use, and job searches. This was due to the diverse household's attitude, awareness, behaviours, perception, sensitivity and emotionality, willingness and ability to pay, culture, were determined the water consumption and recycling efficiency. Particularly, this study found out that the household's and factories were attempted to reduce an economic cost compared to the social and environmental costs. This study found disintegrated social, economic and environmental aspects between consumer's water consumption and recycling intensities. This study, therefore, merged the consumer's social, economic and environmental aspects and built the socio-eco efficiency framework. However, the household's perception, consumption behaviours and culture do not see to adequately explain the divergence of characters and the socio-eco efficiency framework in a different ecological and behavioural discipline that would have different insights between the consumer's social, economic and environment motives.

The households and factory's groundwater resource consumption growth was seen to be more relevant. This study, therefore, contributed a socio-eco efficiency framework and the consistent resource models that could be included in the academia and education curriculum to balance and sustain the groundwater consumption and recycling gaps in growing industrial cities like Kombolecha. Particularly, the green finances such as green tax, groundwater leases have to be included in the drought affected cities Kombolecha water management plan that would balance the water consumption and reclining intensities. This study identified the household's economic aspects (monthly income) and factory's profits were determined the water consumption and recycling intensities. As a recommendation, for further studies, it would be beneficial for a more in-depth comparative industry competitive social, economic and environment advantages and resource models and its endowments in order to isolate the impacts of the household's consumption culture and behaviours. Furthermore, in this study subjectively measured indicators at the household's level. It would be recommended to measure the social aspects across the industry's level using the objectives criterion at aggregate aspects in Ethiopia.

This study contribution was the socio-eco efficiency resource model that would resilient the green environment by balancing the groundwater consumption and waste recycling efficiency. Nevertheless, this resource model is requiring a specified determination of human, financial, and intuitional resources and requirements, which are pertinent to the green environment resilience across countries and cities. So that, this socio-eco efficiency resource model, which consisted the social, economic and environmental resources, has to be studied further in a multidisciplinary field and by academia that would have to optimise the groundwater exploitation, allocation, distribution and sustain the green growth and development. This study socio-eco efficiency resource model, which consists green finances (Pigouvian tax), association and member payments, has to be studied in the future in different field like accounting to collect income that would be assured the global climate change.

5.5 Contribution of the Study

This study contributes the socio-eco efficiency framework that optimises the household and factory's water consumption and recycling efficiency. These socio-eco-efficiency indicators were identified to balance the tradeoffs between the consumption growth and green environmental problems. Moreover, this framework used tofill the gaps between water consumption and the waste recycling and in turn, resilient the green environment. Exceptionally, this study considered the household's social aspects, such as consumption behaviours, perception, culture, poverty, family size, housing ownership and etc; economic aspects (monthly income) and the environmental aspects (water quantity and waste limits). These indicators significance and association were identified and determined by using a binary logistic regression, instrumental variable (IVM), simultaneous equation model(SEM) and propensity score matching estimation (PSM).

However, previous study findings, such as ESCAP (2011), WBCSD (2009), UNIDO (20010) indicators; BASZF (2005&2009), ESCAP (2011) eco efficiency and Sailing*, et al. (*2013) SEE balance, and Tatari, *et al.* (2016) indicators analysis attempted to improve the company's product portfolio and quality performance improvement. However, this study considered both the household's and factory's water consumption and recycling. This study socio-eco efficiency merged the household's social aspects into eco efficiency indicators (economic and environmental) by using the two stage least square estimation. In the first stage regression, it computed the effects of economic (monthly income) and environment (water quantity limit) whereas, in the second stage, it measured the social indicator's effect on the water consumption and recycling efficiency. This study data measured at micro level (household's) level and proved the green environment resilience in the aggregate manner in Ethiopia and over the entire world by integrating the three key indicators or using a socio-eco efficiency framework.

This study green environment is presently considered one of the major problems for today's global climate change and the green growth in eastern Africa, Ethiopia. These green issues and the consistent challenge prevalence were, therefore, concerned topical enough to guarantee this study to develop a socio-eco efficiency resource model to resilient the green environment in. This topic is very relevant and consistent in LDCS including Ethiopia and in particular to Kombolecha, where new emerging firm's growth and population density are alarmingly speeding up the tradeoffs between water consumption growth and the green environment problems. Moreover, this study topic is fitted in sub-Saharan countries and Ethiopia, where the variable rainfall continuously affected the vast agriculture sector. The green environment resilience; groundwater consumption and recycling efficiency policies are, yet, underdeveloped in Kombolecha.

This study socio-eco efficiency indicators would be helped the households, factories, executives, managers, municipal and city authorities, planners and national policy makers to have a road map to adopt the framework as a tool methodologically to optimise the water consumption and recycling efficiency. These decision makers and consumers would be suited and recruited the socio-eco efficiency model in the course of groundwater exploitation, consumption and recycling. This study would also assist policy makers in Ethiopia and abroad in assessing the green growth policies currently under implementation in growth and transformation plan two (GTP2). Moreover, this study would ensure that the future green growth policies undertake the impact of the polices on the understanding of the household's awareness, perception, behaviours to adopt the green mind, consumption, marketing, and technology use in the future policy directions. Particularly, the socio-eco efficiency model, which pinpoints the water consumption and waste recycling is a key driver of the green environment and also provide and inputs to regulatory regarding some of the apathy of groundwater exploitation and consumption policy that served for an avenue for the future living environment.

