AN ASSESSMENT OF LAUNDRY AND DRY CLEANING PRACTICES AMONG HOUSEHOLD AND COMMERCIAL SERVICE PROVIDERS IN KISUMU CITY, KENYA

BY

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DECLARATION

Declaration by the Candidate

I certify that this thesis is my original work and has not been submitted for any academic award in any institution, and shall not be reproduced in part or in full, or in any format without prior written permission from the author and/or the University of Eldoret.

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DEDICATION

I dedicate this thesis to my late father who encouraged me to further my studies and my mother who has remained a mentor to date. My wife Lilian and children, Malian Sarone and Lordwin Otieno for their contribution and perseverance throughout my study period.

ABSTRACT

Laundry and dry cleaning practices are a global process that contributes to the length and life of apparel and textile products. Therefore, it is important that the right cleaning method is selected for a given fabric because they differ in quality and use. Knowledge of these differences is very essential. Studies have indicated that consumers have raised concerns over the distortion of their clothes after laundry and dry cleaning (LDC) practices but it was not clear whether the distortion was due to poor fabric quality or poor cleaning practices. Therefore, there was a need for this study whose purpose was to assess LDC practices among households and commercial service providers in Kisumu City, Kenya. Specifically, the study sought to i) investigate the procedures used in LDC, ii) evaluate the level of consumer satisfaction with LDC services, iii) determine the awareness and practices of LDC service providers towards environmental and self-protection during LDC, iv) determine the waste disposal practices, and v) determine the levels of wastewater physical-chemical parameters disposed of LDC practices concerning environmental pollution. The conceptual framework borrowed ideas from the Expectation Disconfirmation Theory. Cross-sectional and descriptive surveys were employed. Seventy-two (72) respondents from commercial LDC outlets and three-hundred and twelve (312) respondents from households were selected to form the sample size (384). Quota, Census, and snowball techniques were used to determine and identify commercial LDC outlets. Quota, stratified and simple random sampling were used to identify locations and sub-locations within Kisumu City while systematic sampling was used to determine and identify the households. Lastly, purposive and convenient sampling were used to identify and qualify respondents from both households and commercial LDC outlets. Interview schedules, observations, and laboratory analyses were used to gather data. Quantitative data were analyzed using descriptive statistics by SPSS version 20 (2007) and the findings were presented in tables and charts. On the other hand, qualitative data were grouped into themes, coded, and analyzed using the SPSS tool and the results were also presented in tables and charts. Samples of waste water from both household and commercial LDC practices were collected and analyzed for BOD, COD, PO_3^-, Cd, Hg, detergent, pH, NO_3^-, and NO_2^- at Lake Victoria Environmental Management Program (LVEMP) and Safe Water and Aids (SWAP) project laboratories. Statistical analyses of the laboratory data were done using one-way ANOVA in the SPSS software. The study established that LDC service providers did not follow standard recommended procedures used when delivering their services and that customer satisfaction and, or dissatisfaction varied among consumers and with different LDC aspects as well. The study further showed that commercial LDC consumers were more satisfied than household LDC consumers. The findings showed that most commercial LDC service providers used better methods of waste water disposal compared to household LDC service providers who were not well conversant with safe methods of waste water disposal. Physical-chemical waste water parameters at the household level ranged as follows; pH: 7.39-8.17, BOD: 28.83-38.0, COD: 305.83-390.83, NO_3^-: 22.5-28.8, NO_2^-: 2.8-3.4, and lastly PO_3^-: 0.304-0.392. At commercial level, the physical-chemical waste water parameters ranges were: pH: 4.91-9.98, detergent: 0.83-0.93, BOD: 34.0-44.0, COD: 316.67-433.33, NO_3^- : 37.63-49.63, PO_3^-:0.53-0.98, Hg: 0.000-0.003, and lastly Cd: 0.000-0.003. Physical-chemical wastewater parameters from household LDC services were above the

NEMA/WHO effluent standards while those of the commercial LDC services were within the same standards.

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ACRONYMS AND ABBREVIATIONS

COSHH	Control of Substances Hazardous to Health
EDT	Expectation Disconfirmation Theory
FTC	Federal Trade Commission
LDC	Laundry and Dry cleaning
LVEMP	Lake Victoria Environmental Management
NACOSTI	National Commission for Science Technology and Innovation
NEMA	National Environment Management Authority
ODF	Open Defecation Free
PERC	Perchlorethylene
PPE	Personal Protective Equipment
SDGs	Sustainable Development Goals
SPSS	Statistical Package for the Social Sciences
SWAP	Safe Water and Aids Project
TFPIA	Textile Fiber Product Identification Act
US	United States
VOC	Volatile Organic Compounds

OPERATIONAL DEFINITION OF TERMS

Consumer: Recipients of laundry and dry cleaning services.

Commercial Consumer: Recipients of laundry and dry cleaning services from either domicile business premises or mobile laundry and dry cleaning service providers.

Commercial laundry and dry cleaning service provider: Personnel with either domicile business premises or mobile (door-to-door) offering laundry and dry cleaning services.

Commercial laundry and dry cleaning outlets include all the business premises offering commercial laundry and dry cleaning services.

Estate: a residential establishment where households are found within the same compound or the perimeters of the fence or a boundary demarcated by the local authority.

Household: A family living together whose laundry and dry cleaning are done by one of the family members.

Household Consumer: Recipients of laundry and dry cleaning services from household service providers.

Household laundry and dry cleaning service provider: Personnel offering laundry and dry cleaning services at the household level.

Laundry and dry cleaning practices: Series of cleaning activities carried out in the cleaning and maintenance of apparel and textile products.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Apparel and textile production is a worldwide process. The same applies to the care of apparel and textile products. The American Textile Labelling Acts namely the Federal Trade Commission (FTC) Act 2014, Wool Act 2014, and Textile Fiber Product Identification Act (TFPIA) 2008 requires that the apparel and textile manufacturers should be charged with the responsibility of guiding consumers of apparel and textile products in giving the right care and maintenance information (Care Labelling of Textile Wearing Apparel & Certain Piece Goods, 2021 & Federal Trade Commission, 2014). Textile fabric is the main medium used by apparel designers.

Originally, laundry was done in watercourses and also in water-tight vessels. This was the period before washing machines were invented. In some less developed areas and remote regions in the world, laundry services are still done using the traditional ways of cleaning. In the rural areas of Europe and the Mediterranean Basin, for instance, public washhouses in addition to watercourses and vessels are used. This was possible because they were able to channel water from a river or spring and direct it into a building particularly designed for laundry (Launderette Association of Australia, 2005).

Laundry and dry cleaning (LDC) services play an important role in society by preventing apparel and textile products from deteriorating, hence prolonging their life, maintaining their appearance, and promoting hygiene (Melita, Claudia & Lilieth, 2005). The selection of proper LDC products and the use of correct LDC procedures and equipment settings can increase the wear life of apparel and textile

products (Rose & Carol, 2016). The Kenya Literature Bureau (2009) and Mugambi *et al*. (2004) outlined LDC procedures as; repair, sorting, spotting, soaking, washing/dry cleaning, rinsing, drying, finishing, and storage. The selection of specific LDC procedures is dependent on the fabric construction method, fiber and its properties, and special finishes. Recommended measures that when adhered to can help in the reduction of risk that can otherwise cause harm to the textile and apparel products under treatment are provided in the care symbols (Isabel & Nyaradzo, 2013). Today's home and commercial LDC practices, as well as the products used, are vastly different from those used in the past, LDC services are now routine jobs shared by men, women, and children, and fabrics are now made from both natural and synthetic fibers. Laundry products are chemically formulated for varied water qualities and temperatures and are scientifically developed for specific cleaning purposes (Rose & Carol, 2016).

The longevity and desirability of apparel and textiles in use are determined by precaution taken in handling it. The cleaning performance of a washing process is determined by four variables: temperature, mechanical action, chemistry, and time (duration). To effectively optimize the care of textile and apparel products; then temperature, time, washing, and mechanical action have to be optimum. The increasing need for the provision of LDC services in developing countries has been stimulated by global industrialization in the apparel and textile industry, coupled with increased economic and technological advancements (Sogaard, 2015). In developing countries, there is an increase in the production of laundry detergents and chemicals, most of which are used in the LDC sectors (ibid). The major contributing factors to the growth of LDC services are the increased production of detergents and chemicals, and the marketing of home washing machines (Euromonitor International, 2015).

According to Sogaard (2015) and Watchara and Natthaphat (2012), several people have been transformed through an urban lifestyle where they have to earn more money by having an extra job(s) and working outside, a lifestyle that has made it impossible for many people to have time for their LDC. To solve this problem, people resolved to outsource LDC services as it was convenient and time-saving. Some challenges were faced by LDC service providers during their operations. Such challenges were exposure to chemical hazards, inappropriate mixing, and handling of the cleaning detergents (EU-OSHA, 2008), illiterate/ untrained on the standard procedures that should be followed during LDC services (Medina - Rahom *et al.,* 2003; Zock *et al.,* 2002), Exposure to physical hazards (Mondelli*et al*., 2006) and poor ergonomic practices (Scherzer *et al.,* 2005). In view of the above, it was not clear whether the mentioned problems were due to poor LDC tools and equipment, lack of care instructions from the manufacturers, lack of care label knowledge, illiteracy, and lack of training or improper LDC practices. In addition, the challenges the LDC service providers faced (exposure to hazards) might be unknown to them, further compromising their health and quality of life. In relation to achieving Sustainable Development Goal (SDG) 6, LDC service providers need to adhere to the guidelines provided to ensure appropriate dress for work.

Consumers take their clothes to the LDC to ensure that they get professional cleaning services for their apparel and textile products. Consumer satisfaction (CS) was key when offering LDC services. It was not however known whether LDC consumers and service providers were aware of the contributions of the cleaning industry to the sixth (6) Sustainable Development Goal, on safe waste disposal practices and chemical composition of the waste disposed of the LDC services which also accounts for causing environmental pollution (Rashed & Niyazi, 2017). CS should be the ultimate

goal of any LDC practices whether at home or commercial LDC outlets (Kyengo, 2007). Studies by Otieno (1990) and Nyangor (1994) have shown that consumers in Nairobi, Kenya, complained that most clothes lose colour and even shrink after LDC services but it was not indicated whether the complaints were due to poor fabric quality or poor LDC practices. Isabel and Nyaradzo (2013) also aver that some apparel and textiles products fade during LDC, some lost shape, some had a puckered appearance on the lapels, some had protruding picks at the shoulders or lower ends while some had a shiny look after LDC services. From the above findings, it was not clear if the mistreatment of apparel and textile products during LDC services was because of inadequate knowhow on care labels by service providers, insufficient care information on apparel and textiles products, or service providers not following the right LDC practices. Further, a study done by Andy (2007) noted a problem with many washing machines causing small holes in consumers' clothes. Although the apparel and textile care providers were supposed to be guided by apparel and textile manufacturers' care instructions, the above complaints were still reported. This study thus sought to fill these knowledge gaps.

There was a knowledge gap in the way LDC of apparel and textile products were handled, with the SDG 6 projections and targets not being keenly followed (Morgan *et al.*, 2017). There was the need to ensure sanitation and waste water management along the entire value chain in cities like Kisumu, contributing to SDG 11 (sustainable cities and communities). Njuguna (2019) pointed out that many of the Kenyans and water service providers were not aware of the sixth SDG and the measures they take for safeguarding water were informed by the scarcity of the component, and not policy guidelines. Waste poses a threat to public health and the environment if not stored, collected, and disposed of properly Poor waste

disposal in recent years has led to high incidences of sanitation-related illnesses, such as cholera, intestinal worms, and typhoid. The existing waste facilities were inadequate to deal with the quality and quantity of waste generated Local government should therefore be responsible for the collection and disposal of waste generated within their jurisdiction (Ramatta M. Y, Dennish C. & Philip B.A, 2014).

Handling of apparel and textile products was also associated with achieving Sustainable Development Goal number six (SDG 6) which calls for "the availability and sustainable management of water and sanitation for all". It was also linked to other SDGs including number eight (economic growth) , number three (health), and SDG 11 (making cities more sustainable) (Thomson & Koehler, 2016). This study assessed the knowledge of the LDC service providers and the knowledge gaps in providing LDC services to achieve SDG 6. This study was thus aimed to contribute to target three (3) that expects by 2030 to have reduced pollution, removed dumping plus minimized the release of hazardous chemicals and materials into the environment. Target three also calls for reducing by half untreated wastewater and substantially increasing recycling and safe reuse of wastewater across the globe (Thomson & Koehler, 2016). Those working in the textile and apparel cleaning industry need to understand the tenets of contributing safe and clean water, and reducing pollution agents by safe waste disposal. There was a knowledge gap in the way commercial cleaning of apparel and textile was handled, with the SDG 6 projections and targets not being keenly followed (Morgan *et al*., 2017).

1.2 Statement of the Problem

It is a great challenge in the whole world and even in Kenya where many people mostly in the urban areas are busy and have no time for doing their laundry and dry

cleaning creating the demand for LDC services. Various studies (Otieno, 1990; Nyangor, 1994; Isabel & Nyaradzo, 2013; Andy, 2007) indicated that consumers complained that poor maintenance has resulted in the distortion of their clothes. Such distortions are loss of colour, shrinkage, loss of shape, shiny appearance, holes, and loss of some control of fullness. In addition, other apparel lost shape and had a baggy look at the hemline and some had puckered appearance on their lapels. Some apparel had flattened resulting in no folds to indicate the pleat positions, knitted cardigans lost shape and stretched and other garments gained a shiny look after LDC services. The studies further showed that there was always a problem with many washing machines which cause small holes in some apparel and textile products during LDC. However, the above studies did not indicate whether the mentioned problems were due to poor fabric quality, lack of adequate care information from apparel and textile manufacturers, lack of knowledge, or incompetency of the LDC service providers. There was also a need to establish whether the service providers were aware of legislations and regulations that govern LDC practices and if they adhered to such regulations. Often, the LDC service providers were not aware of the Sustainable Development Goal (SDG) six guidelines, which sought to ensure safe water usage and adequate sanitation for all. With the implementation period starting in 2015, the knowledge and practices of LDC service providers towards contributing to this Goal have not been widely documented in Kenya, and thus the study bridge that gap of knowledge. There was a knowledge gap in safe wastewater management practices contributing to it and SDG 11. Therefore, the study sought to assess LDC practices among household and commercial service providers in Kisumu City.

1.3 Objectives of the Study

1.3.1 Broad Objective

To assess laundry and dry cleaning practices among household and commercial service providers in Kisumu city, Kenya.

1.3.2 Specific Objectives

i. To investigate the cleaning procedures used by laundry and dry cleaning service providers in Kisumu city.

ii. To evaluate the level of consumer satisfaction with laundry and dry cleaning services in Kisumu city.

iii. To determine the awareness and practices of laundry and dry cleaning service providers towards environmental and self-protection during laundry and dry cleaning.

iv. To determine the waste disposal practices used by the laundry and dry cleaning service providers in Kisumu city.

v. To determine the levels of the wastewater physical-chemical parameters disposed of from laundry and dry cleaning services in relation to environmental pollution in Kisumu City.

1.4 Research Questions

i. What laundry and dry cleaning procedures are used by laundry and dry cleaning service providers in Kisumu City?

ii. To what extent are consumers satisfied with the laundry and dry cleaning services in Kisumu City?

iii. What practices and levels of awareness do laundry and dry cleaning service providers have towards environmental and self-protection during laundry and dry cleaning?

iv. What waste disposal practices do laundry and dry cleaning service providers use in Kisumu City?

v. What levels of the waste water physical-chemical parameters are disposed of from laundry and dry cleaning services in relation to environmental pollution in Kisumu City?

1.5 Significance of the Study

The findings of the study will benefit apparel and textile manufacturers since they will be informed on factors that lead to satisfaction and dissatisfaction with the care and maintenance of apparel and textile products. The findings will also benefit consumers since they will gain knowledge on care labels which will guide them during the purchase, usage, and care of textile and apparel products. results also benefit the consumers as they would have the knowledge of care labels thus helping in their decisions during the purchase and usage of apparel and textile products. The study also benefits the existing LDC commercial outlets, households, and training institutions that are concerned with the care of apparel and textile products in relation to what the market demands from the consumers. It also gives an insight into the possible causes of consumers' complaints regarding LDC practices and lastly adds to and builds the body of knowledge on the factors that are associated with LDC practices in Kenya.

1.6 Scope and Limitation of the Study

The study was done among household and commercial LDC service providers and household and commercial LDC consumers in Kisumu City hence the generalization of findings was limited to this population.

1.7 Theoretical Framework

This study was modelled on the theory of expectation disconfirmation as proposed by Oliver in 1980. The theory was used by Huang (2014), Chen*et al.* (2010), and Fernando *et al*, (2015).

1.7.1 Conceptual Framework

The conceptual framework explained the relationship among variables of this study using ideas of Expectation Disconfirmation Theory (EDT) (Neemiah & Aryati, 2015). EDT is a prominent theory from service firms that predict and explain Consumer Satisfaction (CS) with products or services. The theory proposes that users first form expectations of attribute occurrence and then form post-usage perceptions about performance and a comparison between initial expectations and performance known as disconfirmation of expectations. A positive disconfirmation means performance is better than expected, and a negative disconfirmation means performance is less than expected. According to EDT, when the actual performance of a specific product or service could not meet the consumer's expectation, negative disconfirmation would occur leading to consumer dissatisfaction and if the perceived performance of a specific product or service was able to exceed the consumer's expectation, a positive disconfirmation would occur leading to CS (ibid). The conceptual framework, as presented in Figure 1, consists of perceived performance which includes knowledge of LDC service providers, expectations which includes expected competencies of LDC service providers, cleaning processes, challenges, disconfirmation, and

consumers. In this thesis, it was envisaged that the identified knowledge and expected competencies of LDC service providers on cleaning processes are important components of LDC practices.

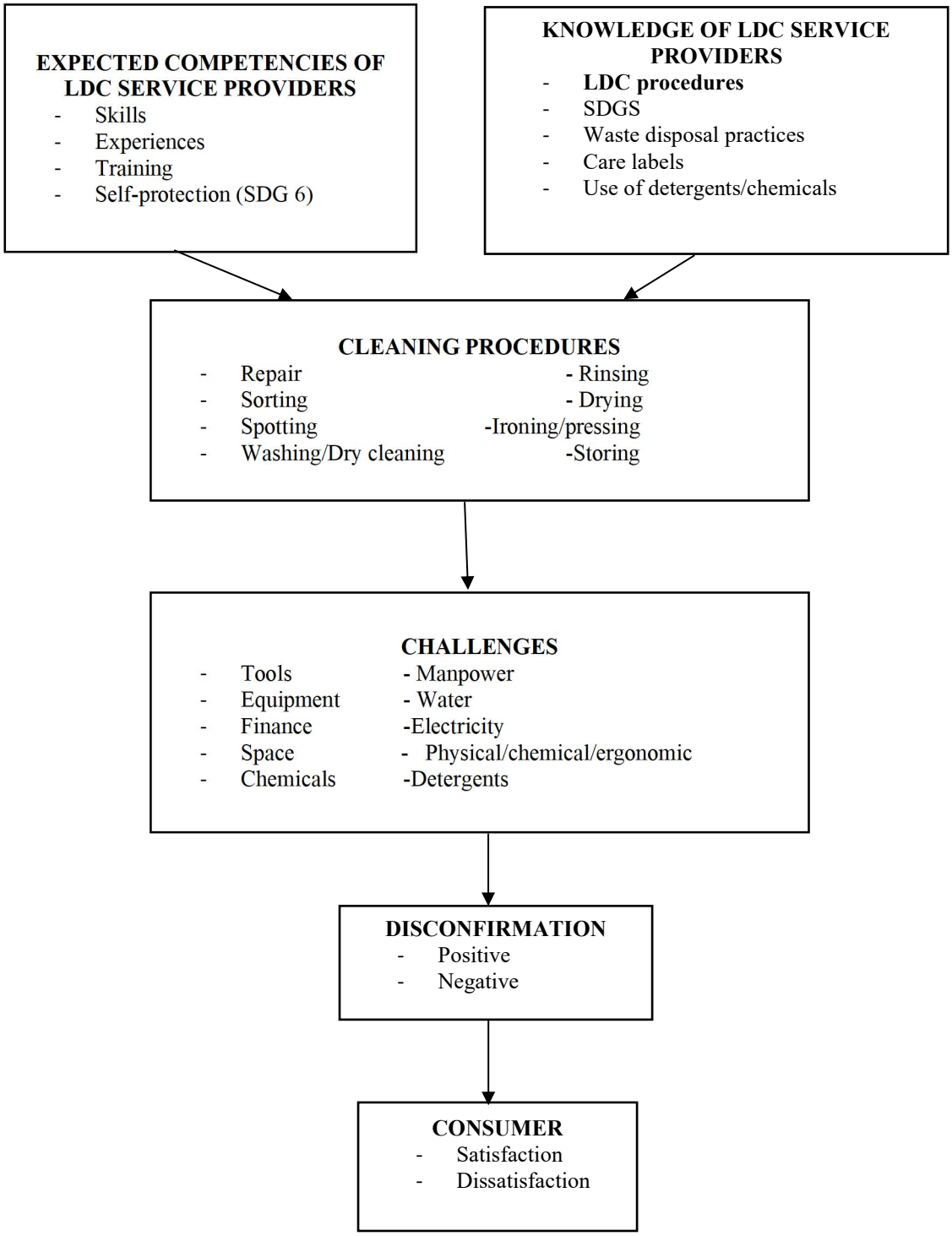

Figure 1.1: Expectation Disconfirmation Theory in Relation to Laundry and Dry Cleaning Practices

(Source: Modified from Neemiah and Aryati, 2015)

The United State Office of Personnel Management (2016) defines competency as a combination of knowledge, skills, and abilities that, when acquired, allow a person to

perform a task at a specifically defined level of proficiency. In this study, competencies referred to the skills, experience, training, and self-protection of LDC service providers. In this case, therefore, there was a positive disconfirmation when LDC service providers had such competencies leading to the selection of appropriate LDC procedures and with minimal challenges leading to a positive disconfirmation and consumer satisfaction and vice versa.

Knowledge is defined as awareness or familiarity gained by experience of a person, fact, or thing or a person's range of information or a theoretical or practical understanding of a subject or language (John, 2001). In this study, knowledge referred to the understanding of SDGs, waste disposal practices, Chemical composition of LDC waste, use of detergents and chemicals, and understanding of care labels. In this case, therefore, when the service provider(s) had such knowledge, they would follow appropriate cleaning procedures and with minimum challenges would lead to positive disconfirmation and then to satisfaction and vice versa. Under the knowledge of LDC service providers, the concept of Sustainable Development Goal (SDG) six was factored in to determine whether the LDC service providers were aware of safe waste disposals and approaches to ensuring that people had access to clean water. Water usage as described in SDG Six accounts for pollution in the environment from wastes emanating from water usage.

Cleaning processes are activities that apparel and textile products undergo from the time they are brought for LDC to the time they are clean and ready for use (Kenya Literature Bureau, 2009). Mugambi et.al. (2004) define cleaning processes as a series of activities carried out in the cleaning and maintenance of apparel and textile products. Therefore from this study, when the service providers had the required competencies such as skills and knowledge, they would follow appropriate cleaning

procedures and together with minimal challenges would lead to positive disconfirmation and CS and vice versa. Challenges are situations being faced with something that needs great mental or physical effort to be done successfully and therefore test a person's ability (Life Challenges, 2016). When challenges were fewer or not there at all, there would be a positive disconfirmation leading to satisfaction and when challenges were too many, there would be negative disconfirmation leading to dissatisfaction. From the modified EDT in Figure 1 above, there was the use of knowledge of LDC service providers instead of expectations and expected competencies instead of perceived performance. Hence, this made the researcher suggest that when knowledge of LDC service providers was combined with their expected competencies followed with the appropriate cleaning procedures and with minimal challenges, there would be a positive disconfirmation and satisfaction and when knowledge and the expected competencies of LDC service providers were not to the required standards followed with inappropriate cleaning procedures, with many of challenges, there could be a negative disconfirmation and dissatisfaction.