Moreover, understanding the household's consumption behaviours, poverty level, housing ownership and culture would be assisted the policy makers in the policy formulation process. Especially, the groundwater regulatory should be incorporated and aware of the socio- eco efficiency dynamic benefits to realize that green environment polices that are tailored to integrate the social, economic and environment indicators in ESCAP (2011), WBCSD (2009), UNEP (2011), BASF (2005&2009) and Sailing, *et al*. (2013) in BASF chemical company. Nevertheless, the development of green initiatives has to seek the economic opportunities in the green resilience and calling the key decision-making units that play a leading role to resilient the green environment. This socio-eco efficiency model has to be done to optimise the water consumption and recycling efficiency. This resource model would alleviate the green poverty and inequality between consumers and should also play a role to recover the green environment and climate changes.

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7. Appendices

Appendices 1: Professional editing

Professional Editing and Analysis Consultancy

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CERTIFICATE

This serves to certify that I have language edited the thesis of Tefere Eshete Kebede a Doctorate candidate in the Department of Environmental Sciences at the University of South Africa.

Entitled: **DEVELOPMENT OF A RESOURCE MODEL FOR GREENING ENVIRONMENTAL RESILIENCE: SOCIO - ECO EFFICIENCY FRAMEWORK ANALYSIS AT KOMBOLCHA INDUSTRIAL ZONE, ETHIOPIA.**

T. Kuziva

Editing and Analysis Consultant

Professional Editing and Analysis Consultancy

Appendices 2: Turnitin Report

Appendices 1

Digital Receipt

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DEVELOPMENT OF A RESOURCE MODEL FOR GREENING ENVIRONMENTAL RESILIENCE:
SOCIO - ECO EFFICIENCY FRAMEWORK ANALYSIS At KOMBOLCHA INDUSTRIAL ZONE,
ETHIOPIA.

By:

TEFERA ESHETE KEBEDE
STUDENT NUMBER *1508767911*

Submitted in accordance with the requirements

For the degree

DOCTORATE (PhD)
IN ENVIRONMENT MANAGEMENT

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES

DEPARTMENT OF ENVIRONMENTAL SCIENCE
At the
UNIVERSITY OF SOUTH AFRICA

SUPERVISOR:

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Appendices 3: Ethical Clearance

UNISA university of south africa

2014-04-03

Ref. Nr.: 2014/CAES/021

To:
Student: TE Kebede
Supervisor: Dr Zenebe Teferi Adimassu
Department of Environmental Sciences
College of Agriculture and Environmental Sciences

Student nr: 50876791

Dear Dr Teferi and Mr Kebede

Request for Ethical approval for the following research project:

Developments of resource model for greening environmental resiliency: Socio-eco efficiency framework analysis in Kombolcha Industrial Zone, Ethiopia

The application for ethical clearance in respect of the above mentioned research has been reviewed by the Research Ethics Review Committee of the College of Agriculture and Environmental Sciences, Unisa. Ethics clearance for the above mentioned project (Ref. Nr.: 2014/CAES/021) **is given** for the duration of the study.

Please be advised that should any part of the research methodology change in any way as outlined in the Ethics application (Ref. Nr.: 2014/CAES/021), it is the responsibility of the researcher to inform the CAES Ethics committee. In this instance a memo should be submitted to the Ethics Committee in which the changes are identified and fully explained.

The Ethics Committee wishes you all the best with this research undertaking.

Kind regards,

Prof E Kempen,
CAES Ethics Review Committee Chair

Prof MJ Linington
Executive Dean: College of Agriculture and Environmental Sciences

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
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Appendices 4: **Sample proportional Determination**

Within each stratum, indeed, there are more methods to determine the allocation of sample households, for this research proposal, proportionate allocation system will be employed. Accordingly, suppose i is the number of people stratum separately in the study area; n_i is the number of sample size in $_i{}^{th}$ stratum and N_i is the population size of $_i{}^{th}$ stratum. Thus, the total sample (n) will be equal to $n_i + N_i$. With this respect, the proportion of sample households will be determined as; $n = n_1 + n_1 + \ldots + n_k$ is the total sample size in stratum and $N = N_1 + N_2 + \ldots + N_k$ is the total sample size in population. The sample size will be computed

using the formula $$n_i = \frac{n}{Ni} Ni$$

Table (1): *Sample proportional allocation in the stratum*

Sample People Proportion in the Stratum					**Total**
Stratum	Factory employee	Supplier	consumer except factory employee	Service providers	
Population size	1537	450	1265	125	
Sample fraction	0.01	0.13	0.01	0.03	
Final sample size	154	55	126	4	338 Total sample

Sample Factory Proportionate in the stratum(based on their consumption process)						
Stratum	Cloth& garment	Beer and soft drink	Metals and steel	Food and related processing	Leather and related producer	Manufacturing
Population size	4	1	3	5	1	6
Sample fraction	1/5	1/20	3/20	¼	1/20	3/10
Sample size	1	1	1	1	1	1

Source; *Kombolcha city municipality office, 2013*

Table 4.28: Water consumers Category in Kombolecha

Attributes							
consumers	**Consumption/m³**	**Metre rent**	**Consumption fee**	**Penalty**	**Total for 4 year**	**Total sold/birr**	**Bill total**
Private	839962	377994	2873613	158767.3	3410374.3	3402603.4	5571904.34
Commercial	173478	25449	1040590.5	16690.8	1082730.3	1080943.1	2030224.9
Government	256661	8967	1745348.15	5426.56	1759741.7	1758416	4927613.7
Factory	161721	2103	1441088	1205.41	1444396.4	1444396.5	2081861.2
Public	20981	2598	129002.5	1635.73	133236.2	133175.7	273256.03
Bono	8024	2979	25840.75	1311.30	30131.05	29809.6	51391.9

Source: Kombolecha water supply and sewerage enterprise office, 2016

Appendices 4: Consent form

THIS CONSENT FORM GUIDELINE WILL SUBMIT TO COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCE, UNISA.