In summary, expected competencies of LDC service providers plus knowledge of LDC service providers, with the right cleaning procedures and with less/no challenges could lead to positive disconfirmation resulting in satisfaction and lack of expected competencies of LDC service providers together with lack of knowledge of LDC service providers could lead to wrong cleaning procedures and with many challenges could result to negative disconfirmation then to customer’s dissatisfaction.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents literature related to Laundry and Dry Cleaning(LDC) practices namely; procedures, consumer satisfaction, awareness and practices of LDC service providers towards environmental and self-protection, waste disposal, and levels of wastewater physical-chemical parameters disposed of from LDC practices in relation to environmental pollution and summary of the reviewed literature.

2.2 Laundry and Dry Cleaning

Laundry is a process of cleaning clothes by hand or machine with a soap solution (Melita at al., 2005). Dry cleaning is the removal of paints, grease, dirt, and other stains by using non-aqueous liquid solvent from wearing textiles, apparel, rugs, fabrics, and similar items (Minneapolis Development Review, 2010). It can also be defined as the process of removing dirt and creases from clothes without using water to restore their appearance which involves repairing, sorting, soaking, dry cleaning, rinsing, drying, and finishing (Kenya Literature Bureau, 2009). The process of dry cleaning also entails flushing, blowing, brushing, vacuuming, scraping, sweeping, and wiping (Scott, 2013).

The services sought from both household LDC and commercial LDC premises are similar. Some of these services include the reading of care labels, sorting, stain removal, selection of laundry products, and selection of cleaning methods (Melita *at.al*, 2005). According to the Launderette Association of Australia (2005), the LDC process is a combination of mechanical and chemical processing, temperature, and time. The washing program entails the compilation of temperature and time. The

washing sequencer regulates the features and subsequently the field of application to a particular washing process offered. Washing machines are used to conduct the mechanical aspect of the washing while a combination of water with washing detergents takes the chemical procedure of the washing. Pre-wash, major wash, and rinsing are the three major stages of washing procedures.

2.2.1 Appropriate Laundry Procedures

Laundry is a systematic process. Melita *at al.,* (2005) outline the appropriate laundry processes that apparel and textile products should go through in the process of laundering for the satisfaction of the consumers as reading care labels, sorting out according to colour, amount of soil, and fabric type, removing stains according to its nature and type of fabric, selection of laundry agents and selection of cleaning method. The Association of Southeast Asian Nations (2012) noted laundry processes as sorting, counting the lodged items, assessing stains on the items, spot cleaning stains, identifying appropriate cleaning methods, operating equipment to realize desired cleaning outcomes, and lastly effect repairs. The same association went further and mentioned post-laundry finishing processes such as checking for stains, repairs, doing the necessary correction before the items are collected, pressing, drying, folding, and packaging. The Kenya Literature Bureau (2009) and Mugambi *et al*., (2004) outline laundry processes as repairing, sorting, soaking, washing, rinsing, drying, finishing and storage. Kumar, Goud, and Joseph (2014) on the other hand said that the laundry process begins from reception to repair, that is the linen receiving area where the linen from various departments is received and segregated, the common hall area where the activity of collection of unwashed clothes are done, washing, drying and pressing takes place, dirty linen washing area where dirty linen is rinsed before transferring to the washing area, washing area where clothes are washed, linen squeezing area where

water from the washed clothes is extracted using “hydro extractor” machine/hand, drying/spreading area where washed clothes are dried, a folding room where the washed clothes are folded and organized, store room where washed clothes are stored and tailoring section that deals with repair of damaged clothes.

2.2.2 The Dry Cleaning Procedures

According to Melita at al., (2005), dry cleaning processes are those that do not use water as part of their cleaning medium as well as the steps or procedures that are followed when clothing articles are received at the dry cleaning plant. Such processes involve the procedures such as reading the care label(s), tagging items for identification, separating clothing items based on weight, colour, and type of fabric, spot cleaning before placing clothing items in the dry cleaning machine, and placing clothing items into the dry cleaning machine.

Clothes that are to be dry cleaned should be prepared well by emptying their pockets and turning them inside out to remove fluffs, removing the trimmings, buttons, and buckles which can be damaged by cleaning fluid, securing the belt, removing shoulder pads which can be destroyed by dry cleaning solvents, letting the hems at the wrist and lower edge if the clothe(s) are suspected that they may shrink during cleaning and pinning a note to the cloth if any particular stain needs special attention (Kenya Literature Bureau, 2009).

The Environmental Protection Agency (2005) and Emissions of Volatile Organic Compounds from Organic Solvents Regulations (2002) says that after loading the clothes into the dry cleaning machine, the cleaning action should follow five processes which are: cleaning the garments into the solvent, spinning to extract solvent, drying with hot air and recovery of solvent, deodorization to remove last

traces of solvent and regeneration of used solvent after the clothes have been cleaned. From the above-mentioned processes, the same organizations further noted that before the last process is done (regeneration of the used solvents), the clothing articles should be removed from the machine first to allow the process of regeneration, and these clothes can either be transferred to a dryer in a transfer machine operation or are dried in the same machine if they are to be dried through a dry-to-dry model. As part of the finishing process, the apparel and textiles are pressed and lastly placed on hangers and covered with a plastic bag or folded and stored. On the other hand, the Dry cleaning and laundry Institute (2017) noted the dry cleaning processes as inspecting and classifying garments before washing, removing the stains, washing, and drying.

2.2.2.1 Factors to be Considered in Laundry and Dry Cleaning Procedures

The following are some of the factors which have been reviewed and need to be considered for successful LDC procedures. This includes the fiber content, fabric construction, care labels, garment care check (during sorting), and selection of LDC agents.

2.2.2.1.1 Fiber Content and Fabric Construction

Textile Labelling Regulations (2016) defines fiber content as the raw materials which make up the yarns and fabric that can be natural, such as cotton, wool, and linen, or synthetic from petroleum products - such as polyester, nylon, acrylic, and spandex. Fiber content is a major contributor to the appearance, comfort, durability, costs, and care characteristics of fabrics and also dictates the mechanical action in LDC. Onyango (1997) also defined fiber content as the number of basic units (raw materials such as cotton, rayon, wool, and nylon used in the fabrication of textile fabrics and further describe fabric construction as the production of fibers by weaving, knitting, and use of other none woven methods.Venkatraman (2015) noted that:

Fiber content includes moisture absorbency which is the ability of a fiber to absorb water. Polyester, Nylon, and spandex are examples of non-absorbent fibers. Such fabrics when washed, water cleans only the outside and does not penetrate giving such fabrics the ability to dry quickly after washing. Natural fibers such as cotton absorb water easily making them take longer to dry. Resiliency is the ability of a fiber to return to its original size and shape after being twisted/crumpled. Wool and silk are more wrinkle-resistant than cotton and flax but less resilient than some manufactured fibers. Fabrics like cotton and flax are not wrinkle resistant and require ironing after washing and may also require touch – up pressing between wearing. Strength as a characteristic is found in most natural fibers such as cotton and flax making them strong when wet /dry. Wool and silk are much weaker when wet than when dry making them be handled carefully to prevent them from any damage when washed hence are recommended for dry cleaning. Many fibers are heat sensitive for example wool which can shrink with too much heat. Some fibers are combined to improve some characteristics for example cotton and polyester when combined dry fast and become more wrinkle resistant, some fabrics can be blended to improve their characteristics for example wool and nylon

1. Fabric construction is the way a piece of fabric is made. The two most common types of fabric construction are weaving and knitting. The looseness or firmness of the weave will determine the care it needs. Firm woven/knitted fabrics will withstand more handling without stretching and vice versa. Loosely woven/knitted fabrics need careful handling in hanging, washing, drying, and pressing. Knitted garments such as sweaters can be stored flat, and folded in a drawer or box without becoming wrinkled. Firm woven garments do not stretch out of shape when they are pressed.

2. Colorfastness of fabric is determined by its ability to maintain its exact shade of color throughout its life. Fabrics differ in the degree of colourfastness and that color can be damaged by sunlight, perspiration, rubbing, heat, stain removers, detergents, soaps, bleaches, and hot water.

3. Fabric finishes such as shrink resistant for fabrics like cotton and wrinkle-resistant for fabrics like linen. These and other finishes usually make it easier to care for many apparel and textile products.

4. Garment construction that includes details like trim, seam finishes, seam allowances, and pockets, among others should be carefully handled. Buttons, belts, ribbons, and other trims require the same care as the rest of the apparel/textile articles. Trims that require special care need to be removed when laundering or dry cleaning. Therefore, fiber content, fabric construction, colourfastness, fabric finishes, and garment construction influence how LDC service providers would care for and maintain apparel and textile products.

According to Anthony (1999), fabric construction/structure consists of weaving which consists of interlacing warp and weft yarns according to a predetermined pattern, and knitting where the fabric is composed of a series of interconnected loops. Fabrics can also be made by the methods of lace and net production by the felting of wool and by modern techniques used for the production of so-called non-woven fabrics.

2.2.2.1.2 Knowledge of How Different Fabrics Are Produced and Their Properties

Cotton comes from the fibers of the cotton plant, the genus Gossypium. Cotton fibers grow from the seedpod hence they are seed hair fibers. Cotton fibers are grouped as seed hair fibers since they grow out of seedpod is a multipurpose product that blends

and accepts dyes well with other fibers. Has the ability to resist damage when being cleaned due to its alkalinity property. When garment trappings are endangered by wet cleaning, cotton fabrics are used since they are not damaged by dry cleaning (Lin, Nakamura &Mammel, 2011).

Linen yarns and fabrics are produced from linen flax fibers. This can either be wet-cleaned or dry-cleaned at home. Light or adequate use of chlorine can be used to whiten linen fabrics when damaged by extreme chlorine bleaching. Shrinkage from laundry wrinkles can be minimized through dry-cleaning. Dry cleaning helps in the reduction of shrinking caused by laundry wrinkles (Lin *et al.,* 2011). All hair fibers coming from goat, sheep, rabbits, or a camel is wool. Because of its property of warmth, it is mainly used in making winter clothing. In addition, it is also identified with suits making it easy to crease using several methods of pressing. Since wool has the like hood of shrinking, if wet- cleaned, it is always preferable to dry-clean it (ibid).

Silk is produced by the silkworm, which creates a filament fiber while spinning a cocoon. Casual garments and decorations are the most products of silk. As silk filaments are mostly prone to breakage whenever the fabric becomes wet, they are mainly cleaned through the dry cleaning process. The most common procedure for silk cleaning is dry-cleaning. Once the fabric becomes wet, silk filaments are more vulnerable to breaking. Subjecting silk to the sun can degrade them and can break upon the slightest of the washing machine. To improve their durability, it is important to always subject them to dry-cleaning (ibid).

Rayon is a regenerated fiber manufactured from cellulose pulp sheets that are treated with chemicals at specific stages. Textiles greatly use rayon in garment making since it is aesthetically pleasing and drapes very well. Rayon has a short life span and hence

requires gentle laundry and preferably dry-cleaning to avert breaking of the fibers (ibid).

Polyester is a petroleum-based fiber that can be extruded into any form. Durability and creases resilient ability are some of the major properties that make polyester easy to maintain. Since polyester is mostly blended with other fibers, it is of value to be considerate of the properties of other fibers when caring for them. Caring for acrylic is also very easy because it is a synthetic fiber and maintaining it is the same as for polyester. Wool and acrylic share some features only that acrylic has a relatively lower absorbency rate and does not shrink when wet-cleaned as wool often does (ibid, 2011).

The material nature of textiles is largely organic though may include inorganic materials such as metals and glass. The fibers themselves are organic, polymeric materials. For example, cotton and flax which are plant fibers are composed mostly of cellulose, whereas animal fibers are formed from protein polymers. Modern man-made fibers consist of organic polymers of synthetic nature. Due to the partially crystalline and partially non-crystalline nature of polymeric materials, they are permeable to gases, vapors, and certain liquids such as water, and except for a few modern synthetics, they are strongly hygroscopic. Due to their fibrous and relatively open structures, textile fabrics present a huge surface are of air passing around and through them. Again, they are efficient collectors of air-borne pollutants, like dust, and respond rapidly to changes in the relative humidity of the surrounding atmosphere (Anthony, 1999).

2.2.2.1.3 Knowledge of Service Providers on LDC Detergents, their Uses and their Appropriateness on Different fabrics

Detergents which have builder components are good for heavy-duty washing of cotton and linens however they spoil woolens and other delicate fabrics and those which have bleached and blue are suitable for white cotton and linens but bleach-colored clothes making them look dull. Mild detergents are suitable for washing woolen and delicate fabrics and antiseptic detergents are suitable for disinfecting clothes. Bleaches remove stains and discoloration that are too difficult to remove with stain removers and also remove dyes from fast-colored clothes. Starch is a stiffening agent which is good for linen and cotton fabrics making them heavier, smooth, and resistant to dirt. Laundry blue is used to absorb some yellow light so that less yellow is reflected and the fabric looks whiter, fabric conditioner is added to the final rinse water for synthetic fabrics to get rid of static electricity while salt is used to dissolve mucus in handkerchiefs, to fix dye in loose colored cotton and to remove blood and ink stains (Kenya Literature Bureau, 2009). Mugambi *et al*. (2004)on the other hand noted that soap detergents can be used effectively on woolens and in all other fabrics since they do not harm such fabrics and are recommended for delicate fabrics such as silk, wool, viscose, and acetate rayons. Soapless detergents can be used with natural fibers except for wool and all manmade fibers. The study was to measure the knowledge of LDC service providers on detergents use on different fabrics and its effects on the environment and how it affects the contribution of the LDC service providers to SDG Six.

Table 2.1: Fiber Content and Fabric Construction in Relation to Care

Fabric	Washing	Drying	Ironing
Wool	• Is a delicate fabric. • Dry clean. • To remove soil and dust from it, brush lengthwise with a garment brush.	• Dry trousers and skirts upside down. • Keep the garment away from the sun and other sources of heat while drying.	• Never iron without steam. • Press the garment from the inside.
Silk	• Machine wash. • Always blot the stain with cold water. • For perspiration or deodorant stains, apply to dilute vinegar to the area with a soft sponge.	• Roll up in a towel to absorb excess water. • Hang or lay dry.	• No much ironing is needed. • Lowest heat to be used when ironing. • Iron on the inside using a dump cloth.
Knit Wear	• Hand washes gently. • Machine wash with a cool wash, low spin. • Never wring or hang dry since wet wool stretches easily.	• Lay on a clean towel and roll it up to extract water. • Lay flat to dry.	• Minimum steam and ironing with a low setting with the garment inside out.
Cotton	Hand or machine wash.	• Dry in a cloth dryer or natural drying over a cloth rail or in the sunshine. • No special requirement is needed.	• Iron while still dumping. • Avoid excessive drying.
Linen	• Hand or machine wash. • Use a mild detergent with a gentle cycle.	• Dry flat. • Hangers or cloth spins do cause marks and deformation	• Iron while slightly dump from inside out.
Manmade	• Turn it inside out before placing it on the washing machine. • Are susceptible to static cling without fabric softener.	• Air dry or machine dry at a low temperature. • Dries quickly and maintains its shape.	• Iron on a low setting. • Most of them do not crease so minimum iron is required.

(Source: Tanya, 2016)

2.2.2.1.4 Care Labels

According to the Dry cleaning and Laundry Institute (2015), a care label contains various instructions for laundering apparel and textile products. In most cases, these care labels are given in form of care symbols. Some fabrics can be laundered by water while others by chemicals, some run color when in contact with water while others do not and some are made by blending different fibers. The variety of apparel and textiles in the market makes it difficult to tell the type of care to give specific apparel and textile product since different fabrics require different care. For these reasons, the International Care Labelling was developed to help consumers and LDC service providers understand how to launder or dry clean apparel and textile products correctly. The codes in care labeling contain words and symbols which mean the same globally.

The guideline on apparel and textile products maintenance is always printed on the care labels. The care labels are meant to ensure that during use and care, apparel and textile products keep their quality. Apparel and textiles products' attractiveness and durability are shortened when the information on the care labels are neglected (Isabel &Nyaradzo, 2013).

The pattern of arrangement of the five care labels is of similar order in both the United Kingdom and other countries. This has been noted since they are the basis for care labeling as shown in Table 2.

Table 2.2: Symbols of Care Labels

SYMBOLS					
MEANING	Washing	Bleaching	Ironing	Dry cleaning	Drying

(Source: Isabel and Nyaradzo, 2013)

The combination of symbols varies with the fiber content, finish, and fabric structure. Despite the variation in the guide presentation by country, the information relayed to the consumers of apparel and textile products is understood universally. Care labels are usually found on the neckline, waist seams, side seam, or any convenient place in apparel and textile products. In the United States (US), the symbols may be arranged vertically while in Europe they are horizontally arranged. Most care labels contain the size, brand, and fiber composition (ibid).

In the 1960s and 1970s, there was some quick improvement and the entry of new synthetic textiles into the market. This posed a great challenge to those who cares for the garments, as they did not have the knowledge and skills required to care for the new fibers. As a result, many apparel and textiles were destroyed by melting, shrinkage, or running of colors by incorrect care and cleaning procedures by the LDC service providers. Before the introduction of mandatory standards in 1979, it is believed that the use of inappropriate care procedures on apparel and textile products had caused significant destruction to them (Regulation Impact Statement, 2010). Producers of new apparel and textile products should ensure that care labeling is articulated in the provision of care information on the garments. This was because there were increasing innovations in clothing design and fiber with inadequate universal access to the internet that can be used to obtain care information.

A discussion with stakeholders has pointed out that labeling of fiber content in it is not adequate to offer laundry and dry cleaners the needed information to examine the suitable procedure for cleaning and keeping all apparel and textiles. Manufacturers were in a prime position to decide on the needs, concerning other important aspects

like the apparel and textile components, composition, fastenings, finishes, and trims that LDC service providers can overlook by mistake or not take into consideration from inadequate straight care information. In January 2004, the labeling standard of care for modern consumer product safety information was affected. The standard entails several things from household textiles, clothing, furnishings; plastic coated fabrics, piece goods made from textiles, suede skins, furs, and leathers. Generally, the policy dictates that care guidelines be: written in English, permanently attached to articles, legible, adequate, and appropriate for the maintenance of the item such that when adhered to the item cannot be destroyed, and available during selling (ibid).

A Care label means a permanent label or tag, containing regular care information and instructions that are attached or fixed in such a manner that it will not become separated from the apparel and textile products and will remain legible during the useful life of the product. Care labels must provide basic information that is usually needed by an average person to use the product. Dry cleaning or washing guidelines are mandatory for textile-wearing apparel (Care Labelling of Textile Wearing Apparel & Certain Piece Goods, 2021).

The caring message most of the time is displayed using symbols while information on apparel and textile labels is commonly presented in written or text format. The actual usage of information on apparel and textile labels is reliant on the LDC service provider's reading, interpretation, and understanding capability of this information. The formulation of information on care labels should be easier for LDC service providers and consumers to understand and use effectively (Staden, 2012). Table 3 is a Summary of care label symbols, instructions, and meanings.

Table 2.3: Care Label Symbols and Meaning

Care Symbol	Written Care Instructions	What Care Symbol and Instructions Mean
WASH		
	Water washing	It is okay to do water washing either by machine or hand.
	Signifies 30%C washing temperature	Recommended wool water temperatures to avoid shrinkage. Felting and matting should be avoided through minimum agitation.
	Low temperatures.	Recommended temperatures to be used on either polyester or cotton in deep colors, and for a mixture of wool with viscose/cotton and silk fabrics in colors.
	60%Cmoderate temperatures	Used with mixtures where colors and finishes are applied, polyester, and cotton.
	The high temperature for a hot wash	Spinning and normal rinsing is the requirement for fabrics of white cotton or linen without special finishes.
	A gentle wash program	An indication of a gentle washing schedule
	Even gentler program	More gentle washing program
	Hand Wash	Hand washing only
	Do Not Wash	Garments are not safe for any form of laundry procedure. UsuallyDry Clean instructions are attached.
BLEACH		
Care Symbol	**Written Care Instructions**	**What Care Symbol and Instructions Mean**
	If required bleach	Any bleach can be used in the article and it is normally significant for both commercial laundries using bleach and for domestic stain

		removal.
	Bleach when required	As required bleach but for nonchlorine only. This is because non-chlorine color-safe bleach can be applied when needed on these garments.
	No bleaching	No bleach should be applied to the garment.
DRY		
	Tumble Dry	Suitable for non-heat-sensitive fibers such as cotton.
	Line Dry	Out or in doors hanging of damp garments from bar or line.
	Drip Dry	Neither smooth nor hand shape but hang dripping wet garment from bar or line, out or in doors.
	Dry Flat	Horizontal laying to dry
	Dry In Shade	Avoid direct sunlight during drying. Applicable for drip or line dry.
IRON		
	Iron	Domestic ironing procedure sign
	Iron, Low temperature	For pressing heat-penetrating fabrics e.g. polyester, acetate, acrylics, and nylons. Minimum ironing is suitable for resilient fibers that do not crease easily like nylon.
	Iron, Medium temperature	A medium temperature of 160 ^{0}C suitable for viscose, wool, polyester, silk
	Iron, maximum temperature	A maximum temperature of 210 %C can be applied. Suitable for ironing linen and cotton Since they can endure high temperatures
Care Symbol	**Written Care Instructions**	**What Care Symbol and Instructions Mean**
	No ironing	No ironing or steam pressing.
	Do Not Iron	Smoothing or finishing with the iron is not required

DRY CLEAN		
	Dry clean	Moisture, cycle, solvent, and heat should be dry cleaned.
	Dryclean, Normal Solvent	No restrictions for all normal solvents
	Dryclean, Petroleum Solvent Only	Fluor hydrocarbons and white spirit
	Dryclean, perchloroethylene, and fluoro hydrocarbon solvents	Use the mostly used dry cleaning solvents like four hydrocarbons and perchloroethylene
	Do not dry clean	Applicable for fabrics containing 100% containing and do not need special care in the laundry

(Source: Textile Industry Affairs, 2010)

2.2.2.1.5 Garment Care Check (During Sorting)

According to Tanya (2016), important information that should be considered during the sorting process includes fabric structure, color, workmanship, trims, and extras. Fabric structure can either be loose or stable. Stable fabrics are stronger and can withhold faster longer spinning and washing. The loose fabric needs much care, from washing to drying and ironing as it can lose shape permanently. Colours from red and indigo dyes are not stable and do loose colour over time with excessive washing. Colour-blocked garments need to be checked for the quality of fabric to ensure that they can be washed. A shorter spin cycle and cooler temperature can help to stop the colour from running into each other. Workmanship consists of seams that are finished well inside and outside of apparel and have no loose threads. If the seams are weak, the garment could be damaged when LDC and therefore they should be repaired before cleaning. Trims and extras should be fixed well. Loose trims should be hand fixed with thread.

2.2.2.1.6 Laundry and Dry Cleaning Detergents

The Kenya Literature Bureau (2009) defines detergents as substances that aid in the removal of dirt while Mugambi e*t al*. (2004), define them as a cleanser, something that helps in the removal of dirt from the surface of cloth or other materials. The two authors further classified detergents into soaps and Soapless and said that soaps are made from animal fats/vegetables while Soapless are made of chemicals. Laundry detergents and laundry aids are substances that improve the cleaning action of water and contribute to the effectiveness of laundry agents especially that of water as well as providing special functions.

According to the America Cleaning Institute (2015), laundry agents include; water, detergents, bleaches, bluing, boosters, enzymes, fabric softeners, water softeners, and fabric stiffeners. Other different forms of laundry agents are powders, sticks, gels, sprays, liquids, pumps, bars, and sheets. They have been formulated in such a way that they can meet numerous soils and stain removal.