TITLE:

DEVELOPMENT OF RESOURCE MODEL FOR GREENING ENVIRONMENTAL RESILIENCY: SOCIO-ECO EFFICIENCY FRAMEWORK ANALYSIS IN KOMBOLCHA INDUSTRIAL ZONE, ETHIOPIA.

NATURE AND PURPOSE OF THE STUDY

The purpose of this proposal is prepared for PhD thesis research in environmental management, College of Agriculture and Environmental Science, University of South Africa.Recently, the number of factories and people are alarmingly increasing in Kombolcha city industrial zone, Ethiopia. Their resource (water and waste) consumption and recycling activities inefficiently erode the nature of green environment. Such that it is vital to investigate more researches which will balance the apparent tradeoff between environmental problems and resource consumption to resilient the degraded environment. Hence, the purpose of this proposal will increase knowledge and applicability of socio - eco efficiency framework, which resolves green environmental problems, on people and factory's resource consumption and recycling activity in Kombolcha. Its aim will assess people social aspects and describe socio - eco efficiency framework regarding the current water and waste consumption and recycling activity in meeting green environmental problems in Kombolcha industrial zone. To achieve this, its main objective will determine association of indicators on water and waste consumption and recycling process at altering social, economic and environmental lifecycles.

Data will be gathered using self-completedstructured questionnaire, interviews, focus group discussion and conference meetings which consist of both open and close ended questions. For which it concerns and to be understandable for you, the questionnaire will be prepared in English but later translate in to Ethiopian Amharic language. It will contribute new insight for the pursuit of knowledge for the community and research inputs for the country at a global perspective.

RESEARCH PROCESS

This study will have the following research process along with your data information.

Dear questionnaire, focus group, interview and conference participant be reminding the following points: -

I. Do not write your name in any of the questionnaire page
II. Feel free to answer the question since it is an academic study that give opportunity to reflect your idea, opinions, suggestions and comments
III. The researcher will visit and come back to your home and office to distribute and gather questionnaire and to get feedbacks
IV. Make sure that there is no right or wrong answer but be straight forward to the context of this study particularly the questions
V. Unfortunately, if questions will not be understandable and vague, the researcher will interpret them
VI. Video recording and digital camera will be used during interview, focus group discussion and conference meetings during data collection process
VII. If you can't write your answer on the questionnaire, the researcher will be ready to write your answer on the questionnaire
VIII. Your response will have paramount importance for your community to recover the degraded green environment in the study area and also at global perspectives

CONFIDENTIALITY

The confidentiality of respondents will be kept by the researcher. That is your view and response will be treated as confidential besides to not publishyou name in any journals or part of this study. Therefore, the data will be used only by the researcher, supervisorand college of Agriculture and Environmental Science, UNISA.

VIDEO, TAPE AND CAMERA RECORDING NOTIFICATION

This study will be used videoand digital camera to take video and photograph during interview, group discussion and conference for the purpose of data collection only. This document will be only used for academic researches and hence no individual character and right violation will be recorded and taken in photograph. The document will be kept by the researcher in own computer files and documents. Without the permission of you, any of the video, photographand profiles will not be disseminated for other purposes.

WITHDRAWAL CLAUSE

The respondent hereafter I, understand that I may withdraw from being part of the questionnaire anytime. I, therefore, participate voluntarily until such time as I request otherwise.

BENEFITS OF THE STUDY

Indeed, greening environment and climate change todayseemsevery one issue, however, poverty and unemployment leadgovernments toshiftvast agriculture to industrial sectors. With this respect, in Ethiopia cities like Kombolcha, factories and people'sresource consumption growth exploit land, water, and forest to generate their profit and satisfactions. In other words, dense population and factory's consumption and recycling activities plunder and put enormous pressure on environment that affect the quality of green nature and multiplying health problem.

Until population growth and poverty are speeding up, industrial growth is continuing and impossible to giving up in Kombolcha. Hence, brown environment and resultant problems are multiplying at global perspectives. So as to resolve such prevalent and interrelated problems, this study will be potentially beneficial for households, factories, societies and government's national programs which reduce environmental problems and hence realize green economy growth. Moreover, socio- eco efficiency framework analysis, which consider social, economic and environmental indicator on consumption and recycling activities, resilient the degraded green environment at the same time reduce resource (water and waste)use in Kombolcha and at large in Ethiopia.

INFORMATION

If any inquires and information, I will request and consult my supervisor Dr. Chipo Mukonza and Dr chitakira Munyaradzi, UNISA, SA. Address: e-mail: chiponyam2@yahoo.com.

DECLARACTION

I, undersigned…………………………………………………………………………………….(full name) have read the above information relating to the research and have also heard the verbal version and declare that I understand it and have been afforded the opportunity to discuss relevant aspects of the study with the researcher and hereby declare that I agree voluntarily to participate in this research.

I further undertake to make no claim against the University in respect of damages to me or reputation that may be incurred as a result of the research.

I will receive a signed copy of this consent form.

Signature of participant………………………………………………………………….

Signed at………………………………… on…………………………………………..

WITNESSES

Name	**Signature**
1.---	
2.--	
3. ……………………………………………	………………...

Appendices 5: Diagnostic Test and Indicators Correlation Result

Spearman correlation SOCINDI culture ECOINDI ENVINDI WCORECF SOCIECO

(obs=49)

	SOCINDI	culture	ECOINDI	ENVINDI	WCORECF	SOCIECO
SOCINDI	1.0000					
culture	0.0954	1.0000				
ECOINDI	0.0215	-0.0085	1.0000			
ENVINDI	-0.2371	0.0999	0.0877	1.0000		
WCORECF	0.0611	0.0274	-0.1334	-0.0822	1.0000	
SOCIECO	-0.0299	-0.1841	-0.0288	-0.1833	0.0479	1.0000

Appendices 5: Logistic Regression Result

```
. mlogit COENVTRD Awgrnmin Awgrnpco Awgrnbuy Awgrntec Awgrnjob, baseoutcome(0) nolog

Multinomial logistic regression                 Number of obs   =        338
                                                LR chi2(5)      =      40.79
                                                Prob > chi2     =     0.0000
Log likelihood = -87.716351                     Pseudo R2       =     0.1886
```

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
No	(base outcome)					
yes						
Awgrnmin	1.108172	.7063789	1.57	0.117	-.2763047	2.49265
Awgrnpco	-1.202664	.6939987	-1.73	0.083	-2.562877	.1575481
Awgrnbuy	-.4748437	.5273683	-0.90	0.368	-1.508467	.5587791
Awgrntec	-1.811958	.5165143	-3.51	0.000	-2.824307	-.7996082
Awgrnjob	-.3313192	.5073174	-0.65	0.514	-1.325643	.6630047
_cons	2.840912	.3322868	8.55	0.000	2.189642	3.492183

```
. mlogit COENVTRD HHPLWENI HHPGrnco HHPgrnpr HHPgrnMk HHPGTECH HHPGindu, baseoutcome(0) nolog

Multinomial logistic regression                 Number of obs   =        338
                                                LR chi2(6)      =      30.84
                                                Prob > chi2     =     0.0000
Log likelihood = -92.690054                     Pseudo R2       =     0.1426
```

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
No	(base outcome)					
yes						
HHPLWENI	-.6335702	.2717764	-2.33	0.020	-1.166242	-.1008982
HHPGrnco	.745936	.2937399	2.54	0.011	.1702164	1.321656
HHPgrnpr	-.8574688	.3074394	-2.79	0.005	-1.460039	-.2548986
HHPgrnMk	.0615853	.2636859	0.23	0.815	-.4552295	.5784001
HHPGTECH	-.4822763	.2521824	-1.91	0.056	-.9765448	.0119922
HHPGindu	-.469131	.2546109	-1.84	0.065	-.9681591	.0298972
_cons	7.549852	1.800747	4.19	0.000	4.020454	11.07925

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
No	(base outcome)					
yes						
HHPLWENI	-.6335702	.2717764	-2.33	0.020	-1.166242	-.1008982
HHPGrnco	.745936	.2937399	2.54	0.011	.1702164	1.321656
HHPgrnpr	-.8574688	.3074394	-2.79	0.005	-1.460039	-.2548986
HHPgrnMk	.0615853	.2636859	0.23	0.815	-.4552295	.5784001
HHPGTECH	-.4822763	.2521824	-1.91	0.056	-.9765448	.0119922
HHPGindu	-.469131	.2546109	-1.84	0.065	-.9681591	.0298972
_cons	7.549852	1.800747	4.19	0.000	4.020454	11.07925

```
. mlogit COENVTRD HHBGNCOF HHBWORY HHBWatLO HHBWagft, baseoutcome(0) nolog

Multinomial logistic regression                 Number of obs   =        338
                                                LR chi2(4)      =      49.86
                                                Prob > chi2     =     0.0000
Log likelihood = -83.178914                     Pseudo R2       =     0.2306
```

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
No	(base outcome)					
yes						
HHBGNCOF	-.855952	.2564686	-3.34	0.001	-1.358621	-.3532827
HHBWORY	.7734017	.2250477	3.44	0.001	.3323163	1.214487
HHBWatLO	1.050137	.1965207	5.34	0.000	.6649631	1.43531
HHBWagft	.087821	.1597219	0.55	0.582	-.2252283	.4008702
_cons	-1.425148	.8970374	-1.59	0.112	-3.183309	.3330131

```
. mlogit COENVTRD HHBWgrnc HHBWeco HHBwlivp HHBwNip HHBwrkig HHBwfutg HHBwenvp, baseoutcome(0) nolog

Multinomial logistic regression                 Number of obs   =        338
                                                LR chi2(7)      =      47.87
                                                Prob > chi2     =     0.0000
Log likelihood = -84.176057                     Pseudo R2       =     0.2214
```

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
No	(base outcome)					
yes						
HHBWgrnc	1.391093	.4142593	3.36	0.001	.5791599	2.203026
HHBWeco	-.4847289	.3498434	-1.39	0.166	-1.170409	.2009516
HHBwlivp	-.0568422	.3695872	-0.15	0.878	-.7812197	.6675354
HHBwNip	1.384769	.375413	3.69	0.000	.6489733	2.120565
HHBwrkig	-.9832376	.3191808	-3.08	0.002	-1.608821	-.3576547
HHBwfutg	-.5949729	.299767	-1.98	0.047	-1.182505	-.0074403
HHBwenvp	-.0590846	.2898647	-0.20	0.838	-.627209	.5090397
_cons	1.274535	.8664444	1.47	0.141	-.423665	2.972735

```
. mlogit COENVTRD HHSSEco HHSSLIV HHSSHLTH HHSSNIB, baseoutcome(0) nolog

Multinomial logistic regression                 Number of obs   =        338
                                                LR chi2(4)      =       7.67
                                                Prob > chi2     =     0.1044
Log likelihood = -104.27391                     Pseudo R2       =     0.0355
```