Bill (2015) categorized detergents for general purposes or light duty. General-purpose detergents are suitable for all washable fabrics and can either be in liquid or powdered form. All washable fabrics can be cleaned using general-purpose detergents that are either in powdered or liquid form. Pre-treating stains, and cleaning oily soils, liquid detergents are the best while for lifting out ground dirt and clay, powdered detergents are more suited. Light-duty detergents are used in machine or hand washing of less soiled items and fragile fabrics. Oxygen and chlorine bleaches brighten and whiten fabrics and assist eliminate tough stains by converting soils into colorless, solvable particles that can be eliminated using detergents and cleared by wash water. Disinfection and deodorization of fabrics can be done with liquid chlorine. In nearly

all washable fabrics, one can use oxygen bleach since it works safely and gently. During rinsing or washing, one can apply bluing, as it is absorbed by fabrics.

In addition to detergents, dry cleaners use boosters to promote the stain and soil elimination, buffering, brightening, and water softening performance of detergents. In the removal of tough soils and stains, enzyme *pre-soaks* are used for soaking clothes before washing. *Fabric softeners* leave residues on the fabric after laundering making the fabric feel softer and fluffier and reducing static electricity and wrinkles. Fabric softeners can either be wash added, rinse added or dryer added. *Prewash soil and stain removers* are used to pre-treat heavily soiled and stained clothes especially those made from synthetic fibers while starches are used in the final rinse or after drying to give body to fabrics and make them more soil-resistant and easier to iron. *Water softeners* aid in loosening and removal of soil during laundering and are designed to attack oily soil and are likely to contain organic solvents and surfactants hence the solvent can attack the oily soil and that surfactant holds it in suspension until it can be rinsed away. They are applied before laundering and are available as an aerosol and pump spray. Softeners improve the power of cleaning, as detergents are extra effective in soft water. *Stiffening agents* are used in laundry to restore natural stiffness, and give body to fabrics making them have a glossy and shiny finish. The stiffeners, therefore, prevent fabrics from catching dirt easily (Bill, 2015).

According to California Air Resources Board (2005), dry cleaning solvents are known as grease solvents because they clean fabrics by dissolving in the dirt, thereby loosening the dirt particles. They do not react with the fibers or dyes in the fabrics, hence do not cause shrinking, loss of colour, or cause damage to fabric finishes, and are more advantageous to use than water. Grease solvents that are used for dry cleaning include perchloroethylene, white spirit, carbon tetrachloride, and

trichloroethylene. Other grease solvents that can be used for home or simple dry cleaning include Fuller's earth, benzene, talcum powder, and petrol. Several diverse chemicals have been used like solvents for dry cleaning; the list entails turpentine spirits, benzene, camphor oil, white gasoline, kerosene, petroleum solvents, carbon tetrachloride, chloroform, trichloroethylene, trichlorotrifluoroethane perchloroethylene, glycol ethers, decamethylcyclopentasiloxane, trichloroethane, liquid carbon dioxide, and n-propyl bromide.

In the LDC procedures, detergents are used to do three varied roles; first is to convey moisture to assist in the elimination of water-soluble soils, secondly is to suspend dirt once it has been eliminated from the fabric, and lastly serve as spotting agents to enter the fabric so that the solvent and water can eliminate stains. They have been grouped into three based on their water carriage and charging properties namely; -*anionic detergents* that carry water through solubilization and are negatively charged, non-*anionic detergents* that have no charge and transmit water through solubilization, and *cationic detergents* that are having a positive charge and carry water through an emulsion. Spot cleaning and pre-cleaning procedures consume the most number and diverse chemicals used in dry cleaning. Before being placed in the dry cleaning machine, heavily stained garments are usually pre-cleaned or pre-spotted with cleaning chemicals. The fabric being cleaned and the type of stain determine the chemical types to be used. Chemicals used during pre-cleaning are always used for spot cleaning if garments still have stains after they are dry cleaned (California Air Resources Board, 2005).

Pre-cleaning/spotting agents can be wet-side agents, dry-side agents, or bleaches. Water-soluble stains are cleaned using wet-side spotting agents from clothing. Dry-side spotting agents are used to removing oily-type stains. Generally, the major

harmful agents are dry-spotting agents. This is based on contamination and regulatory stance. Spotting methods are used to eliminate tough stains using bleaching in a procedure regarded as “spot bleaching”. In addition, bleaches are utilized in conservative laundry processes that are done at many dry cleaning plants. Reducing or oxidizing, are the two grouping of bleaches. After dry cleaning use *Garment treatment chemicals* to treat garments. The roles of the chemicals are pest control, flame-retardants, waterproofing, stain repellents, deodorizing, and refurbishing (California Air Resources Board, 2005).

2.2.2.1.7 Selection of Laundry and Dry Cleaning Detergents

Laundry detergents are more available than ever before. They include bleaches, fabric softeners, water softeners, enzyme presoak products, pre-wash products, starches, fabric finishes, and laundry sanitizers. There has been an increase in product choices because more fabrics are now made of synthetic fibers. Oily dirt is held by these fibers making them difficult to clean. Commonly used, non-phosphate detergents generally do not clean some soils as well as phosphate detergents, especially in hard water. Additional LDC detergents may be needed. Bright colours or the fabric fiber content often requires a warm or cold water wash, therefore more chemical cleaning power may be needed. Matching the right products to the right purpose is the key to success in LDC (Rose &Carol, 2016).

The more wash load, the more detergent is needed. This also applies to the degree of soil and stains; the more dirt, the more detergent is needed (Terese, 2015). On the other hand, Bain, Beton, Schultze, and Mudgal (2009) noted that concentrated detergent products have less effect compared to a lower concentrated detergent across a variety of environmental pointers; additional concentration can hence offer extra environmental benefits. It is therefore important for the LDC service providers to

have some knowledge of fabric construction that will determine the use and selection of detergents.

2.2.3 Challenges in Laundry and Dry Cleaning Sectors

Laundry and dry-cleaning activities are a task that involves many procedures hence characterized by many challenges/problems. According to EU-OSHA (2018), the most common problem encountered in the laundry business is the exposure of the cleaners and the workers in LDC outlets to chemical hazards. The extent of contact with the chemicals relies on kind of the items used plus the nature of the work place where one uses the chemicals. This includes aspects such as the efficiency of ventilation during and after cleaning. LDC staff can be subjected to diverse chemicals contained in the cleaning products that they utilize for dust elimination, surface maintenance, and disinfection, plus other things in the soot and dust can be inhaled, and poses serious health risks (Medina - Rahom *et al.,* 2003; Zock *et al.,* 2002). Furthermore, most of the workers in the LDC outlets are illiterate or untrained on the standard procedures that should be followed in the operation of the cleaning machines and mixing of the washing detergents. EU-OSHA (2008) highlights that inappropriate mixing and handling of cleaning detergents can lead to fire breakouts and the formation of fumes that can cause respiratory problems and dermatitis. Exposure of LDC workers to physical hazards has also been documented.

2.3 Consumer Satisfaction (CS)

Customer satisfaction (CS) has become a key intermediary objective in service operations due to the benefits it brings to organizations such as repeated purchases, loyalty, and positive word of mouth, and will also increase long-term profitability (Michael *et at*, 2008). Shelly and Lakhwinder (2002) point out that whether the buyer is satisfied after purchase depends on the offer’s performance about the buyer’s

expectations. Similarly, consumers have expectations about the behavior of service providers, when these are exceeded; the level of their satisfaction with the service provider is positively influenced.

According to Shaffer (2008), one key to consumer retention is CS - a satisfied consumer stays loyal, longer and loyalty drives profitability and growth. Loyal and satisfied consumers are best achieved by loyal and satisfied employees. It is widely recognized from the literature that without satisfied and motivated employees, it is impossible to produce world-class products and impossible to achieve satisfied and loyal consumers (Eskildsen & Dahlgaard, 2000). CS can be seen as the company's key performance indicator. In a market place where there is competition for a wider consumer base, CS is seen as a key differentiator from other competitors and is also viewed as a key business strategy for establishing a wide consumer base (Munusamy *et al.,* 2010). No matter the size and the nature of the company or the organization, CS is a global issue that affects all companies or institutions. Companies that have more satisfied consumers experience high profits and economic returns (Yung *et al*., 2006). Given this, many companies should lay down strategies to ensure that consumers are satisfied, as it leads to increased economic rewards and profits, which is the core objective of the business.

There are different forms of CS, which is defined as an individual feeling of pleasure or disappointment resulting from comparing the perceived outcome in relation to the expectation (Loverlock *et al.,* 2001). There are two general conceptualizations of satisfaction-transaction-specific and cumulative satisfaction. Transaction-specific satisfaction is the customer's very own evaluation of his or her experience towards a particular service. This reaction is expressed by the consumers when using the service for the very first time while cumulative satisfaction refers to the consumer's overall

evaluation of the consumption experience to date (Boshoff & Gray, 2004). It is from this accumulation that consumers establish a personal standard that is used to gauge service quality.

In a service industry, consumers are content if their experience exceeds or matches their anticipations. Consumer expectations vary from one consumer to another and consumer wants and needs to vary with time; thus anticipation of consumers is that service offered should vary as well with time. Consumers are likely to appreciate diverse type's contentment: satisfaction, pleasure, delight, and relief (Poku *et al.*, 2013). For instance, the consumer can experience satisfaction when regular service is offered contently, delight when a package surprises the consumer, liking when a service makes the consumer feel exited and beyond anticipation, and reprieve when a package goes beyond a potentially tough situation and offers contentment (ibid). Highly satisfied consumers can create emotional ties to a product or service. Satisfied consumers in many cases make a repeat purchase, are less price sensitive, remain consumers for a longer time, and tell others about the product(s) or the services of a particular plant or individual service provider. CS is a psychological idea that entails the sense of comfort and liking that comes from getting what one anticipates and hopes from an attractive service or product (Wachiye, 2012).

CS can also be defined based on a process or result. The outcome definition of CS characterizes satisfaction as the end state resulting from the experience of consumption. This end state may be a cognitive state of reward or an emotional response to an experience or a comparison of rewards and costs to the anticipated consequences. The definition of CS is based on the process takes the processes of perceptual, evaluative, and psychological; all of which contribute to CS. In all these

processes, an assessment of satisfaction is made during the service delivery process (ibid).

2.3.1 Factors Influencing Consumer Satisfaction with Laundry and Dry Cleaning Services

Jiao (2013) points out image, price, perceived quality, tangibles, reliability, empathy, assurance, and responsiveness as factors that influence consumer satisfaction with laundry and dry cleaning (LDC) services. *Image* is based upon the consumers' beliefs about a brand or outlook and its associations held in memory and that image comes from the perceptions of the consumers. In marketing services, image is identified as a significant factor in a company's overall evaluation and has been described as individual knowledge such as an attitude or a combination of product characteristics that are identified by the product and is different from the product physical characteristics. An image has also been described as the overall impression left in the minds of consumers. Image is defined as a filter that affects the perception of a company's operation. The overall image of the institution is affected by perceived value, service quality and CS. *Price* is also a major determinant of consumer choice. It is the cost incurred in making a purchase that, together with perceived service quality and perceived value, influences spending behavior. Consumers will determine what price can be paid based on the factors affecting their satisfaction with LDC services. How much a consumer is willing to pay depends on what they need what they expect and their evaluation of the quality of service at its given time and place. High-priced products and services are believed to be high-quality and their prices are normally higher than lower-quality equivalent products or services as price impacts perceived quality. If consumers have no experience in obtaining a service, they, therefore, make a decision based on their expectations, image, perception of quality,

and price. *Perceived quality* is the judgment of superiority by consumers about a product's overall excellence or it is like an attitude. Perceived quality is defined as the consumers' comparison between their expectations and perception of service performance. *Reliability* refers to the ability of a firm to perform the promised service dependably and accurately. *Tangibles* refer to personal appearance, physical facilities like shop/house decorations, display and equipment, interiors and exteriors, the appearance and condition of the shelf space, the physical appearance of the staff, the appearance and design of the brochure, the shop/plant sign and its advertisements, are also key to CS. The. *Empathy* refers to the firms' personalized attention to their consumers and in giving them care and assistance. Empathy has several ways that can be shown to consumers such as knowing the consumer's name, preferences, and needs. Many institutions use this competence to provide customized services as a competitive advantage over others. *Responsiveness* or the employees' expression of willingness to help consumers and provide quick service is a dimension that is concerned with dealing with the consumer's requests, questions, and complaints promptly and attentively. When it communicates to its consumers, a firm need to know how to be responsive and how long it would take to get answers and solve problems. If institutions want to be successful, they need to look at the view point of the consumer rather than the institutions' perspective. *Assurance*, which is the trained courtesy of employees and also the ability to inspire trust and confidence in them, is another factor that influences CS. Assurance represents the personnel who link the consumer to the organization through trust and confidence.

The National Business Research Institute (2016) lists some of the factors that influence CS with LDC services as quality services, access, and a nice atmosphere. Terhi (2013) further points out that CS is primarily affected by employee satisfaction

in contact institutions. This is because the satisfaction of the employee is highly important in creating an intensive consumer relationship. It is also possible that employee satisfaction mediates how well the employee performs in consumer orientation behavior. The premise of the course is that a happy employee does a better job and an employee's positive mood has a positive effect on the performance.

Rothbard and Wilk (2011) postulate that when an employee starts work in either a positive or a negative mood, the performance can be affected and therefore performance can be influenced by affective reactions. Suree (2007) and Weeraya (2009) aver that a marketing mix that includes service, process, place, product, people, and promotion also influences CS in one way or another. Studies by Watchara and Yisuntes (2012) also demonstrate that consumers used laundry services because they do not have enough time to do it by themselves. The consumers were therefore influenced by the advertising boards in front of the shops, discount coupon promotions, chose shops that are near their residence, and also by the marketing mix factors.

In summary, it can be noted from the above literature that there are more positive benefits of CS than negative benefits in all the service institutions and that consumers do get satisfaction at different levels or stages. From the above-reviewed studies, the researcher observes that hardly any study has been done on "An assessment of laundry and dry cleaning practices among household and commercial service providers in Kisumu City, Kenya regarding CS with LDC services. Again it is not clear at which point the consumers get satisfaction with the LDC services and therefore the current study intends to fill this knowledge gap.

2.4 Sustainable Development Goal (SDG) Six in Relation to Laundry and Dry Cleaning Services

Sanitation is a state of well- being and the observation of environmental hygiene practices such as proper disposal of human waste and refuse, and the use of effective and appropriate drainage facilities. Causes of poor sanitation are ignorance of the danger of careless disposal of waste, congested and crowded living conditions, and poor urban planning. Poor sanitation encourages the breeding of disease-causing organisms, and contamination of water that leads to the spread of communicable diseases and also results in an unsightly environment (Kenya Literature Bureau, 2009). Mugambi *at al.* (2004) defines sanitation as something free from dirt or other substances that may cause diseases and further say that it deals with keeping the environment clean. The purpose of good sanitation is to promote health by preventing diseases. According to them, poor sanitation is caused by improper disposal of waste, unhygienic habits such as careless coughing, poor personal hygiene, pollution of water and land, and use of dirty tools and equipment. The dangers of poor sanitation are diseases, household pests, and accidents.

The surroundings in which we live make up the environment. Environmental hygiene refers to keeping and maintaining high standards of cleanliness around the environment through proper sanitation, refuse disposal, avoidance of pollutants, and proper drainage (Kenya Literature Bureau, 2009). On the other hand, Mugambi *at al*., (2004) refers to environmental hygiene as the cleanliness of the surroundings. Environmental pollution is adding of harmful or unpleasant substances to the environment. Environmental pollution can be classified as air, land, and water pollution. Water pollution is the addition of undesirable, unpleasant, and harmful substances into the water bodies making the water surface unsafe for human use.

Water pollutants include; Detergents, Industrial waste, toxic Agricultural chemicals, sewage leaks, oil leaks, sediments from soil erosion, and household waste (Kenya Literature Bureau, 2009).

The focus on SDG six and how the cleaners and other major water users have contributed to water sustainability is not explicitly expounded (Behnke *et al*., 2017). The Kenya Environmental Sanitation and Hygiene Strategic Framework (KESSF) for the period 2016-2020, the strategic framework strives to contribute to SDG 6 on ensuring the availability and sustainable management of sanitation for all people by 2030. Article 43 of the Kenya Constitution 2010 stipulates that people acquire the highest attainable standard of health and sanitation. The strategy of SDG 6 in Kenya as contained in the KESSF and the KESHP (Kenya Environmental Sanitation and Hygiene Policy) provides that the government and the people of Kenya achieve and sustain a 100% Open Defecation Free (ODF) by 2030. The strategy also states that people need to achieve 100% access to improved sanitation in both urban and rural areas by 2030 (Simiyu, 2016). There is also a need for both the government and the private sector to invest in hygiene and sanitation from the then 0.2% to at least 0.5% percent of the GDP by 2020, as well as increasing it to 0.9% of the GDP by 2030 (Rajasingham *et al*., 2018).

The government and the private sectors need to improve rural and urban sanitation by providing clean and safe drinking water (Nhamo, Nhemachena & Nhamo, 2019). Large and commercial water consumers ought to abide by the eight principles provided by KESHP which include scaling up access to improved sanitation, and assuring a clean and healthy environment free from public nuisances. The strategy also calls for innovations in rural water disposal combined with incentives (Abu, Bisung, & Elliott, 2019). There is also the encouragement of private-public

partnerships that facilitate the development and management of sewerage systems. The Kenyan vision 2030 on hygiene and safety calls for the reduction of hazards that are related to unhealthy environments with respect to pollution and waste management (Simiyu, 2016). There is also a need to provide total solutions on health matters where private partners are welcome to support the delivery of a healthy environment.

In the context of the Kenyan strategy for improved health and sanitation, urban players need to improve their services while adhering to safety guidelines. The development and enforcement mechanisms that target pollution and waste management are highly encouraged among private practitioners in health and sanitation (Abu, Bisung, & Elliott, 2019). Cleaners in Kisumu City by the virtue of being private players in water and sanitation, there is need for them to adhere to the requisite KESSF guidelines and adhere to safe waste disposal (Mureithi *et al*., 2018; Simiyu, 2016). The gaps identified in addressing the problem of poor waste management seem to be pronounced in urban areas when compared to rural areas. There is a need to understand whether LDC services providers are aware of the provisions of the KESSF and Vision 2030 (Mureithi *et al*., 2018).

2.5 Laundry and Dry Cleaning Practices

Laundry and dry cleaning (LDC) practices are a routine habit of carrying out different cleaning activities. These practices can affect LDC service providers and consumers negatively or positively, either directly by exposing people to harmful detergents, or indirectly by disrupting life-sustaining ecosystems. According to this research, these practices include LDC service providers, the site where LDC is done, safety measures (use of protective equipment), and Environmental practices (waste disposal).

2.5.1 Laundry and Dry Cleaning Service Providers

According to Terese (2015), seventy percent of the world's population washes their apparel and textile products by hand. However, the invention of the washing machine has created an opportunity to ease the work of LDC and save time. Washing by hand is time-consuming and physically challenging, where as in developing countries, the majority of the laundry work is done by women. Constance and Amanda (2006) on the other hand noted that in the first decade of the 21st century, the majority of the household responsibilities have been left to women, therefore, consuming most of their energy and time.

2.5.2 Laundry and Dry Cleaning Sites

Launderette Association of Australia (2005) reported that in some third-world countries, humankind has not transformed from tradition practices of washing clothes along riverbanks, near a well, by the sea, or near any source of water. Effective washing results and good quality in washing require observance of important information about textile and apparel products and their washing conditions.

2.5.3 Laundry and Dry Cleaning Waste

The Environmental protection agency (2005) identified LDC waste as still residue, filter contents (lint, dirt, filters aid), lint filter & button trap contents (lint and dirt.), waste from water separator cleaning, spent filter cartridges, separator water, water waste, waste solvents, and other solvent contaminated materials. ChemTrac (2010) on the other hand outlines LDC substances produce as soil items, chemicals, and pressing items that are produced during drying, pressing and equipment cleaning and maintenance operation produce.

Alemayehu(2004) defined waste as undesirable. Human and animal activities results in some wastes referred to as solid wastes being discarded as unusable or undesirable. Solid wastes comprise all solid waste material generated by households, institutions, commercial establishments, and industries, and discharged from their premises for collection while wastewater or liquid waste is any spent or used water from homes, communities, farms, commercial and industrial entities that contains enough harmful material to damage the water's quality and the Environment. Wastewater includes sludge from on-site sanitation systems such as pit latrines, urine-diverting dry toilets, septic tanks, domestic sewage, and industrial waste from manufacturing sources (Ministry of Health, 2016). There are four categories of waste: first is domestic sewage which comprises wash water from homes and human wastes, secondly, commercial or public buildings waste is composed of wastes from the bathroom, barns, kitchens, and laundry with no human wastes, thirdly, is the industrial waste which is manufacturing procedures used water, and lastly is storm water as a result of down pour carrying suspended and dissolved solids, organics, and any other objects washed up by the running water (Alemayehu, 2004). Ondieki (2013) on the other hand categorized wastewater as grey water that includes water from laundry machines, sinks, showers, and run-offs. He also points out black water including that from the kitchen, dishwashers, and toilets. Ministry of Health (2016) classified solid waste into two categories: organic and inorganic. Even though organic solid wastes are normally biodegradable and decomposable, if left unattended, can produce an irritating and offensive smell in the process. Depending on the nature and type of the material constituting the inorganic solid waste, they are combustible since they cannot decompose. Agricultural, institutional, demolition or construction, industrial, treatment plants, commercial, and residential are the major sources of solid waste.

2.5.4 Laundry and Dry Cleaning Waste Management

According to the United State Environmental Protection Agency (2016), dry cleaning activities discharge harmful chemicals into the air. Dry cleaning plants operating near homes and businesses, should devise mechanisms for containing vapors emanating from perchloroethylene (PERC) that they use from spreading into residential. Employees of dry cleaning plants should be covered from PERC exposures, as it is a health hazard. Nausea, dizziness, sleepiness, and headaches are signs that employees have been exposure to large quantities of PERC vapors. Long-time exposure to PERC vapors at low levels may result in a serious health effects the employees and building occupants. In New York City, PERC levels in residential buildings with dry cleaning plants are elevated. Dry cleaners are obligated by local regulations, and federal, and state laws to ensure that PERC vapours are kept low in their shops and out of neighboring spaces. United Environment Protection Agency requirement on the use of PERC includes; - 4th generation dry cleaning machines only to be used in residential houses with good practices for dry cleaning, use of the vapor barrier enclosure properly, checking dry cleaning equipment once a week, using and storing chemicals safely, handling hazardous waste properly, ensuring fresh air into the dry cleaning shops, maintaining the facility and ensuring that workers are trained and certified.

Electrolux (2015) said that LDC service providers should never sort clothes on the floor, use personal protective equipment when carrying out LDC, never put dirty clothes with clean ones, do regularly cleaning, and disinfect dirty laundry collection bags. The author's recommendation on care and maintenance practices on machines is that, during LDC processes, the machines should not be overloaded or under loaded, good quality and correct amount of detergents should be used, the washing machine

door should always be left open between loads, the drier should be pre-heated to optimize the drying cycle time, the dryer door should not be left open after unloading and before loading the next batch, fluff filter should be cleaned regularly during the day since a clean filter reduces energy use and hot laundry in the dryer should never be left at the end of the working day as it is a serious fire hazard. In addition, during storage, control of substances that are hazardous to health should be practiced by not storing anything on top of the machine, washing hands regularly, wearing protective clothing, keeping the machines clean, not storing laundry for long periods, and cleaning the soap box regularly.

The America Cleaning Institute (2015) also notes the following as good LDC practices that should be followed when offering laundry and dry cleaning services:

1. Laundry should be done when one is active and attentive without any distracters.
2. Empty containers should not be re-used for storage
3. Laundry products should be kept in a safe place where children or pets cannot reach
4. Other cleaning products are to be stored separately from laundry detergents
5. After dispensing or measuring laundry products, ensure you wash your hands plus any other items used in the process
6. Do not leave any laundry detergent box, container, pouch, or bottle open. Always close immediately after use.
7. Always be keen while reading product requirements while being more careful with “Caution," "Warning," "Danger" or "Poison" statements.
8. Maintain products in their original containers and don’t interfere with the label.