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
No	(base outcome)					
yes						
HHSSEco	.0809355	.2230931	0.36	0.717	-.3563189	.5181899
HHSSLIV	1.104056	.4754861	2.32	0.020	.1721205	2.035992
HHSSHLTH	-.9077366	.4251212	-2.14	0.033	-1.740959	-.0745143
HHSSNIB	-.1578458	.2202587	-0.72	0.474	-.589545	.2738533
_cons	1.886986	.612399	3.08	0.002	.6867054	3.087266

```
. mlogit COENVTRD HHablity HHwiling  watrconl HHFRcult, baseoutcome(0) nolog

Multinomial logistic regression                 Number of obs   =        338
                                                LR chi2(4)      =      42.93
                                                Prob > chi2     =     0.0000
Log likelihood =  -86.64317                     Pseudo R2       =     0.1986
```

COENVTRD	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
No	(base outcome)					
yes						
HHablity	.4656368	.2169348	2.15	0.032	.0404523	.8908213
HHwiling	-.3139389	.271906	-1.15	0.248	-.8468648	.218987
watrconl	.6537209	.1753818	3.73	0.000	.3099789	.9974628
HHFRcult	1.302826	.3207633	4.06	0.000	.674142	1.931511
_cons	-3.042286	1.116442	-2.72	0.006	-5.230472	-.8540992

```
. mlogit Enverode Awgrnmin Awgrnpco Awgrnbuy Awgrntec Awgrnjob Awgrnenv, baseoutcome(0) nolog

Multinomial logistic regression                 Number of obs   =        338
                                                LR chi2(6)      =      46.03
                                                Prob > chi2     =     0.0000
Log likelihood = -186.41842                     Pseudo R2       =     0.1099
```

Enverode	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
No	(base outcome)					
yes						
Awgrnmin	.9702457	.318214	3.05	0.002	.3465577	1.593934
Awgrnpco	-.3368781	.4021661	-0.84	0.402	-1.125109	.4513529
Awgrnbuy	-.1041898	.4647268	-0.22	0.823	-1.015038	.806658
Awgrntec	1.548705	.5414858	2.86	0.004	.4874127	2.609998
Awgrnjob	.7695648	.5074346	1.52	0.129	-.2249887	1.764118
Awgrnenv	-1.104727	.2702974	-4.09	0.000	-1.6345	-.5749535
_cons	.5935632	.2029883	2.92	0.003	.1957136	.9914129

Appendices 6 : Awareness, sensitivity and behaviours Correlation Result

```
. spearman Awgrnmin Awgrnpco Awgrnbuy Awgrntec Awgrnjob Awgrnenv COENVTRD
(obs=338)
```

	Awgrnmin	Awgrnpco	Awgrnbuy	Awgrntec	Awgrnjob	Awgrnenv	COENVTRD
Awgrnmin	1.0000						
Awgrnpco	0.5535	1.0000					
Awgrnbuy	0.3067	0.4733	1.0000				
Awgrntec	0.2093	0.3627	0.5349	1.0000			
Awgrnjob	0.0272	0.2117	0.4414	0.5315	1.0000		
Awgrnenv	0.0885	0.2805	0.3045	0.3698	0.1961	1.0000	
COENVTRD	-0.0646	-0.2107	-0.2634	-0.3735	-0.2609	-0.1998	1.0000

```
. spearman HHPLWENI HHPGrnco HHPgrnpr HHPgrnMk HHPGTECH HHPGindu COENVTRD
(obs=338)
```

	HHPLWENI	HHPGrnco	HHPgrnpr	HHPgrnMk	HHPGTECH	HHPGindu	COENVTRD
HHPLWENI	1.0000						
HHPGrnco	0.1760	1.0000					
HHPgrnpr	0.1786	0.1523	1.0000				
HHPgrnMk	0.2013	0.2172	0.3117	1.0000			
HHPGTECH	0.1227	0.2183	0.0819	0.3293	1.0000		
HHPGindu	0.0051	0.1760	0.1402	0.3066	0.2947	1.0000	
COENVTRD	-0.1343	0.0739	-0.1725	-0.0828	-0.1397	-0.1258	1.0000

. spearman HHBWgrnc HHBWeco HHBwlivp HHBwNip HHBwrkig HHBwfutg HHBwenvp COENVTRD
(obs=338)

	HHBWgrnc	HHBWeco	HHBwlivp	HHBwNip	HHBwrkig	HHBwfutg	HHBwenvp	COENVTRD
HHBWgrnc	1.0000							
HHBWeco	0.4619	1.0000						
HHBwlivp	0.4964	0.6647	1.0000					
HHBwNip	0.4006	0.4642	0.5354	1.0000				
HHBwrkig	0.2505	0.3468	0.6465	0.5272	1.0000			
HHBwfutg	0.5825	0.4421	0.4988	0.5951	0.4719	1.0000		
HHBwenvp	0.4251	0.3005	0.4476	0.4956	0.5615	0.5856	1.0000	
COENVTRD	0.1833	0.0170	-0.0670	0.0953	-0.2002	-0.0431	-0.0304	1.0000