9. Clean up product spills immediately.

Electrolux (2015) and America Cleaning Institute (2015) showed good LDC practices and only talk about how to use and care for machines, equipment, and the use of care labels but did not mention ergonomic practices that the service providers should adhere to while doing LDC and how laundry aids should be handled. On the other hand, there are varieties of detergents in the market today that when used well can or may lead to positive disconfirmation and then satisfaction to the consumers and vice versa. Currently, there are varieties of apparel and textile products made from natural or synthetic fibers. Therefore, particular LDC procedures have to be selected based on the fiber content, properties, fabric construction, fabric finishes, and care labels instructions. The researcher supports what the above studies have reported because when such practices are followed well, the complaints of consumers may be minimal and consumers are satisfied. However, it is not clear whether the mentioned waste management practices are followed by the LDC service providers in Kisumu City; hence this study is set to fill the knowledge gap.

2.5.5 Impact of Laundry and Dry Cleaning Waste Disposal on the Environment

The environmental impacts of apparel and textile cleaning affect the environment their entire life cycle, composed of several environmental concerns. Apparel and textile cleaning procedures are the origin of numerous environmental impacts, associated with water consumption, energy, solvents, and detergents. Illustrations of the effects are water pollution, resource use, greenhouse gas emissions, eutrophication, and potential toxicity impacts (Bain, Beton, Schultze& Mudgal, 2009). The impact of wastewater is high even in high-income countries. Some of the threats to humans include typhoid and cholera. To the environment, untreated wastewater can result in

the contamination of ground and surface water as well as poses dangers to marine and aquatic life(Ondieki, 2013) and The Kenya literature bureau (2004). Dilution disposal/ "Self-purification of water bodies" is an obvious behavior by a portion of communities discharging untreated sewage into nearby water masses such as streams, rivers, seas, and lakes for its strength to be reduced or for it to be diluted by the water causing nuisance and unsanitary (Alemayehu, 2004). In developing countries like Kenya, air pollutions have major effects on human health, triggering, and inducing several diseases leading to increased mortalities and morbidities (Ghorani-Azam, Riahi-Zanjani, &Balali-Mood, 2016). E-waste poses environmental hazards through atmospheric pollution, groundwater contamination, and water pollution either because of surface runoff or due to immediate discharge. Depending on the nature of human involvement, either indirectly or directly e-waste threats to human health include health effects and occupational safety because of the technique used to process the waste. Central nervous system growth in young children and IQ can be affected by high levels of (Ministry of Health, 2016). This study was to establish ways through which LDC service providers in Kisumu City dispose of their waste and whether they are aware of the regulations that guide them. The study also provides information on whether the practices that ensure the sustainability of the environment are adhered to in relation to contributing to Sustainable Development Goals (SDG) six. Pollution with lead and other heavy materials pose occupational hazards that further threaten to expose the locals to increased morbidities. Though not observing the right procedures for waste disposal, LDC service providers in Kisumu would be negatively contributing to the delayed realization of the Sustainable Development Goals.

2.5.6 Measures to Curb Pollution Arising from Laundry and Dry Cleaning

Various environmental impacts associated with energy, water consumption, detergents, and solvents are originated through clothes cleaning procedures. Examples of the environmental effects include resource use, eutrophication, greenhouse gas emissions, water pollution, and potential toxicity impacts. The following controls should be exercised to minimize environmental effects resulting from clothes cleaning: -

- Cleaners are encouraged to wash at 30°C as it has a significant reduction in environmental effects.
- Independent life cycle assessment analysis should regulate the development and verification of detergents to minimize the use of detergents with environmental effects. Detergent products with more concentration are more friendly to the environment than less concentrated detergent products. This has been proved across a range of environmental indicators; additional concentration may thus offer extra environmental benefits.
- Encourage more LDC service providers to embrace line drying as compared to mechanical drying to reduce pressure on the environment. The washing efficiency of spin-drying should be enhanced over mechanical drying to minimize energy consumption and hence reduce pressure on the environment.
- The review of the international standard on labeling clothes (ISO 3758), offers a chance to impact both consumers and manufactures, by encouraging producers to normalize care label terminologies and make easier instructions for consumers to enhance better practices to realize environmental gains.

> Visibility of care labels is of importance to consumers and thus should be placed strategically (Bain, Beton, Schultze &Mudgal, 2009).

The amount of emitted Volatile organic compounds (VOCs) from the dry cleaning process depends on the age of the facility's machine(s), the solvent used, and the level of equipment maintenance. Under Canadian law and Regulations, dry cleaning facilities that use tetrachloroethylene (PERC) are required to use machines that have a single drum for washing, extraction, drying, and deodorizing cycles. In addition, machines must have a refrigerated condenser and an integral tetrachloroethylene - water separator that recovers the PERC from the wastewater (ChemTrac, 2010). Further, ChemTrac (2010) identifies two measures that should be taken into consideration Pollution Prevention Assessment and Pollution prevention. *Pollution Prevention Assessment* is done in the early stages to avoid serious dangers during operations. It is done with the help of the expert and the process entails the identification of process flows, evaluating the way of usage and storage of chemicals, reviewing equipment uses, assessing the means of utilizing energy, and revising waste management practices and discharges. This evaluation helps to pinpoint several pollution inhibition chances and select which actions to execute.

Better management starts from the supervision of chemical acquisitions, use of chemicals, and waste disposal in the process of pollution prevention. Environmental performance can be improved through Pollution Prevention. Pollution inhibition can be realized by identifying key substances and other chemicals used that are likely to cause environmental and/or health effects. Estimation of the quantity of each chemical used and possible associated emissions, and finally deliberation on the avenues of reducing or eliminating these chemicals and, where possible, auctioning, tracing the

number of chemicals used and assessing if it reduces with time, reviewing growth and pinpointing if or not to advocate for modifications of company's procedures and practices (ChemTrac, 2010).

2.5.7 Changes/Measures that could be made in Laundry and Dry Cleaning Facilities

Measures that can be taken in LDC facilities have variations in terms of cost and ease of implementation. Implementation of some measures will just require alterations of some day-to-day methods of operations, while others will dictate the management to acquire new machines. Such measures include:

- Reduction of chemical use through changes in operation and management by adopting low-cost and good operating procedures. This includes slight modifications to regular practices, procedure advancements, and training with proper housekeeping chances. No new technology is required to implement this measure.

- Use modern chemicals that are less dangerous, but the implementation of the measure is dependent on cost and ease of acquiring the alternative product.

- New system or technology, involves the creation of a new system, process, or machine (ChemTrac, 2010).

Owner Information Sheet (2005) noted that individuals subjected to poisonous air pollutants at adequate concentrations, for an adequate period, have higher chances of acquiring cancer or suffering from other grave health effects, such as birth defects, reproductive problems, and aggravated asthma. Utilization of materials, procedures, or practices that minimize or remove air pollution at the origin protects the health of

consumers, staff, and families. Embracing pollution prevention habits is economical as less money is spent on solvent usage, waste disposal, and the cost of air pollution controls.

In addition, improved pollution prevention efforts can also reduce the effects on the environment and human health. Air pollution from LDC operations can be reduced by: checking hoses, pumps, valves, couplings, and gaskets regularly for leaks; lowering emissions at the origin, using a halogenated leak detector to help pinpoint leaks; substituting cartridge filters with spin disk filters that can be cleaned without opening; mending leaks on time and letting drying cycle to complete before opening the door; casing containers of solvents to reduce solvent loss from evaporation and fugitive emissions of toxic air pollutants and VOC; minimizing procedure vent emissions by utilizing a closed loop dry-to-dry machine with a refrigerated condenser; and finally, inhibiting spills by dispensing materials with spigots and pumps.

The added carbon absorber can reduce extra emissions through solvent recovery.

- Proper machine loading as overloading minimizes the efficacy of solvent retrieval equipment and under loading reduces the efficacy of the solvent.
- Before disposal of cartridges, the solvents in the filters should be drained for 24 hours in the filter rooms to recover solvents.
- The dry cleaning machines should have spill containment structures installed all over.
- Assess investment using other innovative cleaning technologies or in a closed-loop dry-to-dry machine. Try comparing the initial costs with savings for a while less hazardous disposal costs and lower raw materials acquisition costs.

- Recovery of solvent from the dry cleaning process requires the installation of refrigerated condensers.
- Employ new technologies such as liquid CO2, silicone-based, and cleaning wet cleaning, machines.
- Clothes that naturally require dry cleaning use water and solvent for wet cleaning processes (Owner Information Sheet, 2005).

On the other hand, the requirements by the United Environment protection Agency (2016) as per the users of PERC include: Use of only 4th generation dry cleaning machines in residential buildings, best dry cleaning practices for shops in residential areas, use of the vapour barrier enclosure properly, checking dry cleaning equipment once a week, using and storing chemicals safely, handling hazardous waste properly, ensuring fresh air into the dry cleaning shops, maintaining the facility and ensuring that workers are trained and certified. In adapting to the changes in laundry and dry cleaning practices, care also needs to be given to ensuring waste disposal is done correctly, thus contributing to SDG six. This study was to establish whether there were regulations governing waste management practices of LDC service providers in Kisumu City and whether they are following such regulations.

2.6 Levels of Waste Water Physical-Chemical Parameters Disposal of Laundry and Dry Cleaning Practices

The wastewater used for washing is responsible for the pollution of the environment. The material safety data sheets (MSDS) as well as sources provide sources of waste that when used can guide the effluents from washing water. While some chemicals and materials are no longer used for washing in the United States, though are still being used in developing countries. All product ingredients and constituents can be

both hazardous and non-hazardous (Rashed & Niyazi, 2017). There are five categories of chemicals used in dry cleaning including; dry cleaning solvents, chemicals used in the process of dry cleaning machines, garment treatment chemicals, pre-cleaning and spotting agents, and chemicals used in solvent and equipment maintenance (State Coalition for Remediation of dry cleaners, 2009).

2.6.1 Raw Materials Used in Laundry and Dry Cleaning

The raw materials used in laundry and dry cleaning (LDC) include laundry and dry cleaning agents, detergents, soaps, and chemicals. Some common names in the dry cleaning industry include turpentine spirits, kerosene, camphor oil, white gasoline, chloroform, benzene, petroleum solvents, perchloroethylene, carbon tetrachloride, glycol ethers, and liquid carbon dioxide among others. Petroleum dry cleaning solvents are the most widely used in dry cleaning. Raw white gasoline has been the dry cleaning solvent of choice for the United States. Stoddard solvent is a mixture of petroleum distillate fractions that has over two hundred compounds. The component is composed of between 30-50% straight- and branched-chained alkanes, around 30-40% cycloalkanes as well as between 10 and 20% alkyl aromatic compounds (Han, Abel, Akkanen & Werner, 2017).

Hydrocarbons that are used for cleaning textiles are also sources of environmental pollution and thus, the components can be marked as potential sources of environmental pollutants. The petroleum materials used for cleaning have a challenge in biodegradation. The bacteria that are introduced into the dry-cleaning system in water to feed on the petroleum solvent, oils, and fatty acids produce sour smells. The bactericides and the antioxidants used for the cleaning system (especially the detergents) are a source of the foul smells and they end up creating an environmentally unconducive environment. The products used for petroleum dry-

cleaning solvents include the Desolan NT and Vermicide which have been used as "bacteriostatic" and for preventing the development of rancid odours respectively. Carbon tetrachloride was also used for dry cleaning operations, a component that has high toxicity with a tendency to cause corrosion on machinery. Perchloroethylene has also been used by commercial cleaners and it was associated with the formation of hydrochloric acid that caused corrosion of metals (Ling *et al*., 2015). Detergents used in laundry and dry cleaning(LDC)perform different functions that include carrying moisture to aid in the removal of water soils, suspending soil after it has been removed from the fabric, and acting as a spotting agent to aid in penetrating the fabric to allow the solvent to remove the stains. The anionic, non-anionic, and cationic detergents are classified based on their charge as well as how they carry water (ibid).

Pre-cleaning and spotting agents include wet-side spotting agents, dry-side agents, and bleaches. Bleaches are either oxidizing or reducing bleaches. The garment treatment chemicals include the application of chemicals that do waterproofing, flame retardants, and stain repellents. The other group of raw materials include surfactants, bleaching agents, minors, builders, and enzymes that are used in the dry cleaning industry. The types of laundry detergents include heavy detergents, liquid detergents, power detergents, and ultra-detergents that can be used for dry cleaning (ibid).

2.6.2 Wastes Generated from the Raw Materials Used in Laundry and Dry Cleaning

Laundry detergents have an effect on the environment as pollutants as Bajpai and Tyagi (2007) reported. Much of the fresh water supplies have become polluted and dirty to consume. The environmentalists observe that people are being poisoned by consuming the poisoned water disposed-off from LDC processes. The chemicals are non-renewable and billions of tons are released into water daily, making water unsafe

for human consumption. Laundry detergents that have concentrations of about 2 parts per million are capable of causing damage and death in fish, which can be translated to human consumption. The phosphates that are used in detergents when released into water cause algal blooms that deplete oxygen in waterways as well as release toxins into the safe water. Accumulation of surfactants in both industries and household are toxic and when they accumulate, they become a challenge to biodegradation.

The anionic surfactant-based detergents (especially the sulphonates) are not degraded under anaerobic conditions. The real environment conditions are more likely to be oxygen-limited than the rigorously anaerobic conditions (Han, Abel, Akkanen & Werner, 2017). Non-ionic surfactant-based detergents are more biodegradable. Washing inputs, processes, and outputs in dry cleaning are important as they dictate solid waste disposal and the potential for pollution. The outputs (solvents) from dry cleaning include the remaining solvents, emitted VOCs (air emissions), lint, waste water, sludge, and oil that when combined cause pollution in the environment. The wastes form washing detergents form a concern for pollution.

2.6.3 Constituents of Wastewater

Wastewater is return water after domestic and industrial use and can be classified into two main categories:1)Organic wastes which come mainly from domestic wastewater although industries also contribute a substantial amount. Some of these organic wastes are from vegetable and fruit packaging, oils and fat, dairy processing, meat packaging, tanning, paper, synthetic detergents, and fiber wood among others and, 2) Inorganic wastes which originate from the industries such as chromium, mercury, cyanide, and copper, which are very toxic to aquatic life (WASREB, 2008).

2.6.4 Side Effects of Wastes Eliminated by the Chemicals on the Environment

The effluent from washing water has been associated with the pollution of water masses and increased damage to aquatic life. The polluted water is passed into agricultural farms where it is used for crop farming, leading to contaminated crops, which end-up as food for human consumption. The focus on water waste is on the usage and the effect on other consumers who might inject food having the waste from LDC, or animals that might consume the pollutants and translate them into food. Some detergents are associated with producing foul smells, polluting the air, and consequently making the environment non-habitable (Han, Abel, Akkanen & Werner, 2017). Other solvents are corrosive, a condition that makes them not suitable for washing machinery and other easily-corroded materials.

2.6.5 Chemical Determination of Laundry and Dry Cleaning Waste

Chemical analysis was done at Lake Victoria Environmental Management (LVEMP) laboratory in Kisumu and the Safe water and Aids project(SWAP) laboratory in Kisumu as well. Waste samples were analyzed using UV- VIS spectrophotometer Hach methods and Atomic Absorption Spectrophotometer. Parameters that were analyzed included, Zinc (Zn), Cadmium (CD), Chemical oxygen demand (COD), Biological oxygen demand (BOD), Detergents, Mercury(Hg), Nitrate, Nitrite, Ammonia, Phosphate, pH, Electrical conductivity, total dissolved solids (TDS) and alkalinity (The Environmental Management and Co-ordination (Water Quality) Regulations, 2006).

2.7 Summary of Literature Review

Studies by Otieno (1990), Nyangor (1994), Isabel and Nyaradzo (2013), and Andy (2007) had shown complaints from consumers about laundry and dry cleaning(LDC) services. Given the nature of the complains, it was not clear whether the complains

were arising from poor LDC tools and equipment, lack of care instructions from apparel and textile manufacturers, lack of care label knowledge by LDC service providers, or failure to follow the right procedures by LDC service providers. Studies on LDC procedures by Melita, Claudia & Lilieth (2005), Minneapolis Development Review(2010), Kenya Literature Bureau (2009), Scott (2013), Launderette Association of Australia (2005), The Association of Southeast Asian Nations (2012), The Kenya Literature Bureau (2009) and Mugambi *et al*., (2004), Kumar, Goud and Joseph(2014) and Dry cleaning and laundry Institute (2017) outlines various LDC procedures which are supposed to be followed when carrying out LDC. From the mentioned studies, the procedures were not the same though all were right. The study focussed on LDC procedures that were followed by both households and commercial LDC service providers in Kisumu City. The findings indicate that LDC service providers were not following all LDC procedures hence no standard procedures were followed by the household and commercial LDC service providers.

Studies by EU-OSHA (2008), Medina-Rahom*et al.* (2003); Zock *et al.* (2002), Mondelli *et al.* (2006), Scherzer*et al.* (2005), Kumar & Kumar (2008), and Unge *et al*. (2007) identified the challenges of LDC service providers as exposure to chemical and physical hazards, illiteracy or untrained service providers and poor ergonomic practices. LDC service providers in Kisumu City also faced some of these challenges. In addition, they faced challenges such as: Not being able to interpret care labels, lack of enough tools and equipment, lack of some important detergents, lack of stain removers, inadequate space for drying out, lack of space for disposing of waste, lack of finance and lack of safe water source. Though they did not mention illiteracy/lack of training as a challenge, the problem was noticed during the administration of interviews and the interpretation of care labels.

Consumer satisfaction (CS) is a psychological concept that involves the feeling of wellbeing and pleasure that results from obtaining what one hopes for and expects from an appealing product or service (Wachiye, 2012). It is a key intermediary objective in service operations due to its benefits (Michael *et al,* 2008; Shaffer, 2008). It is seen as a key differentiator from other competitors and is also viewed as a key business strategy to establish a wide consumer base (Jayaraman*et al.,* 2010). Two general conceptualizations of satisfaction were identified: First, transaction-specific satisfaction which is the customer's very own evaluation of his or her experience towards a particular service and is expressed by the consumers when using the service for the very first time secondly, cumulative satisfaction which refers to the consumer's overall evaluation of the consumption experience to date (Boshoff & Gray, 2004). It is from this accumulation that consumers establish a personal standard that is used to gauge service quality. Outcome CS characterizes satisfaction as the end state resulting from the experience of consumption. CS based on the process takes the processes of perceptual, evaluative, and psychological, all of which contribute to CS. In all these processes, an assessment of satisfaction is made during the service delivery process (Wachiye, 2012). Image, price, perceived quality, reliability, tangibles, empathy, responsiveness, assurance, quality services, access, and a nice atmosphere, advertising board in front of the shops, discount coupon promotions, chose shops which are near their residence, and marketing mix factors are all factors that influence CS with LDC services (Jiao, 2013; National Business Research Institute, 2016; Watchara &Yisuntes, 2012).Satisfaction/dissatisfaction of consumers varies from one consumer to the other, with different aspects, and takes place in processes/stages depending on the individual consumer.

Despite various regulations that govern waste management in the world as outlined by the United State Environmental Protection Agency (2016), Electrolux (2015), The American Cleaning Institute (2015), The Kenya Environmental Sanitation and Hygiene Strategic Framework (KESSF), Kenya Environmental Sanitation and Hygiene Policy (KESHP) (2007) in addition to Kenyan statutory and regulatory requirements including NEMA, Environmental Management & Coordination Act and OSHA Act offering guidelines or policies on SDGs and waste disposal; it was not clear whether these policies were being implemented by LDC service providers in Kisumu City since waste water used for cleaning is responsible for the pollution to the environment. Chemical analysis was conducted at the lake Victoria environmental management (LVEMP) laboratory and at the Safe Water Aids Project (SWAP) laboratory in Kisumu City where levels of waste water chemical parameters were determined using the UV-spectrophotometer Hach methods and Atomic Absorption Spectrophotometer according to the established procedures of Perkin (1982) and ion probs. Parameters used included Zinc(Zn), Cadmium(CD), Chemical Oxygen Demand(COD), Biological Oxygen Demand(BOD), Detergents, Mercury(Hg), Nitrate, Nitrite, Ammonia, Phosphate, pH, Electrical Conductivity (EC), Total Dissolved Solids(TDS), and Alkalinity.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used in the research. The following areas were covered: the research design, study area, study population, sample size, sampling procedures, data collection methods and procedures, ethical considerations, and data analysis.

3.2 Research Design

The study was conducted through a cross-sectional survey and descriptive survey. Quantitative and qualitative data were collected and analyzed to describe the specific phenomenon in its current trends, current events, and linkages between different factors at the current time (Mugenda & Mugenda, 2003).

3.3 Study Area

The study was done in Kisumu City which comprises four locations namely: Kisumu Town, Kondele, Kolwa West, and Kisumu central. Kisumu is Kenya's third-largest city. It is located on the shores of Lake Victoria in Nyanza, Western Kenya. The total number of people living within the city is 507,720 which makes 52.4 percent of the total county population according to the Population Density Census, (Kenya National Bureau of Statistics (KNBS) 2009). The City had 59,793 households in the year 2009 and a projected number of households of 278,387 by the year2018 within its locations (Kenya National Bureau of Statistics (KNBS), 2009). Appendix 5 shows the number of households as per the 2009 population census in Kisumu.

The main economic activities in Kisumu City are fishing, light industries such as textiles, molasses, fish processing, agricultural produce processing, and a large-scale maize milling present in the main industrial area. In addition, several backyard industries including tailoring garment making, handicrafts, and boat-building. There are also service industries like wholesale and retail trade, bicycle repair, car repair, entertainment centers, small-scale Information Technology (IT) services, post offices, couriers, mobile phones, Banks, and water transport.

The city is fast developing into a major tourist destination in the Western Tourism Circuit of Kenya, replete with great scenery and diversity concentrated within a relatively small area. The Kisumu Museum and the Impala Park provide further tourist attractions. The Kisumu International Airport now has the potential to deliver international tourists directly into the city. Tourist infrastructure, like hotels and lodges, are now springing up in many places. Kisumu city has several colleges and universities, several health institutions, and two teaching and referral hospitals (Urban Transects Kisumu, 2015). Figures 3.1 and 3.2 show the location of Kisumu city in Kenya and the sub-locations respectively

Figure 3.1: Location of Kisumu City in Kenya (Source: Kulisha , 2015)

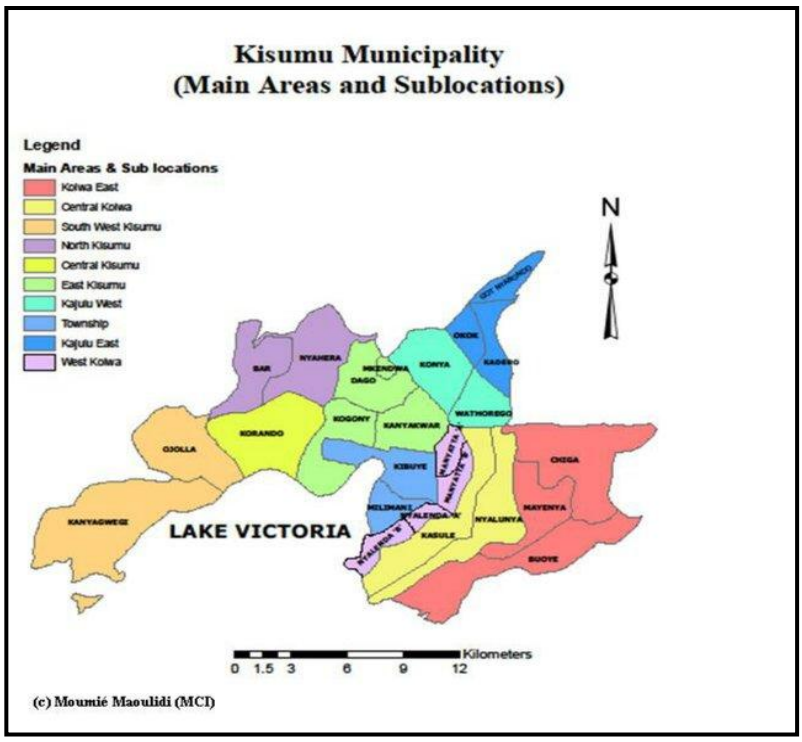

Figure 3.2: Main Areas or Sub-Locations in Kisumu City (Source: Moumie, 2010)

3.4 Study Population

The study population was made up of Commercial Laundry and Dry Cleaning Service Providers (CLDSP): Households' Laundry and Dry Cleaning Service Providers (HLDSP), Commercial Laundry and Dry Cleaning Consumers (CLDC), and Household Laundry and Dry Cleaning Consumers (HLDC) in Kisumu city. The City had a total number of 59,793households in the year 2009 and a projected total number of278,387 households by the year2018 within its locations (KNBS, 2009). Therefore, the study used 59,793households and 12 commercial LDC to determine the sample size.