. spearman HHSSEco HHSSLIV HHSSHLTH HHSSNIB COENVTRD
(obs=338)

	HHSSEco	HHSSLIV	HHSSHLTH	HHSSNIB	COENVTRD
HHSSEco	1.0000				
HHSSLIV	0.3569	1.0000			
HHSSHLTH	0.2059	0.6745	1.0000		
HHSSNIB	0.4224	0.4604	0.5264	1.0000	
COENVTRD	0.0571	0.1287	0.0238	0.0263	1.0000

. spearman HHBGNCOF HHBWORY HHBWatLO HHBWagft COENVTRD
(obs=338)

	HHBGNCOF	HHBWORY	HHBWatLO	HHBWagft	COENVTRD
HHBGNCOF	1.0000				
HHBWORY	0.1381	1.0000			
HHBWatLO	0.0357	0.0443	1.0000		
HHBWagft	0.0024	0.3508	0.1448	1.0000	
COENVTRD	-0.0532	0.1406	0.2867	0.0586	1.0000

Appendices 7: Descriptive Statistics Results

Table4.15: Household's Perception About Green Consumption

Response	Number of respondents	Percent
very well	23	6.8
Well	95	28.1
not well	118	34.9
Little	100	29.6
i don't know	2	.6
Total	338	100.0

Source: Survey Results, 2017

Appendices 8: Questionnaire One

Dear respondent thank you very much for your willingness to complete this questionnaire. This research is being conducted by Tefera Eshete Kebede student in University of South Africa/ UNISA/ to comply with the requirement of my study for the degree, doctor of philosophy in environmental management. Your participation and answer in this study is strictly confidential. To guarantee your anonymity of your response, you should not write your name in the questionnaire. The questionnaire is classified in to two major parts. The first part assesses your socio-demographic variable; the second part I would like to determine your perception and consumption behaviours during your resource / water &waste/ consumption and recycle process in general. Hence, I ask you kindly respond frankly and accurately following the instruction given below.

Part I: SOCIO - DEMOGRAPHIC VARAIBLES

Below, dear respondent by writing thick / √ / in the space provided indicate the various options that explain your answer

1. Sex respondent: Male………..Female……………….
2. Age of respondent : ---
3. Maritalstatus: 1) single……..2) married……3)Divorced………4)windowed………5)separated…….
4. Education level: 1) Illiterate……… 2) Read &Write …… 3) Primary (Up to 6 Th grade) … 4) (7st -10th) grade……… 5) Diploma (10+ 12 +) ……..6) First Degree ….. 7) Second Degree and Above

5. Family Size…………..

6. Religious……………

7. Are you born in Kombolcha city? 1) Yes……. 0) No……..

8. How many years you live in kombolcha?-------------------

9. Employment status: 1) Employed…….2) Unemployed…….. 3) Pensioned……..

10. Dear respondent, if your answer is employed for Q8 above, are you working as ……….?

    1) Factory employed…….2) Self employed….…..3) Government employees………4) NGO employee……5) if other explain…..

11. If your answer for Q10 is self employed in which sector it belongs?

    1) Agriculture…….. 2) Hotel and other services……. 3) Industry …. 4) Shopping ……… 5) if other explain………………………………..

12. How much money is your monthly income? ---------------------

13. Do you have a house? 1) Yes…………..0) No…………

14. If answer is yes for question 5 above, is it………?

    1) Own house……. 2) rent house) …….. 3) Factory House …..4) Government/ kebele/ house………5) family House…………

15. Are you a member of environmental protection/pollution reduction/ committee?

    1) Yes …… 0) No………………..

16. Before this time, does your health disturbed and felt sick due to industrial pollution?

    1) Yes……0)No…….

17. Do you have health service accessibility in your area? Yes………..No………..

18. If your answer is 'yes' who pay health related payments

    1) Myself……….. 2)Family……..3)My office……. 4)Relatives…….5)if other explain………..

19. Do factories pay money or any subsidy to compensate your health and environmental problems? 1) Yes …………0) No…………

20. Dear respondent, which methods of waste management is given priority during your Resource production and consumption activity?

    1) Waste avoidance using technology cleaning………2) waste treatment using technology………3) waste recycling ……4) waste minimization by reuse process…….. 5) Waste disposal using landfill, incineration, encapsulation and etc.……………6) if other methods, explain…………

Part II: PERCEPTION, ATTITUDES AND BEHAVIOURAL VARIABLES

21. Dear respondent write X for the following questions to indicate your level of awareness in the space provided:-

1. Do you aware about concept of greening mind? 1) Yes ……….. 0) No…………
2. Do you aware about green product consumption? 1) Yes ………. 0) No…………..
3. Do you aware about green market and purchase? 1) Yes ……… 0) No…………
4. Do you aware about concept of green technology? 1) Yes ……….. 0) No………….
5. Do you aware about green jobs in your work area? 1) Yes……….. 0) No………….
6. Do you aware about green environment? 1) Yes ……….. 0) No……
7. Does the natural environment in Kombolecha is eroding and losing its greening by over resource/water/ consumption activity? 1) Yes ………..0) No….

8. Do you believe that there is tradeoff between resource /water/ consumption and environmental problems like pollution in Kombolecha industrial zone? 1) Yes………0) NO……..
9. If your answer is yes in question 9 above, which one most explain gap between resource consumption and environment problem in Kombolecha industrial zone,

   1) Wide tradeoffs……..2) Moderate tradeoffs…………..3) Narrow tradeoffs………

   5) Little tradeoffs………. 6) no tradeoffs
10. What is your perception about status of green environment in Kombolcha industrial zone?