3.4.1 Sample Size Determination

The study used Fisher's formula (Fisher, 1998) to determine the sample size for both households and commercial LDC service providers and consumers. The total target population under the study for the households was 59,793(Kenya National Bureau of Statistics, 2009) and 12 registered commercial LDC outlets. Since the respondents were from the households LDC and commercial LDC outlets, the study, therefore, used 59,793 (number of households) (ibid) plus 12 commercial LDC outlets as the target population. This number (59,793) plus 12 was more than 10,000 prompting the researcher to estimate the sample size using Fisher's formula which states: -

$$n = \frac{Z^2 pq}{d^2}$$

Where n = target population greater than 10,000

Z = degree of confidence (1.96)

p = Population of estimated study / target population (0.50)

q = proportion of the acceptance proportion significance of respondents estimated to be traced. (0 .50)

d = level of statistical test, 0.05

$$n = \frac{(1.96)^2 (0.5) (.05)}{(0.05)^2} \qquad \frac{9604}{25}$$

n = 384 (Sample size)

3.5 Sampling Procedure

First, the study employed quota sampling where the two quotas were listed (12 Commercial LDC outlets and 4 locations within the City). Quota sampling refers to selection with controls, ensuring that specified numbers (quotas) are obtained from each specified population subgroup but with essentially no randomization of unit selection within the subgroups (Elder, 2009).

3.5.1 Commercial Laundry and Dry Cleaning Outlets

From this quota (Commercial LDC outlets), all the commercial LDC outlets within Kisumu City were selected, listed, and visited through census sampling until the required sample size of 12 was achieved. Census sampling is a sampling technique where every unit/everyone in a population is sampled (Australian Bureau of Statistics, 2013). A Snowball sampling procedure was used to reach respondents that were in other LDC outlets. Snowball sampling is a technique in which the few identified subjects name the other subjects that they know to have the required characteristics until the researcher gets the number of cases that he or she requires and is useful when the population that possesses the characteristics was not well known (ibid). Lastly, the researcher used purposive sampling to get the respondents from individual commercial service providers. Purposive sampling is a sampling technique that allows a researcher to use cases that have the required information with respect to the objectives of his or her study(Mugenda & Mugenda, 2003) and convenient sampling to get individual commercial LDC consumers. Convenient sampling involves

selecting cases of observations that will become available to the researcher (Mugenda& Mugenda, 2003). The method was used for pilot or exploratory studies and was where the researcher collected data at the spur of the moment without the rigidity of the procedure and at the same time, the researcher takes the advantage of those who happen to be there at the moment or unexpected events (Oso&Onen, 2009). Seventy-two (72) respondents were picked in a ratio of 1:5 service providers to consumers, representing (12 service providers and 60 consumers) from commercial LDC outlets which makes18.75% of the total sample size.

3.5.2 Households Laundry and Dry Cleaning (LDC) Service Providers and Household Laundry and Dry Cleaning (LDC) Consumers

The Kenya National Bureau of Statistics (2009) sub-divided Kisumu City into four locations and twelve sub-locations as follows:

a) Town location which includes Kaloleni, Southern, Northern, and Bandani sub-location.

b) Kondele location which includes Manyatta A, Nyawita, and Migosi sub-location.

c) West Kolwa which includes Nyalenda B, Nyalenda A, and Manyatta B sub-location.

d) Kisumu central has Korando A and korando B sub-location.

The study used a stratified sampling technique to get the sub-locations from the locations (quotas). The stratified sampling technique was used to identify sub – groups in the population and their proportions to group the population into homogenous subsets that share similar characteristics and to ensure equitable presentation in the sample (Oso&Onen, 2009). Simple random sampling was used to

sample the sub-locations under the study. The method involves giving a number to every subject or member of the accessible population, placing the numbers in a container, and then picking the number at random, the subject corresponding to the number picked is included in the sample (Mugenda & Mugenda, 2003). For the households, the researcher used a systematic sampling technique where every 4^{th} household was interviewed. This method was used to select every n^{th} member of a population from a randomized list of the population. It is a substitute for simple random sampling and was easy and cheaper to implement than simple random sampling. Lastly, the researcher used purposive sampling to get the respondents from individual households. Purposive sampling is a sampling technique that allows a researcher to use cases that have the required information with respect to the objectives of his or her study (Mugenda & Mugenda, 2003) and convenient sampling to get household LDC consumers. This method involves selecting cases or units of observations as they become available to the researcher (Mugenda & Mugenda, 2003). The method was used for pilot or for exploratory studies, where the researcher collected data at the spur of the moment without the rigidity of the procedure taking the advantage of those who happened to be there at the moment of data collection (Oso&Onen, 2009). Three hundred and twelve respondents in the ratio of 1: 5 (52 service providers and 260 consumers) from household and commercial LDC were selected which makes 81.25 % of the total sample size.

The summary of household calculations sample size and that of licensed LDC outlets is shown in Tables 3.1 and Table 3.2, respectively.

Table 3.1: Summary Table of Household Sampling

No.	Locations (Quotas)	Sub – Locations (Stratas)	No. of Households	Totals	Sampled Sub-Locations(Simple Random Sampling)	No. of Households to be Sampled(Systematic Sampling)	No. of Respondents to be Sampled(Purposive Sampling) Ratio 1:5		%
							LDCSP	LDCC	
1.	Town	- Kaloleni	3658		1	13	13	65	20.3
		- Southern	2476						
		- Northern	2107	**10,162**					
		- Bandani	1921						
2.	Kondele	- Manyatta A	12525		1	13	13	65	20.3
		- Nyawita	4099	**21,419**					
		- Migosi	4795						
3.	Kolwa West	-Nyalenda B	8561		1	13	13	65	20.3
		-Nyalenda A	8070	**24,439**					
		-Manyatta B	7808						
4.	Kisumu Central	-Korando A	2406		1	13	13	65	20.3
		Korando B	1367	**3773**					
		TOTAL		**59,793**	4	52	52	260	81.25

Source: Summary table of household sampling, modified from the Kenya National Bureau of Statistics (2009)

Table 3.2: Summary Table for Licensed Commercial Laundry and Dry Cleaning (LDC) Outlets in Kisumu City

No.	Name of LDC(Census Sampling Technique)	Where Located within Kisumu City	Respondents (CSP and CC) 1:5 ratio		%
1.	Blue Dry Cleaner and Laundry	Tuffoam	1	5	1.5625
2.	Blue Dry Cleaner and Laundry	Lolwe	1	5	1.5625
3.	Blue Dry Cleaner and Laundry	New Bus Park	1	5	1.5625
4.	Blue Dry Cleaner and Laundry	United Mall	1	5	1.5625
5.	Bellaire Laundry and Dry Cleaning	Along Kampala Street	1	5	1.5625
6.	White Rose Dry Cleaners Ltd	Court Road	1	5	1.5625
7.	Flush Dry Cleaner	Industrial Area	1	5	1.5625
8.	Kilo Field Cleaners and Sanitary Services	Sango Plaza, Ogada Street	1	5	1.5625
9.	Metro Cleaners and Renovators Ltd	United Mall	1	5	1.5625
10.	Ben Land Investment Enterprise	Acra Street	1	5	1.5625
11.	Sleep Inn Ltd	Alimran Plaza	1	5	1.5625
12.	Ravine Moyale Laundry	Manyatta Corner Lejo	1	5	1.5625
TOTAL			12	60	18.75

Source: Modified from the county government of Kisumu (2018)

3.5.3 Samples from Households and Commercial Outlets

The study used a purposive sampling technique to get 12 samples from 4 commercial outlets and 24 samples from 8 households. These selected commercial outlets and households were chosen considering the number of consumers visiting the facilities, size, and composition of the selected households resulting in high washing turnover. Three samples were collected from each commercial outlet and individual household which allows statistical data analysis to be carried out.

3.6 Data Collection Methods and Procedures

Pre - determined interview schedule and observation checklist were used to collect data and for laboratory analysis, the researcher did a purposive effluent samples

collection from four estates, two households from each estate were purposively identified for sample collection making a total of eight samples and four samples from four purposively selected commercial LDC outlets.

The interview schedule involved face-to-face interaction with the service providers and consumers of LDC services. Respondents were motivated and encouraged to give both positive and negative aspects of their work life and perceptions. The questions to LDC service providers sought insight into LDC procedures, rating factors that were associated with consumer satisfaction; fiber properties, laundry and dry cleaning sequence, stain removal, knowledge of care labels symbols, and challenges that they face when carrying out LDC services, SDGs and waste disposal methods. The interview schedules for the commercial and household LDC consumers were on the factors that are related to their satisfaction with LDC service providers and the services that they offer.

An observation checklist was used to collect information on tools and equipment, facilities for drying out, space used to carry out LDC services, gender of the service provider, location/site where the service provider was carrying out LDC services (water source), ventilation in the working areas, general cleanliness of the working areas, safe precaution used by LDC service providers and how LDC they dispose of waste.

An experiment was carried out at Lake Victoria environmental management (LVEMP) laboratory and at the Safe Water and Aids Project (SWAP) laboratory in Kisumu City, Kenya where levels of wastewater parameters were determined, analyzed, and then compared to the standard guidelines of the National Environment Management Authority (NEMA) in Kenya and World Health Organization (WHO) standards for discharge into the environment and the public sewer. The equipment used were; UV-

spectrophotometer Hach methods and Atomic Absorption Spectrophotometer. Parameters used included: Zinc(Zn), Cadmium(CD), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Detergents, Mercury (Hg), Nitrate, Nitrite, Total Phosphate, pH, Total Dissolved Solids, Electrical Conductivity and Alkalinity.

Table 3.3 shows the methods used to determine the levels of wastewater chemical parameters from households and commercial outlets.

Table 3.3: Methods Used to Determine the Wastewater Chemical Parameters Disposed from Household and Commercial LDC Outlets

Parameters	Units	Methods
Zinc (Zn)	Mg/l	Zincon 8009 – HACH
Cadmium(CD),	Mg/l	HACH8017
Chemical oxygen demand (COD)	Mg/l	Dichromate 8000
Biological oxygen demand (BOD),	BOD5	Digestion, BOD5
Detergent	MBAS	MBAS
Mercury (Hg),	Mg/l	Cold vapour 10065
Nitrate	Mg/l	HACH 8192
Nitrite	Mg/l	Ferosulphate 8153
Ammonia	Mg/l	Silicate 8155
Total Phosphate	Mg/l	HACH8048
PH	HACH pH meter units	HACH pH meter
Electrical conductivity	HACH EC meter units	HACH EC meter
Total dissolved solids (TDS)	HACH TDS meter units	HACH TDS meter
Alkalinity	Alkalinity meter units	Methyl orange method

(Source: Lake Victoria Environmental Management and at Safe Water and Aids Project Laboratory, Kisumu City)

3.7 Validity and Reliability

Validity is how well a test measures what it purported to measure (Colin & Julie, 2006). The researcher used sampling validity that ensured that the measure covers a broad range of areas within the concept of the study. Interview schedules and observation checklists were subjected to scrutiny by supervisors and experts in the relevant profession. Suggestions were used as a basis to adjust the research items and make them more compliant with the study.

Reliability is the degree to which an assessment tool produces stable and consistent results (Colin & Julie, 2006). As per the definition, the researcher pre-tested 10% which was 38 respondents (6 service providers and 24 consumers) from households and (2 service providers and 6 consumers) from LDC outlets. The figure was arrived at by using Connely (2008) who postulates that 10% of the sample size of the study can be used for pre-testing. Pre-testing was done among respondents who were not part of the study and it enabled the researcher to note the time taken in giving responses, clarities, and possible repetitions on the instruments. The pre-tested instruments were then reorganized, reframed, and improved hence becoming reliable in gathering information which was valid for data collection.

3.8 Ethical Considerations

Permission to carry out the research was sought from the relevant authorities namely: the University of Eldoret, the Family and Consumer Sciences Department, the National Commission for Science Technology and Innovation (NACOSTI), the County Director of Education, Kisumu, the County Commissioner, Kisumu, and from the Office of the County Governor of Kisumu. Informed consent was sought from the respondents of LDC consumers and service providers (both from households and

commercial LDC outlets). The researcher assured the respondents of the confidentiality of any information given. This was done by using numbers and not names of the respondents on the interview schedules, observation checklist, and samples.

3.9 Response Rate

The study was carried out in Nyalenda A, Manyatta A, Bandani, and Korando B which were among estates in Kisumu City. Out of 384 respondents, only 366 participated in the study representing a 95% response rate as depicted in Table 3.4.

Table 3.4: Response Rate

Sampling Group	**Sample Size**	**Actual no. of Respondents**	**Response Rate (%)**
Household LDC service providers	52	47	90%
Household LDC consumers	260	250	96%
Commercial LDC service providers	12	11	92%
Commercial LDC consumers	60	58	97%
Total	**384**	**366**	**95%**

(Source: Field data from household and commercial LDC service providers)

Table 6, indicated that from the sample size of 384 (three hundred and eighty-four), (90%) of households' service providers, (96%) of households' consumers, (92.0%) of commercial LDC service providers, and (97%) of commercial LDC consumers were (95%) of the total number of respondents. The overall response rate of 95% was considered adequate to allow for the data analysis of other variables.

3.10 Data Analysis

Data analysis entailed the separation of data into constituent parts or elements and the separate examination of these parts or elements in relation to the whole (Oso& Onen, 2009). This study employed the use of descriptive and qualitative techniques. Analytical techniques used in the laboratory analyses of samples were also employed, and equipment such as the UV-VIS - spectrophotometer and Atomic Absorption Spectrophotometer (AAS) were used. UV – VIS spectrophotometer was used to analyze nutrients such as Nitrates(NO_3^-), Nitrites(NO_2^-), ammonia(NH_3), and Total phosphate whereas physicochemical parameters such as chemical oxygen demand (COD), Biological Oxygen Demand (BOD), pH, Total dissolved solids (TDS), Electrical conductivity (EC) and alkalinity were analyzed using a multi-parameter meter while the Atomic Absorption Spectrophotometer was used to analyze trace metals such as Zinc, Cadmium, and Mercury. Descriptive analysis refers to the use of central tendency measures such as mean, mode, and median and measures of dispersion such as range, quartile deviation standard, and variance while qualitative data is used to conclude the relationships and differences found in research results (Oso& Onen, 2009). Quantitative data were coded and analyzed using descriptive statistics. The data were analyzed using Statistical Package for the Social Sciences (SPSS) version 20 (2007) and were graphically presented using tables and charts while qualitative data were grouped into themes, coded for further analysis by use of SPSS, and presented using tables and charts.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter provides the demographic characteristics of respondents, results, and a discussion of the findings of this study. Quantitative data were coded and analyzed using descriptive statistics. The data were analyzed using Statistical Package for the Social Sciences (SPSS) version 20 (2007) and were graphically presented using tables and charts while qualitative data were grouped into themes, coded for further analysis by use of SPSS, and presented using tables and charts.

4.2 Demographic Information of LDC Service Providers

The demographic information of laundry and dry cleaning service providers (LDCSP) is summarized and presented in Table 4.1.

Table 4.1: Demographic Information of Household and Commercial LDC Service Providers

Variables		Household LDC Service Providers		Commercial LDC Service providers	
		Frequency	**%**	**Frequency**	**%**
Gender	Male	6	13%	8	73%
	Female	41	87%	3	17%
	Total	**47**	**100%**	**11**	**100%**
Age	Below 18yrs	3	6%	0	0%
	18-35yrs	9	19%	3	27%
	36-50years	23	49%	6	55%
	51-60 years	12	26%	2	18%
	61yrs and above	0	0%	0	0%
	Total	**47**	**100%**	**11**	**100%**
Marital status	Married	33	70%	7	64%
	Separated	3	7%	2	18%
	Single	11	23%	2	18%
	Widow	0	0%	0	0%
	Divorced	0	0%	0	0%
	Widower	0	0%	0	0%
	Total	**47**	**100%**	**11**	**100%**
Education level	Never went to school	13	28%	0	0%
	Primary	18	38%	0	0%
	Secondary	11	23%	5	45%
	Tertiary	5	11%	6	55%
	Total	**47**	**100%**	**11**	**100%**
Experience in LDC	Less than a year	0	0%	0	0%
	1-3 years	1	2%	1	9%
	4-6 years	3	6%	2	18%
	7-9 years	5	11%	3	27%
	10yrs and above	38	81%	5	46%
	Total	**47**	**100%**	**11**	**100%**

(Source: Field data from household and commercial LDC service providers)

Results showed that most, (87%) of the household service providers (HSP) were female and a minority (13%) represented the male category. Most, (72%) of the commercial service providers (CSP) were male and 28% were female. The findings thus affirmed that mostly, women were tasked with household LDC services while most men were tasked with commercial LDC services. The respondents were not

equally distributed by gender in both categories. The result for the household is a true picture of what has been taking place in most Africans homes where women and girls are the ones offering LDC services. The result of the commercial also portrays what is currently taking place in commercial LDC outlets where LDC services are offered mostly by men. These findings were further corroborated by the results of interviews and observation of the two categories of the respondents where most of the household LDC service providers were found to be females while most commercial LDC service providers were male. The results for the household's service providers were found to be in line with Terese (2015) and Constance and Amanda (2006) who noted that the majority of the household LDC were left for women, therefore, consuming most of their energy and time.

Again, the study results from both household and commercial service providers showed that LDC services were done by men, women, and children; which agrees with what Rose and Carole (2016) noted that LDC services are now routine jobs shared by men, women, and children. Most women are tasked with LDC services at household levels because it is a culture that has been practiced for long while most men were found to be involved in commercial LDC since it is a paid-up job that needs those with energy and knowledge plus skills as indicated in Table 8. Most commercial service providers were found to be having either secondary or tertiary education.

In addition, Table 4.1 illustrates that all the CSPs were above 18 years, 27% were between 18- 35 years, 55% were between 36- 50 years, 18% were between 51 – 60 years and none were above 61 years. On the other hand, 6% of the HSP were below 18 years of age, 19% were between 18-35, 49% were between 36-50, 26% were

between 51-60 and none were above 61 years of age. The findings imply that CSPs were mostly adults who were either employed or conducting their businesses as a source of livelihood. This was different from household LDC services that were done by anyone in the home. At the household level, LDC services could be done even by those who were of school-going age as established by 6% falling below age 18. However, the majority, (94%) were above 18 years of age. In Kisumu City and even in many parts of Africa, children can start offering LDC services as far as below age 10 which many families treat as normal. This aspect did not conform to the Kenyan Constitution 2010 and other International Laws and regulations with regard to Child Labour hence needs to be looked at.

When distributed by marital status, the majority, (64%) of the CSP and 70% of the HSP were married while 18% of the CSP and 7% of the HSP were separated. Those respondents who were single were represented by 18% of the CSP and 23% of the HSP. These findings thus signified that the majority of the respondents in the two categories of LDC were married.

The results on the level of education of the respondents as presented in Table 4.1 depicts that the majority (38%) of the HSP had attained primary education while 23% had secondary education. Of the total respondents,11% had tertiary education and 28% never went to school with 45% of the CSP having secondary education as 55% reported to have attained the tertiary level of education. The education level of an individual determines his or her ability to possess adequate information and interaction with the data collection tools. These findings, therefore, support the notion that household LDC services were offered by all categories of people. This finding explains the researcher's observation whereby there was a constant request to clarify

some of the questionnaire items by the respondents at the households' level which signify their inability to understand most of the questionnaire items in the data collection tools without the help of the researcher while commercial LDC services were offered by people who have secondary and tertiary education. This observation can be supported by findings illustrated in Figures 4.1 to 4.5 where their level of understanding of LDC procedures, fabric characteristics, stain removal, care symbols, and competency were higher as compared to those from households of LDC service providers. Again when it comes to consumer satisfaction (CS), Table 13 showed that the rate at which commercial LDC consumers were satisfied with LDC services was higher than that of household LDC consumers as shown in Figure 4.9, household LDC consumers recommend further training for their LDC service providers. This could be because a majority of them had a primary level of education.

The majority, (81%) of both households and CSP 46% had an experience of more than 10 years and above. For the remaining HSP, 2% had between 1-3 years of experience, 6% had between 4-6 years of experience and11% had an experience of between 7-9 years. On the other hand, for CSP, 9% had an experience of between 1-3 years, 18% between 4-6 years, and 27%, had an experience of between 7- 9 years. From these findings, it could be construed that the majority of both household and commercial LDC service providers had an experience of 10 years and above which was an indication of a stable consumer base. The reported years of LDC service provision among the respondents in both categories were below 50% in each age bracket which points to the misunderstanding/inability to answer some important questionnaire items such as fiber properties, stain removal, and care label symbols.

4.3 Demographic Information of Laundry and Dry Cleaning Consumers

Demographics information on laundry and dry cleaning consumers (LDCC) is summarized and presented in Table 4.2 below.

Table 4.2: Demographics Information of Household and Commercial LDC Consumers

	Variables	Household LDC Consumers		Commercial LDC Consumers	
		Frequency	**%**	**Frequency**	**%**
Gender	Male	233	93%	51	88%
	Female	17	7%	7	12%
	Total	**250**	**100%**	**58**	**100%**
Age	below 18 years	47	19%	0	0%
	18-35 years	42	17%	5	9%
	36-50 years	104	42%	47	81%
	51-60 years	54	22%	6	10%
	61 and above years	3	1%	0	0%
	Total	**250**	**100%**	**58**	**100%**
Marital status	Married	188	75%	39	67%
	Separated	6	2%	1	2%
	Single	38	15%	16	28%
	Divorced	14	6%	1	2%
	Widower	4	2%	1	2%
	Total	**250**	**100%**	**58**	**100%**
Education level	Primary	53	21%	1	2%
	Secondary	129	52%	7	12%
	Tertiary	61	24%	49	85%
	never went to school	7	3%	1	2%
	Total	**250**	**100%**	**58**	**100%**
Occupation	Employed in the public sector	15	6%	27	47%
	Employed in the private sector	32	13%	15	26%
	Self-employed offering services	74	30%	7	12%
	Self-employed doing business	88	35%	9	16%
	Not employed	41	16%	0	0%
	Total	**250**	**100%**	**58**	**100%**

(Source: Field data from household and commercial LDC service providers)

Results showed that most, (93%) and (88%), of the household LDC consumers and commercial LDC consumers respectively, were male. The female category represented seven percent (7%) of the household LDC consumers while 12% of females were commercial LDC consumers. The respondents were not equally distributed by gender among the two categories of consumers as depicted by the results showing that the male gender largely utilized both household and commercial LDC services as compared to the females. This could imply that since most men were seeking LDC services, then those who provided the services were mostly females. From the researchers 'view, this result represents the real picture of what was happening in society where most consumers at either household or a commercial level were male. These findings agree with Terese (2015) and Constance and Amanda (2006) who noted that the majority of the household LDC services were left for women. In this case, when LDC could be said to be left for the women, automatically, the consumers largely become the men. LDC in most African societies was left for women at the household level while at a commercial level, it is for men since it needs a lot of energy when being carried out.