    1) Good…..…….2) Bad…………3) Fair……….4) Confused…………….
11. Does Kombolcha Municipality office imposed pollution tax for example pigovian tax on polluters? 1) Yes…………0) No…………..
12. From your experience, which environmental pollution is more prevalent in Kombolecha industrial zone? 1) River Water pollution …….. 2) Air pollution…….. 3) Living life pollution…….3) soil pollution…….. 4) Working life pollution…. 5) If other justify………
13. What is your attitude towards future green environment regards to resource/water/ consumption growth and effects in industrial zone?

    1) Optimists……2) pessimists….. 3) Neutral………. 4) I don't know……
14. Do you believe that I am environmentally friend consumer during your production and consumption activity? 1) Yes…………0) No…………..
15. Do you agree that as far as some you can pay for water fees, no authority or office requested to limit the quantity of water consumption?

    1) Strongly agree ….. 2) Agree …… 3) strongly disagree …….4) disagree….. 5) I don't know…………
16. Dear respondents, for what purpose you consume water?

    1) For food and related preparation……… 2) Animal drink and feeding…… 3) For materials and cloth washing…….. 4) Urban agriculture…….5) if for other activity, explain………

22. **Below in the table I, write √ in the space provided to indicate your answer and level of <u>PERCEPTION towards protecting environment</u>**

Ser No	Statement	Very well	well	Little	Not well	I don't know
1	During your water consumption and waste disposal activity, how do you scale and explain your perception regards to protect the environment safe for living and working activity?					
2	How do you scale and explain your perception to buy and consume Green product to protect the environment					
3	During resource/water/ consumption activity, how do you scale and explain your perception to practice green production process to protect the environment					
4	How do you scale and explain your perception to exchange in green marketing and purchasing activity to protect the environment					
5	During resource /water/ consumption activity, how do you explain your perception to keep green environment					
6	How do you scale and explain your perception to use Green technology to protect the environment					
7	How do you scale and explain your perception and effort to achieve Green Industrial zone in Kombolcha					

23. Below in the table II, write √ how much do you agree or disagree with each of statements listed to indicate your <u>consumption behaviours</u>? Where, SA = Strongly Agree, A= agree, SD= strongly Disagree and D= Disagree

Ser No.	Statement	SA	A	Indecisive	D	SD
1.	With regarding to resource consumption behaviours, I am confused about concept of greening environment resilience?					
2.	I don't worry about the nature of existing environment and natural resources like water since it is a common resource					
3.	i worry about water lose due to over consumption in cities, we will die					
4.	Water is gifted by God and hence it should be freely consumed. Such that charging water/ml is loss of human right?					
5.	Elders family resource /water/ consumption culture highly affects my resource consumption behavior					
6.	The existing green environment is eroding and losing its nature by over consumption behviours					
7.	During my purchasing activity, I behave to buy green resources ,which is preferred and consumed , than grey products					

8.	I usually behave to consume water and recycle wastes to reduce economic costs					
9.	I usually behave to consume water and recycle wastes to reduce my and family living life pollution					
10.	I usually behave to consume water and recycle wastes to reduce neighbor's life pollution					
11.	I usually behave to consume water and recycle wastes to reduce working life pollution					
12.	I usually behave to consume water and recyclewastes to keep future generation demand					
13.	I usually behave to consume water and recycle wastes to reduce environment pollution					
14.	With regarding to resource/ water/ consumptionbehaviour, I am behaving and belonging to green consumerism					
15.	If resource /water/ consumption behaviours continues in Kombolecha like today, I am pessimistic about future green environment situation					
16.	If resource /water/ consumption continues in kombolecha, I am optimistic about future environment situation					
17.	I am able and willing to pay money to protect environment problems					
18.	I am able and willing to establish green					

	environment resilience members					
19.	I am able and willing to establish natural resource / water/ rehabilitation and conservation members					
20.	In general, current resource /water/ consumption behaviour in kombolcha meets the need of the present generation without compromising future generation needs?					
21.	City administration, water authority office and kebele offices are effective to control and follow up waste disposals activity so as to reduce environmental problems					

24. Below in the table III, dear respondent write /√ / to indicate various option for your <u>sensitivity and emotionality behaviours</u> something that you can do for keeping the environment in Kombolecha industrial zone? Where, Where, SA = Strongly Agree, A= agree, SD= strongly Disagree and D= Disagree

SerNo.	Respondent's behaviours	SA	A	Indecisive	D	SD
22.	I am sensitive and emotional to save water resources and recycle waste for economic costs /payments					
23.	I am sensitive and emotional to recycle water and wastes to keep environment safe for living and working activity					
24.	I am sensitive and emotional to saving water and recycle					

	wastes to reduce my family health problems					
25.	I am sensitive and emotional to recycle water and wastes to protect pollution for nearby residents and the public					
26.	factories are sensitive and emotional to save water and recycle wastes to reduce water payments					
27.	Factories are sensitive and emotional to recycle water and wastes to reduce neighbor's pollution					
28.	Factories are sensitive and emotional to recycle water and wastes to reduce an employee pollution					
29.	Factories are sensitive and emotional to recycle water and wastes to reduce environment pollution					
30.	Factories are sensitive and emotional to recycle water and wastes to reduce penalties and compliance					
31.	Service providers and input suppliers are sensitive and emotional to protect environment					
32.	There is weak integration					

	between households, service providers, consumers, input suppliers and factories to keep environment safe for living and working activities					