When distributed by age, most (42%) of household LDC consumers were between the age of 36 – 50 years, 22% between the age of 51 – 60 years, 17% between the age of 18 – 35years, and 19% below age 18. Only 1% of the household LDC consumers were above age 61. On the other hand, most (81%) of the commercial LDC consumers were between the age of 36 – 50 years, 10% were between the age of 51 – 60years and 9% were between ages 18 – 35years. None of the commercial LDC consumers were aged 61years and above nor below age 18 years. From the findings, it was noted that the majority of both household and commercial LDC consumers were in the age bracket of 36-50years. It could be deduced therefore that at this age, the

majority of the consumer respondents were either working/earning/ family members hence they could either get LDC services from households or commercial LDC services providers with ease. At the household level, age does not matter in most families where children could be trained on how to wash their clothes as early as from even six years.

When distributed by marital status, most (75%) of the household LDC consumers were married, 2% were separated, 15% were singles, 6% were divorced and 1% were widowed. For commercial LDC consumers, most (67%) were married, 2% were separated, 28% were single, 2% were divorced and 2% were widowed. Most, (75%) of the household LDC consumers and 67% of commercial LDC consumers were married and other aspects like those who were separated, single, divorced and widowed were in smaller percentages for the two categories. These findings thus signify that majority of the respondents in the two categories were married. Unmarried consumers whether male or female could carry out LDC with or without help of another party. This is something that happens mostly in households where there was no employed LDC service provider.

On education level, it was established that most, (52%) of household LDC consumers had secondary education, 21% had primary education, 24%had tertiary education and 3% never went to school. With respect to commercial LDC consumers, most (85%) of them had tertiary education, 12% had secondary education, 2% had primary education and 2% never went to school as indicated in Table 9. These findings established that majority of the household LDC consumers had secondary education while a majority of the commercial LDC consumers had tertiary education. This was further confirmed by their occupation where a majority of commercial LDC consumers were employed

in public sectors and were aware of commercial LDC services while a majority of the households' LDC consumers were self-employed, and involved in various commercial businesses.

In addition, when the respondents were distributed by type of occupation, for the household LDC consumers, 6% were employed in the public sector, 13% in the private sector, and 30% were self-employed offering services. At least 35% were self-employed and involved in commercial businesses and those who were not employed were 16%. Among commercial LDC consumers, most, (47%) were employed in the public sector, 26% were employed in the private sector, 12% were self-employed offering services and 16% were self-employed in commercial businesses. It is therefore evident that majority of household LDC consumers were self-employed and a majority of the commercial LDC consumers were employed in public sectors. Since a majority of commercial LDC consumers were employed in public sectors, their chances of getting services from commercial LDC outlets were higher than the household LDC consumers where the majority were either self-employed offering services or involved in businesses and could even be able to carry out LDC services by themselves. Commercial LDC consumers were found to be employed in public sectors thereby making them not have time to carry out LDC services on their own. This finding agrees with what Sogaard (2015) and, Watchara and Natthaphat (2012) reported that several people have been transformed through urban lifestyles where they have to earn more money by having an extra job(s) and working outside their family set-ups, a lifestyle that has made it impossible for them to have time for carrying out LDC services on their own. To solve this problem, they resolved to outsource LDC services from commercial outlets as it was convenient and time-saving for them.

4.4 Observation Checklist

This section discusses the findings in relation to what was observed under the study such as the usage of personal protective equipment (PPE) by household and commercial service providers, water sources used by LDC service providers, and the characteristics of working areas used by the households and commercial LDC service providers in Kisumu City. The usage of personal protective equipment (PPE) by household and commercial service providers is summarized in Figure 4.1 below.

4.4.1 The Use of Personal Protective Equipment by Household and Commercial LDC Service Providers

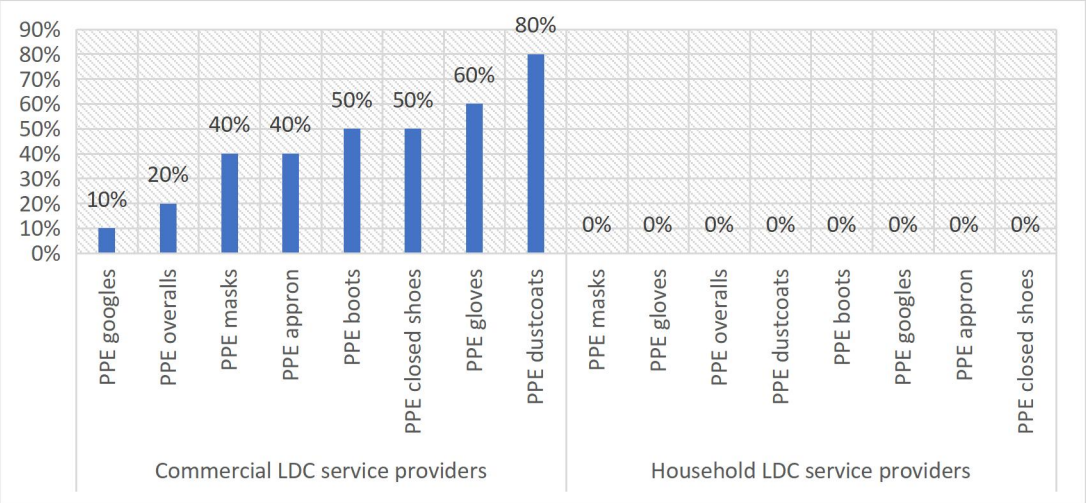

Figure 4.1: Percentage Distribution of Cases of Personal Protective Equipment (PPEs) Usage by LDC Service Providers

Source: Field data from household and commercial LDC service providers.

Results from observation indicate that most, (80%) of commercial service providers (CSP) used dust coats, 60% used gloves, 50% used closed shoes, 50% used boots 40% used aprons, another 40%usingmasks, 20% used overalls and 10% using goggles. On the contrary, all the households' service providers (HSP), 100% did not use any personal protective equipment. From the findings, it was noted that households' LDC

service providers were at risk of chemical or physical hazards because none of them used any PPE. The act of not using PPE was common in the community hence they treated this practice as something normal. The study findings on the use of PPE by households and commercial service providers agree with what was mentioned by EU-OSHA (2008), Medina - Rahom *et al.*(2003), Zock *et al.*(2002), Mondelli *et al.* (2006), Scherzer *et al.*(2005), Kumar and Kumar (2008) and Unge *et al.*(2007). They note that there are problems with getting in contact with LDC cleaning chemicals and they further mentioned causes of physical hazards and poor ergonomic. The use of PPE may help the LDC service providers not to get in contact with chemicals and could also make them avoid some physical hazards. Some household LDC service providers reported that they were not using PPE due to their financial status while for some, it was due to their ignorance or not knowing the importance of using PPE.

4.4.2 The Source of Water Used by Household and Commercial LDC Service Providers

The source of water used by household and commercial LDC service providers is summarized in Figure 4.2 below.

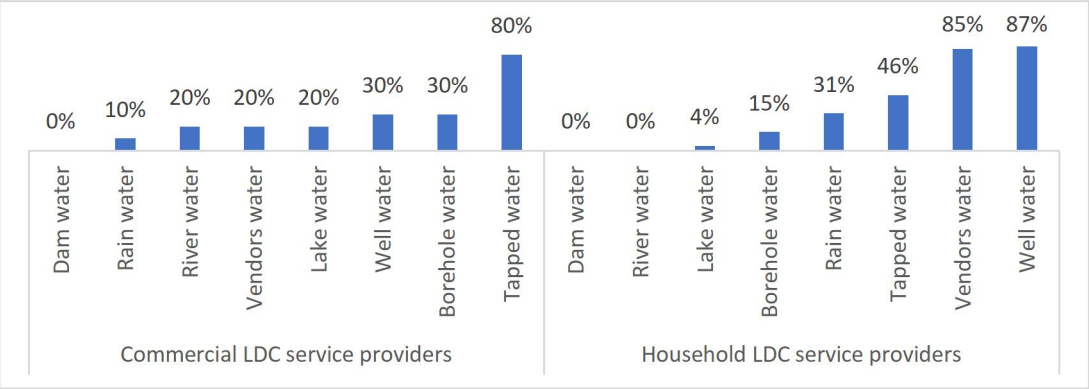

Figure 4.2: The Water Sources Used by LDC Service Providers

(Source: Field data from household and commercial LDC service providers)

It was evident that most, (80%) of CSP sourced water from the tap, 30% used borehole water, 30% used well water with a small percentage using other sources such as lake 20%, vendors 20%, from the river 20%, and 10% used rain water. On the other hand, most, (87%) of the HSP used well water, 85% used water from vendors, 46% used tap water, 31% used rain water, 15% used borehole water, and 4% used lake water. None of the HSP used river or dam water. Where one lives determines the sources of water he or she can use. Most commercial LDC service providers used tap water which was considered safe while most household LDC service providers use water from vendors and well water which was considered to be unsafe as they have no idea of where the water could have been fetched as illustrated in Figure 5. However, most of the water sources used were the same as those used in other parts of the world as reported by the Launderette Association of Australia (2005) where humankind has been found to be washing their clothes along riverbanks, near the well, by the sea or near any source of water like streams. This could be because, by nature, water sources are the same in most regions of the world. This explains why 'water' is regarded to be 'life' hence every available source of water is very important at any particular moment however much it is always advisable to use safe water for healthy living.

4.4.3 Characteristics of Working Areas Used by the Household and Commercial LDC Service Providers

Characteristics of working areas used by the household and commercial service providers are illustrated in Table 4.3.

Table 4.3: Characteristics of Working Areas Used by LDC Service Providers

Variables		Commercial LDC Service Providers		Household LDC Service Providers	
		Frequency	**%**	**Frequency**	**%**
Ventilation	Adequate	3	30%	20	74%
	Inadequate	7	70%	7	26%
	Total	**10**	**100%**	**27**	**100%**
Room size	Adequate	2	20%	19	70%
	Inadequate	8	80%	8	30%
	Total	**10**	**100%**	**27**	**100%**
General cleanliness of a work place	Very clean	3	30%	0	0%
	Clean	5	50%	2	7%
	Fairly clean	1	10%	15	56%
	Dirty	1	10%	10	37%
	Total	**10**	**100%**	**27**	**100%**
Work layout	Very good	2	20%	0	0%
	Good	5	50%	2	7%
	Fair	3	30%	16	60%
	Poor	0	0%	9	33%
	Total	**10**	**100%**	**27**	**100%**
Storage of clean clothes	Very good	2	20%	1	4%
	Good	6	60%	5	19%
	Fair	2	20%	18	66%
	Poor	0	0%	3	11%
	Total	**10**	**100%**	**27**	**100%**
Waste disposal	Very good	0	0%	0	0%
	Good	1	10%	0	0%
	Fair	7	70%	4	15%
	Poor	2	20%	23	85%
	Total	**10**	**100%**	**27**	**100%**
Written LDC instructions	Yes	2	20%	0	0%
	No	8	80%	27	100%
	Total	**10**	**100%**	**27**	**100%**
Tools and equipment	Adequate	8	80%	7	26%
	Inadequate	2	20%	20	74%
	Total	**10**	**100%**	**27**	**100%**
Water availability	Available	7	70%	7	26%
	Not available	3	30%	20	74%
	Total	**10**	**100%**	**27**	**100%**
Water safety	Safe	7	70%	7	26%
	Unsafe	3	30%	20	74%
	Total	**10**	**100%**	**27**	**100%**

(Source: Field data from household and commercial LDC service providers)

For commercial LDC service providers, ventilation was inadequate as indicated by 70%, size of room/space allocated for LDC was inadequate as noted by 80%, general cleanliness of the work place was clean with 50%, work layout was good by 50% and storage of clean clothes was good by 60%. More so, waste disposal was fair by 70%, 80% of them had no written instructions, 80% had adequate tools and equipment while the availability of water was at 70% and use of safe water was at70%. For the household LDC service providers, ventilation was adequate as indicated by 74%, size of room/space allocated for LDC was inadequate at 70%, general cleanliness of the work place was fairly clean at 56% and work layout was fair at 60%. Nonetheless, storage of clean clothes was fair at 66%, and waste disposal was poor at 85%. However, , 100% of them noted that there were no written instructions while74% had inadequate tools and equipment with another 74% indicating that water was not available to them. Additionally, the findings showed that 74% of the household used unsafe water. A safe working environment promotes good health and the availability of the recommended tools and equipment for any task also result in a quality outcome. Considering the aspects that are related to Sustainable Development Goal Six, such as general cleanliness of work place, waste disposal, water availability, and water safety, it was found that most commercial LDC service providers were aware of the contributions of the cleaning industry to the Sustainable Development Goal Six whereas majority of the household LDC service providers were not aware of the contributions of the cleaning industry to the Sustainable Development Goal Six. In the study, the researcher looked at different aspects that surround the LDC working environment while from the literature, The United State Environmental Protection Agency, 2016, noted the kind of vapors that are produced and discharged during LDC and what should be done to control such vapors. Electrolux (2015) recommends

practices that should be followed when offering LDC services and The America Cleaning Institute 2015 also noted good LDC practices during the use and care for LDC equipment which was contrary to the study findings. These differences emerge since what the above authors were looking for was not the same as what the study looked at.

4.5 Cleaning Procedures Used by Laundry and Dry Cleaning Service Providers in Kisumu City

This section discusses the findings in relation to the procedures that were used by LDC service providers, ideal ways of laundering different fabrics, laundry and Dry Cleaning service providers' understanding of fiber properties, LDC service providers' understanding of the right sequence of LDC procedures, LDC service providers understanding on how to prevent damaging of fabrics' physical properties, knowledge on care label symbols and instructions, stain removal, and challenges faced by LDC service providers in Kisumu City.

The findings in relation to the procedures used by the commercial and household LDC service providers are summarized in Table 4.4.

Table 4.4: Laundry and Dry Cleaning (LDC) Practices Conducted by LDC Service Providers

Type of LDC	LDC Practices Conducted by LDC Service Providers	Frequency	Percentage
Commercial LDC service providers	Receiving garments	11	100%
	Reading and interpreting care labels	8	73%
	Mending garments	2	18%
	Spotting	11	100%
	Stain removal	11	100%
	Sorting	11	100%
	Soaking	11	100%

	Washing	11	100%
	Rinsing	11	100%
	Starching	6	55%
	Bluing	5	45%
	Drying	11	100%
	Ironing/pressing	11	100%
	Folding	11	100%
	Storing	11	100%
Household LDC service providers	Receiving garments	47	100%
	Reading and interpreting care labels	5	11%
	Mending garments	1	2%
	Stain removal	2	4%
	Sorting	46	98%
	Soaking	30	64%
	Washing	47	100%
	Rinsing	47	100%
	Starching	0	0%
	Bluing	0	0%
	Drying	47	100%
	Ironing/pressing	27	57%
	Folding	20	43%
	Storing	47	100%

(Source: Field Data from Household and Commercial LDC Service Providers)

The results showed that sorting, soaking, washing, rinsing, drying, ironing/pressing, and storage were common LDC procedures among the two categories of LDC service providers (Household and commercial LDC). However, there are other procedures with varying percentages of adoption; an indication that there were no standard procedures followed by the two categories of LDC service providers. A minority, (18%) of commercial LDC service providers practiced mending, 55% practiced starching and 45% practiced bluing. Other procedures were 73 and 100% practiced. For the HSP, 11% were able to read and interpret care labels, 2% practiced mending, 4% practiced stain removal, 43% practiced folding, 57 practiced ironing, 64% practiced soaking, and 98% practiced sorting and none of them practiced starching

and bluing. The remaining procedures were practiced at 100%. Every task that is carried out should have a starting point and end point. Procedures are put in place to guide and hence should be followed whenever one wants to get a good cleaning result. When procedures are not followed well, the result may be bad leading to satisfaction and when proper procedures are followed, the result will always be good leading to satisfaction.

It was evidenced that most of the household service providers did not carry most LDC procedures as established by Melita *at al.,* (2005), The Association of Southeast Asian Nations (2012), Kenya Literature Bureau (2009), Mugambi *et al*. (2004) and Kumar, Goud and Joseph (2014) hence were found not to offer quality LDC services which could lead to consumer dissatisfaction. Most CSPs carried out most LDC procedures as established by Melita, Claudia, and Lilieth (2005), The Association of Southeast Asian Nations (2012), Kenya Literature Bureau (2009), Mugambi *et al*. (2004) and Kumar, Goud, and Joseph (2014) and were found to offer quality services which could lead to consumer satisfaction as evidenced in Table 4.4.

Household service providers could not be in a position to follow most procedures since they were unable to purchase the required detergents or chemicals or had fewer tools and equipment needed for proper LDC services while commercial service providers could be following most LDC procedures since they were in a better position to acquire what they want while offering LDC services.

4.5.1 The Laundry and Dry Cleaning (LDC) Service Providers' Understanding of Fiber Properties

The understanding of LDC service providers on fiber properties is summarized in Figure 4.3 below.

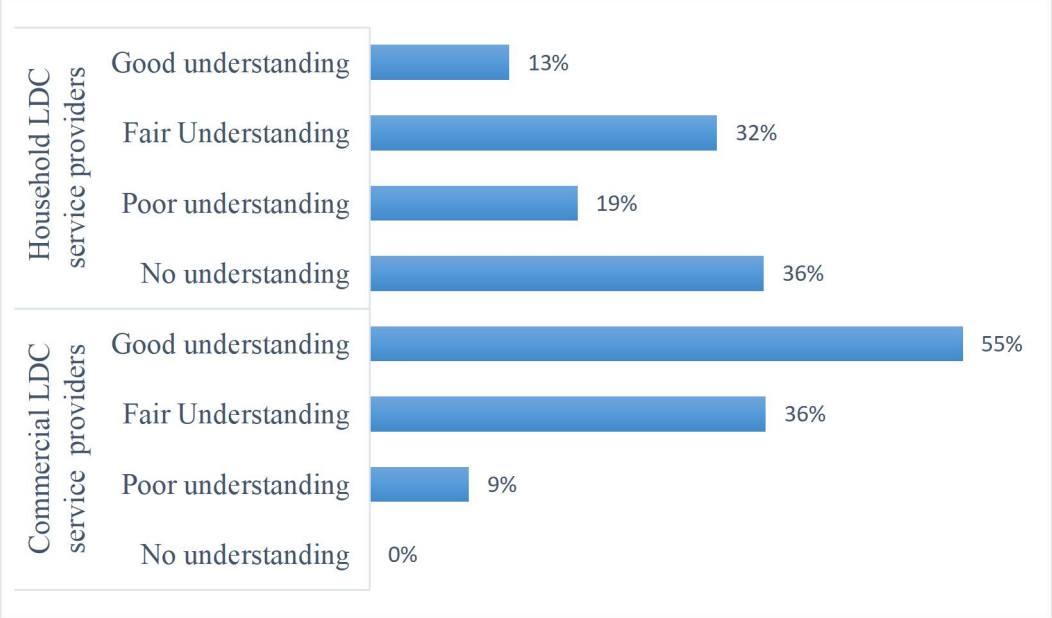

Figure 4.3: The Laundry and Dry Cleaning (LDC) Service Providers' Understanding of Fiber Properties

(Source: Field data from household and commercial LDC service providers)

The majority, (55%) of the commercial service providers (CSP) respondents could match fibers with their respective properties, 36% had a fair matching, 9% had the poor matching ability and none indicated a lack of understanding to match fiber properties. On the other hand, for the household service providers (HSP), 36% could not match the fibers, 32% had a poor matching ability, 19% had the fair matching ability and only 13% had the good matching ability. The finding showed that, though (55%) of the commercial service providers had a good understanding of fiber properties, for both categories, a majority had fair, poor, or no understanding.

Again, commercial service providers had experience in offering LDC services for 7 – 9 years at 27% and more than 10 years and above by 46% while for the households who could not match the fabrics with their respective properties, a majority (38%) had primary education and 13% never went to school. The ability of the CSP to match the fabric could lead them to follow good LDC procedures which could as well lead to consumer satisfaction. This was contrary to the households' LDC service providers who were unable to match the fibers with their right properties hence their chances of not following good LDC procedures could be higher and could have led to dissatisfaction.

4.5.2 Ideal Ways of Laundering Different Fabrics

The understanding of LDC service providers on ideal ways of laundering different fabrics is summarized and presented in Figure 4.4.

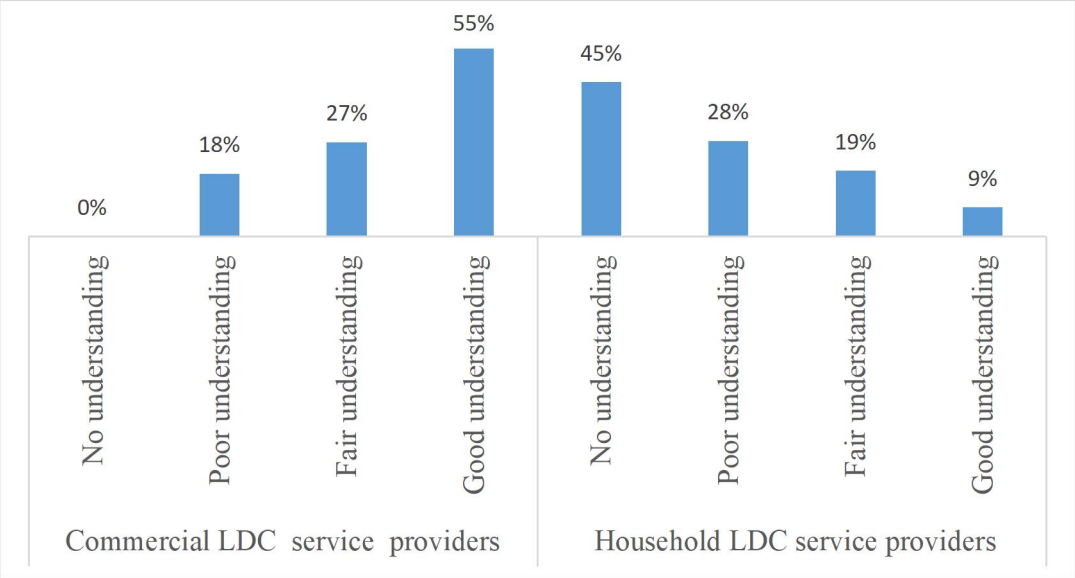

Figure 4.4: Laundry and Dry Cleaning (LDC) Service Providers Understanding of Ideal Ways of Laundering Different Fabrics

(Source: Field data from household and commercial LDC service providers)

It was evident that for commercial LDC service providers, the majority, (55%) had a good understanding of ideal ways of laundering different fabrics, 27% had a fair understanding, 18% had a poor understanding and none had no understanding of the ideal ways of laundering different fabrics. In the case of household LDC service providers, it was the opposite in that, 45% had no understanding, 28% had poor understanding, 19% had fair understanding and only 9% had a good understanding of the ideal ways of laundering different fabrics.

Levels of education and experience are some of the factors that contribute to following ideal ways of laundering fabrics. With reference to Table 4.1, 45% of the commercial service providers had secondary education while 55% had tertiary education and thus had a good understanding of ideal ways how to launder different fabrics. Again, they had experience in offering LDC services for 7 – 9 years as by 27% and more than 10 years and above represented by 46% while for the household who have less understanding of the ideal way of laundering different fabrics, the majority, (38%) had primary education and 13% never went to school. The findings showed that over (55%) of the commercial LDC service providers understood the ideal ways of laundering different fabrics based on their education level and experience at various percentages while most, (45%) of household LDC service providers had no understanding of ideal ways of laundering different fabrics though a smaller percentage of them had fair and poor understanding at (28%) and (19%) respectively. Knowledge of ideal ways of laundering different fabrics contributes a lot to LDC practices and consumer satisfaction. Therefore, the possibility of commercial LDC service providers following proper LDC practices could be higher than those of household LDC service providers. Their satisfaction levels also differed, meaning that

commercial LDC consumers would be more satisfied with LDC services than household LDC consumers.