25. Below in the table IV, dear respondent write √ to indicate how can you do and don't do about waste intensity management

Ser No	Behaviours and Activity	Always	Frequently	Sometimes	Little	Nothing
33.	I treat wastes water and dispose it to Borkena river					
34.	I treat waste water and dispose it to road and free space					
35.	I treat waste water and dispose it to toilet and pit hall					
36.	I treat waste water and reuse for other purpose.					
37.	I collect wastes and recycle to reduce environmental pollution					

26. Below in the table III, dear respondent please write √ to indicate your various options and answers what actually create worry and threats when you consume resources suchas water and wastes

Ser no	worries and threats	Very high	High	low	little	I don't worry
38.	Family Health Disturbance					
39.	Multiply of disease in community					
40.	Rising water charges and payments					
41.	Disturbing neighborhoods health					

42.	Fearing penalties and punishment					
43.	crwodness, and congestion results social problems for nearby areas					
44.	environment pollution					
45.	Water loss in the future					
46.	Air pollution					
47.	Water pollution					
48.	Land or soil pollution					

27. Below in the table V, dear respondent write √ to indicate your various option to show consequences of Kombolecha industrial zone unbalanced resource consumption growth?

Ser. No	Problems	Major	Minor	Little	Very little	I don't know
1.	<u>Social Problems</u>					
•	Health Disturbances in the community					
•	Breakage of community structures and social networks					
•	Dispersal of kith and kins					
•	Weakening of traditions					
•	Loss of cultural identity.					
•	Inter relationship and potential for mutual fraternity is diminished					
•	Poverty					
•	Displacement and unemployment					
•	Insecure safety for life					
•	Insecure safety for work					
•	Insecure social wellbeing					
•	Weak social networks like idir					
2	<u>Economical Problem</u>					

•	Shortage of water resource					
•	Income sources are shattered and ruined					
•	Families face long term hardships.					
•	High resource wastages and degradation costs					
•	High cost for health treatment					
•	High costs for waste disposal					
•	Less saving due to high health costs					
•	High cost of waste recycling					
3	Environmental Problems					
•	high waste disposal activity to free space and road					
•	Factory's waste disposal to free land, road					
•	Service providers waste emission to free space and land and management					
•	Factory's waste production and emission to Borkena river					
•	Consumers waste production and emission on roads, land and river					
•	Factory input supplier's waste production and emission on land and river					
•	Municipality weak environment management practice and control activities					
•	No integration between households, factory's and service provides during					

	resource consumption, waste collection, and disposal activity					
•	No limited threshold line how much quantity of water or resource does factory's or household should consume optimally					
•	there is no free space or trash collection sites nearby industrial zone					
•	lack of expertise and knowledge/skill/ to recycle water, waste after consumption and production process					
•	There is weak culture and tradition to save resource/water/ recycle wastes in the areas					
•	Lack of enterprise which recycle wastes					
•	Less environmental incentives and subsidies					
•	No or lack of sense of ownership for environment protection					
•	Factory's and households ignorance, carelessness and negligence about future environment					
•	Weak practice of environmental protection regulation and legal aspects					
•	Municipality weak waste disposal planning, operation, practice and management					

28. Below in the table, dear respondent write √ to indicate your various option for the correspondent answers that <u>influence and change your resource</u> /water/ consumption behaviour and waste recycling to resilient environment?

Ser. No	Factors	major	minor	little	None	I don't know
49.	my moral philosophy to conserve environment					
50.	My School life, education &skill					
51.	My family Consumption culture and norms					
52.	My religious paradigms and principles					
53.	I saw my neighbors and friends					
54.	Municipality and Kebele awareness creation and capacity building					
55.	My working office trainings and awareness creation					
56.	I listen public media such as TV , radio and etc					
57.	Fear of penalty and punishment by kebele					
58.	I get NGO trainings about resource efficient consumption and protecting environment					
59.	I get training and technology from factories					

29. Below, in table IV, dear respondent write how much quantity of resource /water consume and waste produce in the space provided fill your resource/water and waste / consumption intensity corresponding to type of resource

Ser No.	Quantity Resource	Resource Intensity measurement			
		M^3/ml//day	Ml/Kg/Qi	Price/birr	Costs/birr
60.	Water consumption during production day /ml				
61.	Water waste after production per day /ml				
62.	Liquid Waste recycle or reuse day/ml				

30. Dear respondent put your suggestion by writing √ in the space providing which indicator is more required recover green environment during resource consumption process in Kombolcha city

Ser. No	Require indicators	Very vital	vital	Little vital	Not vital	I don't know
1.	Governance and private networking					
2.	Household and factory Networking					
3.	Green environment framework					
4.	Green economic framework					
5.	Green social framework					
6.	Resource (water) consumption members					
7.	Environment protection members in club					
8.	Environment recovery raising fund members					
9.	Waste minimization and reduction community members					

10.	Green education and training centers					
11.	Resource consumption and waste reduction consultancy enterprises					
12.	Pollution tax imposition					
13.	Environment Policy and program reforms					
14.	Green Loan and credit services					
15.	Green Saving activity					
16.	Green expenditure services					
17.	Water source recovery insurance					
18.	Health insurance					
19.	Household - Service providers-& Factor partnership					
20.	Social, economical & environmental integration framework					
21.	Resourcing models for Socio – eco efficiency indicators					
22.	Socio-eco efficiency indicator application in industrial zone					

Thank you for your patience and cooperation