4.5.3 LDC Service Providers' Understanding of the Right Sequence of LDC Procedures

A summary of the understanding of LDC service providers' understanding of the right sequence of LDC procedures is presented in Figure 4.5.

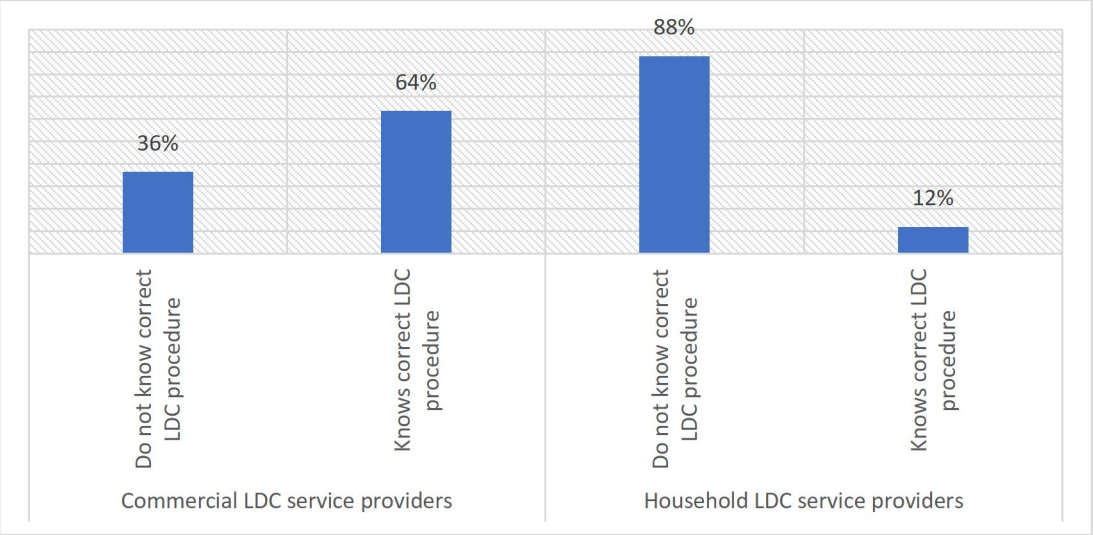

Figure 4.5: LDC Service Providers' Understanding of the Right Sequence of LDC Procedures

(Source: Field data from household and commercial LDC service providers)

Results showed that for commercial LDC, most, (64%) of them understand the right sequence and a minority (36%) did not understand the right sequence LDC procedures whereas, for the household LDC service providers, most (88%) did not understand the right sequence while only 22% understood the right sequence of LDC procedures. This could be attributed to the fact that most of the commercial LDC service providers had either secondary or tertiary education or many years' experience in offering LDC services while the household LDC service providers ' level of education, ranged from

those who never went to school, those who had primary education and a smaller percentage with secondary education as presented earlier in Table 4.1. The finding thus showed that a good percentage, (55%) of the commercial LDC service providers understood the right LDC procedures while a majority (88%) of the household service providers did not understand the right sequence of laundering different. Understanding LDC procedures could mean that they would be able to select good cleaning methods, and use the right detergents/ chemicals, and all would lead to consumer satisfaction and vice versa.

4.5.4 LDC Service Providers' Understanding of How to Prevent Damaging of Fabrics' Physical Properties during Laundry and Dry Cleaning (LDC)

The understanding of LDC service providers on how to prevent fabrics from damaging their physical properties while laundering is summarized and presented in Figure 4.6.

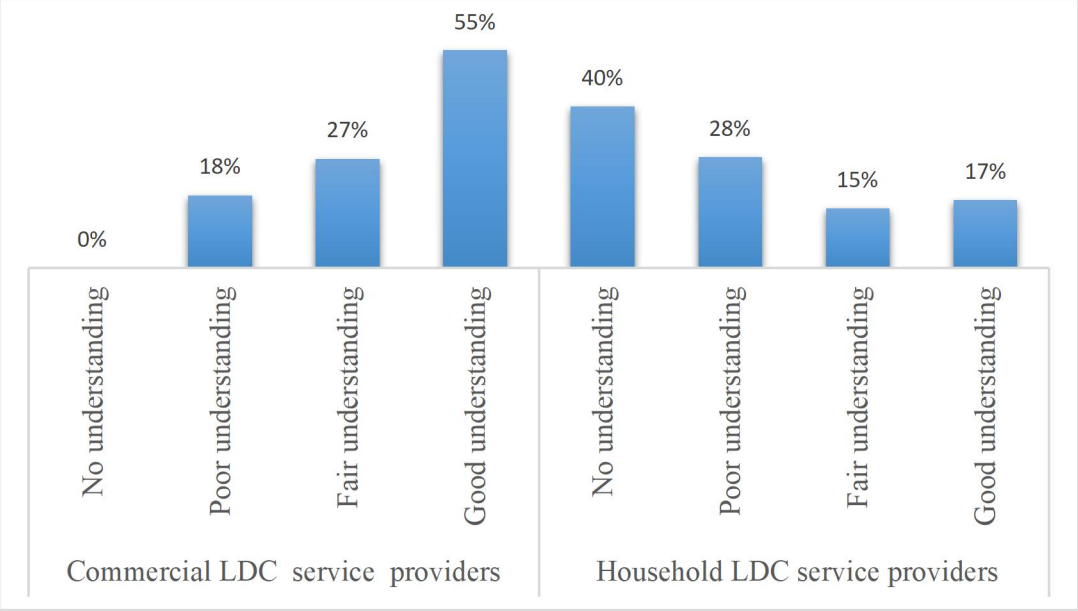

Figure 4.6: LDC Service Providers' Understanding of How to Prevent Damaging of Fabrics' Physical Properties during Laundry and Dry Cleaning (LDC)

(Source: Field data from household and commercial LDC service providers)

The above result showed that (55%) of commercial LDC service providers had a good understanding of how to prevent damage to fabric physical properties, (27%) had a fair understanding, (18%) had a poor understanding while none of them said to have no understanding of how to prevent damage of fabric physical properties. In the case of the households' LDC service providers, (17%) reported a good understanding of how to prevent damage to fabric's physical properties, (15%) had a fair understanding, (28%) had a poor understanding and (40%) had no understanding of how to prevent damage of fabric physical properties. The finding thus showed that at least (55%) of the commercial service providers had a good understanding of how to prevent damaging fabric physical properties during LDC while a majority of the household service providers (40%) had no understanding of how to prevent damaging of fabric physical properties during LDC. When LDC service providers could not in a position to prevent the fabric from being damaged, the result would be dissatisfaction and vice versa.

4.5.5 LDC Service Providers' Understanding of How to Remove Selected Stains from Fabrics

The understanding of LDC service providers on how to remove selected stains from fabrics are summarized and presented in Figure 4.7.

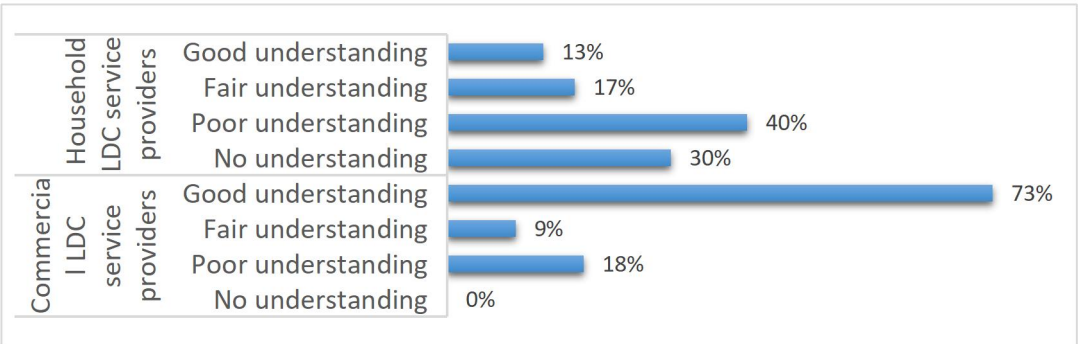

Figure 4.7: LDC Service Providers' Understanding of How to Remove Selected Stains from Fabrics

(Source: Field data from household and commercial LDC service providers)

Results showed that the majority, (73%) of the CSPs had a good understanding of how to remove selected stains from fabrics, 9% had a fair understanding and18% had a poor understanding while none of them said that they had no understanding of how to remove selected stains from fabrics. Forty percent (40%) of the HSP had a poor understanding of how to remove selected stains from fabrics, 17% had a fair understanding, 13% had a good understanding and 30% had no understanding at all. From the findings, only 13% of the household LDC service providers had a good understanding of stain removal, and the rest, 87% had poor, 17% fair understanding, and 30% with no understanding which could lead to offering low-quality services as compared to the commercial LDC service providers whose level of understanding of stain removal were higher with 73% with a good understanding that could lead to a higher percent of consumer satisfaction.

4.5.6 LDC Service Providers' Understanding of the Meaning of Care Label Symbols and Instructions on the Fabrics

Laundry and dry cleaning service provider's understanding of the meaning of care label symbols and instructions on the fabrics is summarized in Figure 4.8.

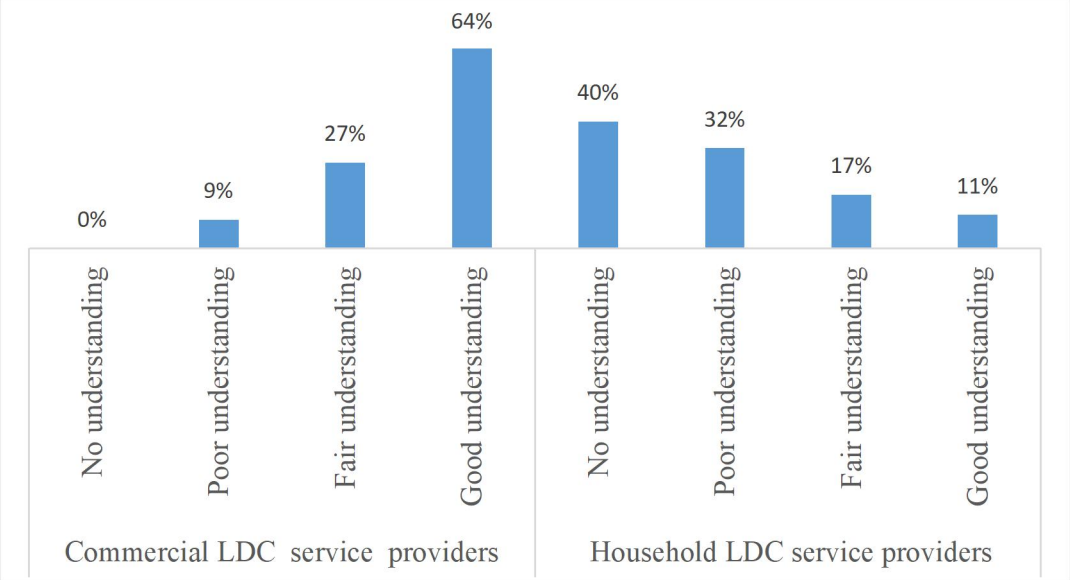

Figure 4.8: LDC Service Providers' Understanding of the Meaning of Care Label Symbols and Instructions on the Fabrics

(Source: Field data from household and commercial LDC service providers)

Results showed that the majority, (64%) of the CSP respondents had a good understanding of care labels; 27% had a fair understanding and 9% had a poor understanding. A majority (40%) of the HSP had no understanding of care labels, 32% had poor understanding, 17% had a fair understanding and only 11% had a good understanding of care labels. Care labels have useful information that should be used by LDC service providers and consumers since they contain various instructions on the care and maintenance of apparel and textile products. The implication of the above findings is that majority of the commercial LDC service providers could understand

the meaning of care label symbols and hence use the right LDC cleaning methods that could lead to satisfaction while most of the household LDC service providers could not understand care label symbols and instructions hence may use wrong LDC cleaning methods which could lead to dissatisfaction with the laundry practices. Understanding of care label symbols by the commercial service providers could be attributed to their level of education and work experience as presented in Table 4.1.

4.5.7 Challenges Faced by Laundry and Dry Cleaning (LDC) Service Providers

Challenges faced by laundry and dry cleaning service provider is summarized and presented in Table 4.5.

Table 4.5: Challenges Faced by LDC Service Providers

Challenges	Challenges Faced by LDC Service Providers							
	Commercial LDC Service Providers				Household LDC Service Providers			
	Always	Occasionally	Rarely	Never	Always	Occasionally	Rarely	Never
Interpretation of care labels	8%	20%	5%	67%	98%	1%	0%	1%
Tools and equipment	5%	4%	17%	74%	97%	3%	0%	0%
Detergents	4%	5%	13%	78%	54%	5%	36%	5%
Space for drying out	12%	22%	44%	22%	56%	33%	10%	1%
Space for disposing of waste	23%	7%	46%	24%	98%	2%	0%	0%
Skin Problem(itching)	40%	7%	23%	20%	20%	15%	45%	20%
Skin Problem(dryness)	50%	3%	37%	10%	43%	7%	20%	30%
Skin problem(rashes)	37%	18%	45%	0%	7%	21%	38%	34%
The reaction by the detergents	13%	19%	26%	42%	60%	12%	8%	20%
Posture problem(standing)	20%	20%	35%	25%	55%	15%	20%	10%
Posture problem(bending)	30%	19%	31%	20%	75%	20%	2%	3%
Posture problem(sitting)	13%	17%	32%	28%	23%	22%	35%	20%
Posture problem(squatting)	10%	7%	27%	33%	50%	10%	30%	20%
Finance	0%	0%	0%	100%	99%	1%	0%	0%
Source of water	12%	0%	78%	10%	37%	56%	7%	0%

(Source: Field data from household and commercial LDC service providers)

The results showed that the challenges with limited tools and equipment indicated by 17%, challenges with lack of enough detergents by (13%), limited space for drying out (44%), with limited space for disposing of waste (46%), with rashes problem (45%), with the reaction by the detergents (26%), 35% with standing posture, 31% with bending, 32% with a sitting problem, 27% with squatting problem, 78% rarely with sources of water and those who never face challenges were at 67% with an interpretation of care labels, 74% with tools and equipment, 78% with detergents, 22% with space for drying out, 24% with space for disposing of waste, 42% with the reaction by detergents, 25% with a standing problem, 28% with a sitting problem, 33% with squatting problem and 100% with financial problems. A smaller percentage of the CSP always faced challenges of itching of the skin at 40%, 50% with dryness of the skin, and 30% with bending. For the HSP, the majority always faced challenges with the interpretation of care labels at 98%, limited tools, and equipment at 97%, lack of enough detergents at 54%, limited space for drying out at 56%, space for disposing waste at 98%, dryness of the skin at 43%, a reaction by the detergents at 60%, a standing problem at 55%, bending problem at75% and source of water at 56%.

A smaller percentage of the HSP rarely faced challenges with space for disposing of waste as noted by 45%, skin rashes by 38%, and bending problems as indicated by 35%. From the results above, it was observed that all (100%) of the commercial LDC service providers did not have any challenges with finance while a majority (98%) of the HSP had challenges with finance. Finance here could be a solution to most LDC challenges since by having finance at hand, all that is needed for LDC services could be made available. Again most (97%) of the HSP had challenges interpreting care labels which could be attributed to their level of education as illustrated in Table 8

where most (52%) had secondary education, 21% with primary education and 3% did not have any formal education and all and none had tertiary education. The challenges as presented in Table 4.5 showed that majority of the commercial LDC service providers rarely or did not face any challenges at all as indicated from the aggregate total of rarely and never whereas the majority of the household LDC service providers faced many challenges from the aggregate total of always and very frequently The challenge that was similar in both regions was that of ergonomics where a smaller percentage of commercial LDC service providers faced problems of posture with standing at 20%, with bending at 30%, with sitting at 13% and with squatting at 10%. On the other hand, for the household LDC service providers, the percentages were higher with a standing problems at 55%, bending problems at 75%, squatting problems at 55%, and a sitting problems at 23%. Medina - Rahom *et al.* (2003); Zock *et al.* (2002), EU-OSHA (2008), Mondelli *et al*. (2006), Scherzer *et al.* (2005), Kumar and Kumar (2008) and Unge *et al*. (2007) also mentioned about poor ergonomic practices as a challenge of LDC service providers. Most of the challenges faced by LDC service providers in Kisumu City are those that can easily be solved when there is money while those mentioned by other authors around the world are those that need proper mechanisms when trying to solve them yet others are so difficult to get solved.

4.6 Level of Consumer Satisfaction with Laundry and Dry Cleaning Services

This section discusses the findings in relation to the level of consumer satisfaction with laundry and dry cleaning services with regard to consumers' perception of the level of competence of LDC service providers and consumers' rating of the level of satisfaction with services offered by LDC service providers. Consumers' perception of the level of competence of LDC service providers is summarized and presented in figure 4.9.

4.6.1 Consumers' Perception of the Level of Competence of LDC Service Providers

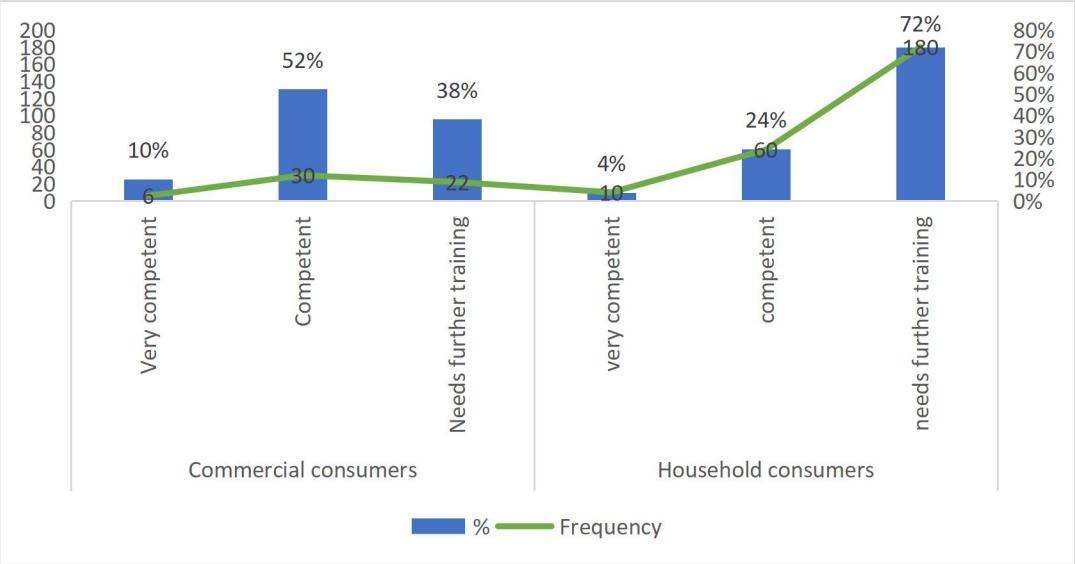

Figure 4.9: Rating of Competency Level of LDC Service Providers by Household and the Commercial Consumers

(Source: Field data from household and commercial LDC service providers)

The results showed that most, (52%) of commercial service providers were competent, 38% needed further training, and 10% were very competent. In the case of the household service providers, a majority (72%) needed further training, 24% were competent, and only 4% were very competent. To be competent, one should have some knowledge and skills in the task performed. Competency therefore could lead to better job performance hence satisfaction in the long run. From the findings, most (72%) of the household's service providers need further training. This was further supported by their being not able to; carry out most of the LDC procedures, match fibers with their respective properties, state LDC procedures in the right sequence, remove stains, state the proper ways of laundering different fabrics, and not able to understand care labels symbols as evidenced in Table 4.5 and on Figures 4.3 to 4.6. Most, (52%) of the commercial service providers were competent as they were able to

carry out most of the LDC procedures, match fibers with their respective properties, state LDC procedures in the right sequence, remove stains, state the proper ways of laundering different fabrics and able to understand care labels symbols as evidenced in Table 4.1 and 11as well as on Figures 4.3 to 4.12 and by the fact that their levels of education were also found to be higher than those of the household service providers. The performance of these two categories of LDC service providers could have been due to their levels of education.

4.6.2 Consumers' Level of Satisfaction with Services Offered by LDC Service Providers

Levels of consumer satisfaction with services offered by LDC service providers are summarized and presented in Table 4.6.

Table 4.6: Levels of consumer satisfaction with services offered by LDC service providers

	Household Consumers					Commercial Consumers				
Parameter	**Extremely satisfied**	**Satisfied**	**Dissatisfied**	**Extremely Dissatisfied**	**Total**	**Extremely satisfied**	**Satisfied**	**Dissatisfied**	**Extremely Dissatisfied**	**Total**
General cleanliness of the laundered or dry-cleaned clothes	6%	89%	5%	0%	100%	12%	85%	3%	0%	100%
Absence of stain	4%	9%	86%	0%	100%	9%	66%	26%	0%	100%
Absence of creases	5%	8%	87%	0%	100%	9%	88%	3%	0%	100%
Packaging	5%	42%	53%	0%	100%	10%	88%	2%	0%	100%
Delivery			NA			10%	52%	38%	0%	100%
A personal relationship with the service provider	8%	89%	3%	0%	100%	10%	85%	5%	0%	100%
Repair of clothes	3%	9%	63%	25%	100%	7%	7%	60%	26%	100%
Storage	4%	37%	59%	0%	100%	12%	86%	2%	0%	100%
Absence of fading to the clothes	4%	29%	66%	1%	100%	9%	74%	16%	2%	100%
Absence of shrinkage to the clothes	4%	8%	88%	1%	100%	9%	81%	9%	2%	100%
Price charged			NA			7%	29%	60%	3%	100%
The general outlook of the working environment	4%	9%	86%	1%	100%	10%	55%	33%	2%	100%
Dress code of the service provider	6%	10%	6%	79%	100%	10%	24%	66%	0%	100%
Reception			NA			10%	85%	5%	0%	100%
Reliability	62%	33%	4%	1%	100%	10%	83%	7%	0%	100%
Accessibility	79%	16%	4%	1%	100%	5%	53%	40%	2%	100%
Mode of communication	22%	73%	4%	1%	100%	9%	80%	9%	2%	100%
Retention of color	4%	43%	52%	1%	100%	9%	79%	10%	2%	100%
Tearing	3%	86%	8%	3%	100%	9%	80%	9%	2%	100%
Burnt article (apparel/textile)	10%	24%	66%	0%	100%	12%	81%	5%	2%	100%
Inability to remove stains	4%	9%	86%	0%	100%	7%	64%	26%	3%	100%

(Source: Field data from household and commercial LDC service providers)

Most, (89%) of household consumers were satisfied with the general cleanliness of the laundered or dry-cleaned clothes, 89% were satisfied with the personal relationship with the service providers while 73% with a mode of communication, and 86% with tearing prevention. On the other hand, the majority were dissatisfied with the following LDC procedures; 86% with the presence of stains, 87% with the presence of creases, 53% with packaging, and 63% with the repair process. In addition, 59% were dissatisfied with storage, 66% with fading of fabric, 88% with shrinkage of the cloth, 86% with the general outlook of the environment, 52% with retention of color, 66% with burnt articles, while 86% were dissatisfied with the inability to remove the stain. Extreme satisfaction were only seen in reliability at 62% and accessibility at 79% and extreme dissatisfaction was in dress code at 79% by HSP.

On the other hand, commercial consumers showed satisfaction in almost all aspects ranging from 53% to 88%. Dissatisfaction was only seen in three aspects which were repair of clothes at 60%, price charge at 60%, and dress code at 66%. Aggregate satisfaction of household consumers was low as compared to those of commercial consumers and aggregate dissatisfaction of household consumers were also higher than those of commercial consumers. Satisfaction is an individual feeling toward a product acquired or from the services received. Levels of satisfaction differ from one individual consumer to another. In LDC, consumers get satisfaction with different aspects and at different stages, for example, one can be satisfied with the way his or her clothes are dried up and the other person can be satisfied with the way his or her clothes are ironed. In this study, the researcher looked at different aspects that make the consumer satisfied or dissatisfied as discussed above. The findings were that commercial LDC consumers were found to be satisfied with most LDC aspects with

over 50% while most household LDC consumers were dissatisfied with most aspects with over 50%. This was further supported when most households' LDC consumers recommended further training for the LDC service providers as in figure 4.9 with 72%. Michael *et al* (2008), Shelly and Lakhwinder (2002), Shaffer (2008) Eskildsen and Dahlgaard (2000), Yung *et al*. (2006), and Poku *et al*. (2013) mentioned the benefits of consumer satisfaction as repeated purchase, loyalty, positive word of mouth, good behavior of service providers, staying longer, high profits and economic returns. Jiao (2013), The National Business Research Institute (2016), Terhi (2013), Rothbard and Wilk (2011), Suree (2007), and Weeraya (2009) pointed out factors that influence consumer satisfaction as price, image, perceived quality, tangibles, reliability, empathy, assurance, quality services, access, a nice atmosphere, employee's satisfaction, marketing mix, personal relationship, mode of communication, accessibility, reliability and general outlook of the working environment.

In summary, the study looked at aspects that could lead to consumer satisfaction/dissatisfaction while from the literature review, the authors looked at the benefits of consumer satisfaction and factors that influence consumer satisfaction. Factors that influence consumer satisfaction such as price, accessibility, reliability, personal relationship, mode of communication**,** and general outlook of the working environment were found to be similar **to** some of the consumers' rating levels of satisfaction in the study as in Table 13. This could be due to the fact that consumer behavior and what influence them is the same in all regions of the world.

4.7 Awareness and Practices of Laundry and Dry Cleaning (LDC) Service Providers towards Environmental and Self-Protection during LDC

This section presents the findings in relation to LDC service provider's awareness of SDG Six Goals, LDC services provider's knowledge of components of SDG Six, components of SDG Six as shared by household and commercial LDC service providers, LDC service provider's awareness of the effect of waste disposal on the environment, LDC service provider's responses on observed change on usual waste disposal points and perception of laundry and dry cleaning (LDC) service providers on meeting the SDG Six Goals. Awareness and practices of laundry and dry cleaning (LDC) service providers towards environmental and self-protection during LDC are summarized and presented in Figure 4.10.

4.7.1 LDC Service Provider's Awareness of SDG Six Goals

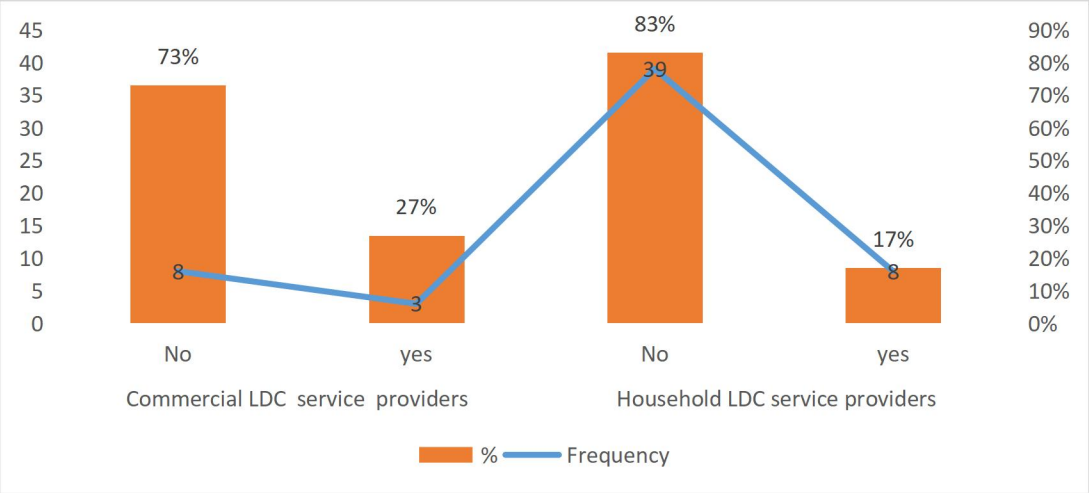

Figure 4.10: LDC Service Provider's Awareness of SDG Six Goals

(Source: Field data from household and commercial LDC service providers)

It is evidenced that majority, (73%) of the commercial and 83% of the household LDC service providers were not aware of sustainable development goal number six which is focusing on clean water and sanitation. This was shown by more than two-thirds (73%) of commercial LDC service providers and (83%) of the households

stating that they were not aware of the SDG six goals. Only (27%) of commercial LDC service providers were aware of the goal. For household LDC service providers, only 17% reported being aware of SDG six. Sustainable development goal number six is a goal issue which is focusing on clean water and sanitation. It is a worldwide plan that was initiated to promote healthy living to all living creatures. Figure 1.10 showed that a greater percentage of both household and commercial LDC service providers were not aware of SDG Six which implies that they were not able to have clean safe water and sanitation and could even impact the environment negatively as they were more likely to dispose of wastes carelessly as well as not able to maintain clean safe water and sanitation. Kenya Literature Bureau (2009) and Mugambi *at al.* (2004) define sanitation as a state of well- being and the observation of environmental hygiene practices, noted causes of poor sanitation as improper disposal of waste, unhygienic habits, poor personal hygiene, pollution of water and land and use of dirty tools and equipment and lastly quoted the dangers of poor sanitation as diseases, household pests, and accidents. Since LDC service providers in Kisumu City were not aware of SDG Six, they were likely not able to observe environmental hygiene practices which could then lead them to dangers of poor sanitation like diseases, household pests, and accidents.

4.7.2 LDC Services Provider's Knowledge of Components of SDG Six

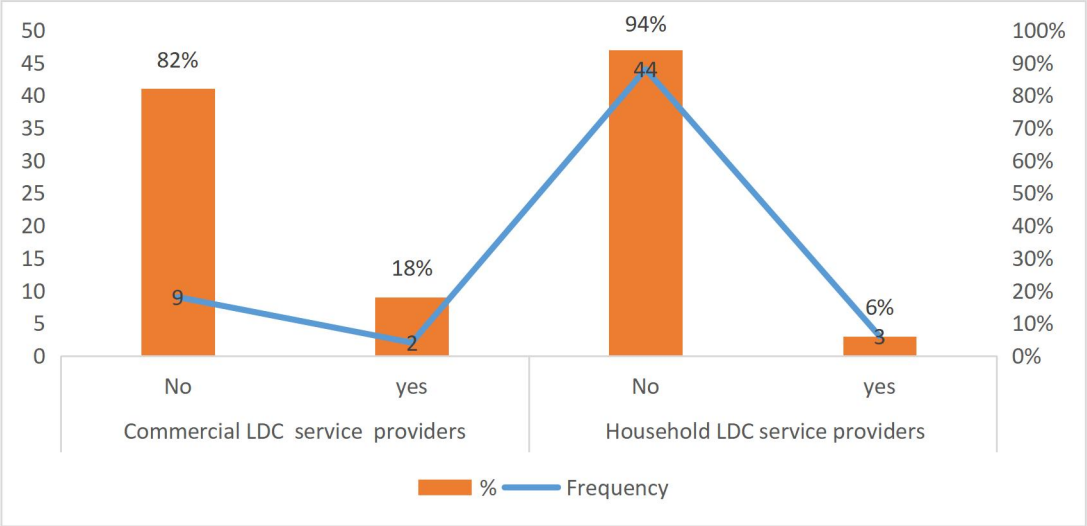

Figure 4.11: LDC Services Provider's Knowledge of Components of SDG Six

(Source: Field data from household and commercial LDC service providers)

The majority of both commercial and household LDC service providers were not knowledgeable on the components of SDG six at 82% and 94% respectively. This was simply due to the vast majority reporting being unaware of SDG six as presented in Figure 4.11. Comparing the proportion of the service providers unawareness of SDG six and the proportion of those who were not knowledgeable of the components of SDG six, it was observed that for the CSP, unawareness of SDG Six as in Figure 4.11, was 73% and those who were not knowledgeable as in Figure 14 were 82% while for the HSP, unawareness as in Figure 4.11 was at 83% and those who were not knowledgeable as in Figure 4.11 were at 94%. For the HSP, those who were unaware of the SDG Six were seen to be higher than those who were unaware of the CSP by 10% and those who were not knowledgeable for the CSP were 82% and those who were not knowledgeable by the HSP were at 94%. Here the study also found that those who were not knowledgeable about the SDG Six components for the HSP were also higher than those for the CSP by 12%. This higher percentage of those who were

not knowledgeable about the SDG Six components and those who were unaware of the SGD Six for both HSP and CSP was a clear indication that even those who were aware of the SDG six were not knowledgeable of the components. The majority of LDC service providers in both categories were not knowledgeable about the components of the SDG six as presented in Figure 4.12 which was a clear indication that even those who were aware of the SDG six were not knowledgeable of the components, a finding that puts derailment on the realization of clean water and better sanitation.

4.7.3 LDC Service Provider's Awareness of the Effect of Waste Disposal on the Environment

Laundry and dry cleaning service providers' awareness of the effect of waste disposal on the environment is summarized and presented in Figure 4.12.

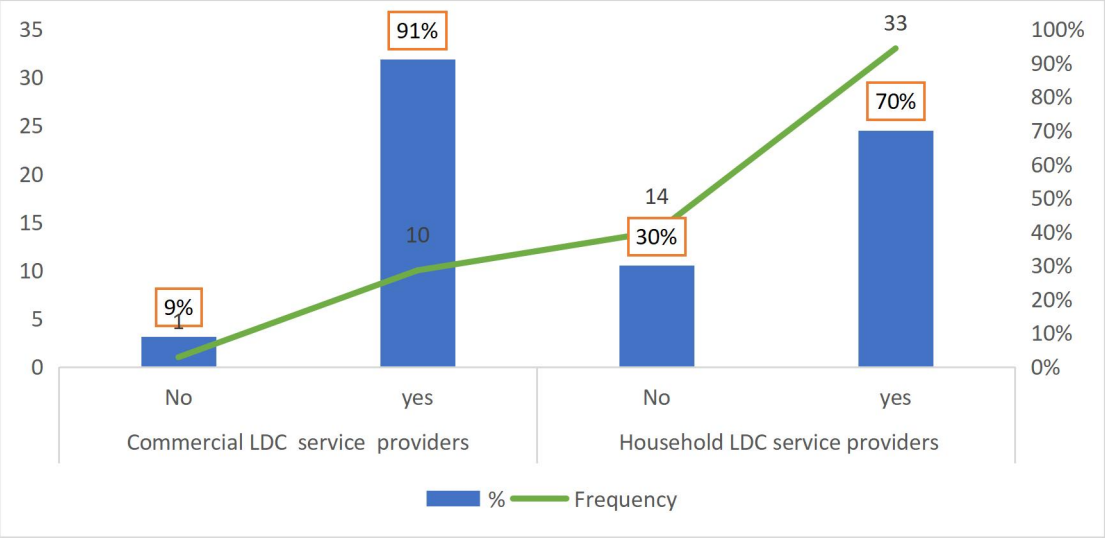

Figure 4.12: LDC Service Provider's Awareness of the Effect of Waste Disposal on the Environment

(Source: Field Data from Household and Commercial LDC Service Providers)

The majority of the service providers were aware of the effect of waste disposal on the environment. Only 9% versus 91% for commercial LDC service providers were not aware and were aware respectively of the effects of waste disposal on the environment. On the other hand, 70% versus 30% of the household LDC service providers were aware but not aware of the effect of waste disposal on the environment. The majority of the service providers were aware of the effect of waste disposal on the environment as shown in Figure 15.

This finding was very encouraging as the awareness could result in eliminating dumping and minimizing the release of hazardous chemicals and materials to the environment. As much as both commercial and household LDC service providers are aware of the effects of waste disposal on the environment, they were not able to employ better methods of managing the waste they generate which was an implication of the absence/inadequate of proper drainage systems and inadequate support and strengthening the participation of local communities in improving water and sanitation.

4.7.4 LDC Service Provider's Responses on Observed Change on Usual Waste Disposal Points

Responses of LDC service providers on observed change in usual waste disposal points are summarized and presented in Figure 4.13.

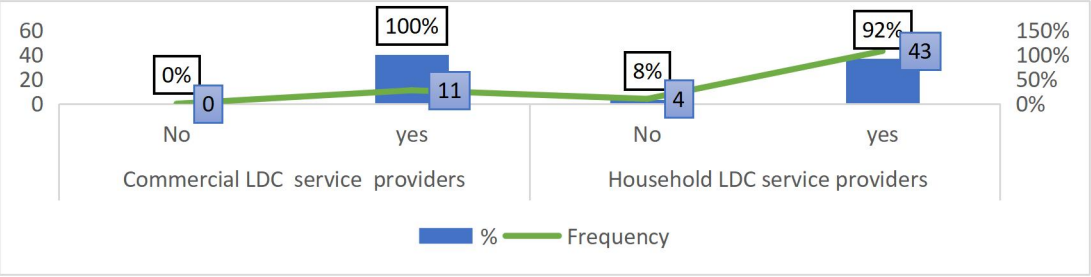

Figure 4.13: LDC Service Provider's Responses on Observed Change on Usual Waste Disposal Points

(Source: Field data from household and commercial LDC service providers)

As much as both categories were aware of the effects of waste disposal on the environment, they were not able to employ better methods of managing the waste they generate. This was reported by 100% and 92% of the commercial and household LDC service providers to have observed change in the environment where they had been disposing wastes. This was an implication of the absence or inadequate proper drainage systems to safely dispose of the wastes emanating from their services. Secondly, there could be inadequate support and strengthening of the participation of local communities in improving water and sanitation management, thus leading to environmental pollution and compromised water quality.

The summary of objective three was that most LDC service providers were not aware of SDG six goals and its components, had no knowledge of SDG six, and were also not aware of the effects of poor waste disposal on the environment. Some of these findings were in line with what was in the literature review while some were not. Kenya Literature Bureau (2009) and Mugambi *et. all.* (2004), Behnke *et al.* (2017), Rajasingham *et al.* (2018), and Abu, Bisung, and Elliott (2019) conveyed the meaning, purpose, and causes of poor sanitation as well as environmental hygiene which was agreeing with the study results where the service providers were supposed to be aware of SDG Six and its components, know SDG Six and be aware of poor waste disposal. Nhamo, Nhemachena, and Nhamo (2019) noted what the government and the private sectors need to do to improve rural and urban sanitation which was not in line with the study. The study was interested in the awareness of SDG Six and Simiyu, Mureithi *et*

al. (2018) and Simiyu (2016) established what the urban players need to do for the improvement of health and sanitation in Kenya which was not in line with the study as well. The unawareness and poor implementation of SDG Six in Kenya could be a result of the low levels of education, lack of in sensitization/empowerment from the government, and ignorance from LDC service providers in Kisumu City while the awareness and good implementation of SDG Six in other regions of the world could be as a result of their advancement in education and technology and good implementation.

4.7.5 Perception of Laundry and Dry Cleaning (LDC) Service Providers on Meeting the SDG Six Goals

The perception of laundry and dry cleaning (LDC) service providers on meeting the SDG Six Goals is summarized in Table 4.7.

Table 4.7: Perception of LDC Service Providers on Meeting the SDG Six Goals

		Commercial LDC Service Providers					Household LDC Service Providers				
		Great extent	To an extent	Less extent	No necessity at all	Total	Great extent	To an extent	Less extent	No necessity at all	Total
The extent of practicing safe waste disposal while doing LDC	**N**	8	2	1	0	11	37	6	0	4	47
	%	73%	18%	9%	0%	100 %	79%	12%	0%	9%	100 %
The lack of safe waste disposals mechanisms compromises the achievement of SDG in Kisumu city	**N**	10	1	0	0	11	17	27	0	3	47
	%	91%	9%	0%	0%	100 %	36%	57%	0%	6%	100 %
The extent of striving to use the minimum water possible while doing LDC	**N**	9	2	0	0	11	6	32	9	0	47
	%	82%	18%	0%	0%	100 %	13%	68%	19%	0%	100 %

(Source: Field data from household and commercial LDC service providers)

Laundry and cleaning service providers were having a great feeling about practicing safe waste disposal as presented in table 4.7 were an aggregate of great extent and to an extent of responses, (91%) of both service providers reported feeling the necessity of practicing safe waste disposal. The service providers also admitted absence of proper mechanisms for disposing of wastes emanating from their services was a greatly compromising the realization of SDG six. This was reported by an aggregate of great extent and to an extent of responses (100%) for commercial and (93%) for household LDC service providers respectively.

It was established that most of the service providers were striving to use water sparingly during LDC services. This was as reported by an aggregate of great extent and to an extent of responses (100%) of commercial and (81%) of household LDC service providers. The study found that there was a desire by the service providers to ensure that they were able to practice safe clean water and sanitation. This was in line with the results in Figure 4.13 which also established high awareness of the effects of waste disposal on the environment. However, there was evidence of the inadequacy of proper drainage mechanisms to support the service providers in disposing of their wastes, and this was affecting the realization of the achievement of SDG six in Kisumu city.

4.8 Waste Disposal Practices Used by the Laundry and Dry Cleaning Service Providers in Kisumu City

The study sought to establish the kind of waste obtained from LDC service providers and the methods used to dispose of such waste. Tables 4.8 and 4.9 present the findings.

4.8.1 Type of Waste Obtained from LDC Service Providers

Table 4.8: Type of Waste Generated from LDC Service Providers

Type of LDC	Waste Obtained from LDC	Frequency	Percentage
Commercial LDC service providers	Dirty/waste water	11	100%
	Lint	4	36%
	waste solvents	9	82%
	Melted buttons	5	45%
	Spotting residues	7	64%
	Soil particles	10	91%
Household LDC service providers	Dirty/waste water	47	100%
	Lint	0	0%
	waste solvents	3	6%
	Melted buttons	0	0%
	Spotting residues	1	2%
	Soil particles	47	100%

(Source: Field data from household and commercial LDC service providers)

When the respondents were asked to state some of the wastes generated during LDC, for commercial service providers, Table 15 shows that 100% stated cases of dirty water, 36% stated lint, 82% stated waste solvents, 45%stated melted buttons, 64% stated spotting residue and 91% stated soil particles. For household LDC service providers, 100% reported cases of dirty water, none stated lint, 6% stated water solvents and none stated melted buttons or spotting residue while100% stated soil particles. The most common waste generated was dirty water for the two categories represented by 100% and soil particles for household and commercial LDC service providers at 91% and 100% respectively. Environmental protection agency (2005), ChemTrac (2010), Alemayehu (2004), and Ministry of Health (2016) listed LDC waste as filter contents waste, filter and button trap contents waste, waste from water separator cleaning, spent filter waste, cartridge waste, separator water waste, chemicals, pressing waste, items pressing and equipment cleaning and maintenance operation produce waste, sludge, urine-diverting dry toilet waste, septic tank waste,

domestic sewage waste and industrial waste which were all different from those produced by LDC service providers in Kisumu City. These different in kind of waste produced in Kenya and other parts of the world could be due to the type of apparel and textile products laundered in Kenya, the kind of detergents, chemicals, and equipment used.

4.8.2 Waste Disposal Methods by Laundry and Dry Cleaning (LDC) Service Providers

Waste disposal methods by LDC service providers are summarized and presented in table 4.9

Table 4.9: Waste Disposal Methods by Laundry and Dry Cleaning (LDC) Service Providers

Type of LDC	Methods of Waste Disposal by LDC Service Providers	Frequency	Percentage
Commercial LDC service providers	Burning	2	18%
	Burying	2	18%
	Pouring waste water into the compound	6	55%
	Pouring waste water on the toilet/latrine	1	9%
	Pouring waste water on the drainage	8	73%
	Wrapping and waiting collection by the city council	5	45%
	Pouring waste chemicals into the drainage	8	73%
	Using waste water for mopping	1	9%
Household LDC service providers	Burning	24	51%
	Burying	26	56%
	Pouring waste water into the compound	46	98%
	Pouring waste water on the toilet/latrine	37	79%
	Pouring waste water on the drainage	1	2%
	Wrapping and waiting collection by the city council	10	21%
	Selling to motor dealers worn-out tools and equipment	10	21%
	Pouring waste chemicals into the drainage	2	4%
	Using waste water for mopping	45	96%

(Source: Field data from household and commercial LDC service providers)

On the waste disposal approach employed by the commercial LDC service providers, the result shows that the highest proportion (73%) of commercial LDC service

providers disposed of wastewater into the drainage and another (73%) disposed of waste chemicals into the drainage. In addition, (55%), disposed of waste water on the compound, 9%, in the toilet/pit latrine and the other 9% used the waste water for mopping. This result shows that most (73%) of the commercial service providers in Kisumu City disposed of the wastewater they generate through legal waste disposal means. From the finding, the researcher noticed that even though most service providers were aware of the harmful effects of improper waste disposal, they still practice illegal waste disposal. Most of the illegally disposed waste, of which a high percentage saw with disposal of wastewater in the compound (55%) and a smaller percentage (9%) disposing wastewater into the compound and (9%) into the latrine respectively. Observed that the first culprit in the pollution in the City was illegal waste disposal means.

For the households' LDC service providers, the result shows that the highest proportion (98%) of household LDC service providers disposed of wastewater into the compound and another (96%) used wastewater for mopping, and the other, (79%) disposed of waste water into the toilet/pit latrine. Only (4%), disposed of the waste chemicals into the drainage and the other (2%) disposed of wastewater into the drainage. This result shows that most (50%) of the household's service providers in Kisumu City disposed of the wastewater they generate through illegal waste disposal means. From the finding, the researcher noticed that even though most of the households' service providers were aware of the harmful effects of improper waste disposal, they still practice illegal waste disposal. Most of the illegally disposed waste, of which a high percentage was noticed with disposal of wastewater in the compound by (98%), into the toilet by (79%) and mopping by (96%). It was observed that the first culprit in the pollution in Kisumu City was illegal waste disposal practices.

For both categories, there were varied ways of disposing of of the mentioned wastes which is exactly what was practiced by LDC service providers on the ground. This was also supported by the observation checklist in Table 4.3, where the general cleanliness of the work place for the commercial service providers was either very clean/clean while for the household, it was either fairly clean or dirty. For the commercial service providers, waste disposal practices were fair compared to that of the household service providers which was poor as evidenced in Table 4.9. Poor waste disposal practices for the household service providers could be attributed to their level of education and unawareness of SDG Six and its components as depicted in table 8 and Figures 13 through 16 respectively. Varied ways of disposing of waste by the two categories could be due to a lack of standard regulations that govern LDC service providers' waste management practices. This was contrary to The United State Environmental Protection Agency (2016), Electrolux (2015), The America Cleaning Institute (2015), and Owner Information Sheet (2005) which mentioned measures that should be used to control pollution emanating from LDC services, ways of using machines and equipment, proper storage of LDC products, environmental protection, worker's protection, safety precautions in the work place and general cleanliness of the work place.

4.9 Levels of Waste Water Physical-Chemical Parameters Disposed of from Laundry and Dry Cleaning Services in Relation to Environmental Pollution in Kisumu City

The final objective was to determine the levels of waste water physical-chemical parameters disposed of from LDC services in relation to environmental pollution in Kisumu City. The study looked at the values of pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Nitrate, Total Phosphate, Detergents,

Mercury**,** and Cadmium and their discharge levels to the environment and into the public sewers. The results of the parameter discharged by households LDC service providers **are** summarized and presented in table 4.10 – 4.13.

4.9.1 Tests of Between-Subjects Effects (ANOVA) for Households Service Providers

Table 4.10: Test results for the household service providers

Source	Dependent Variable	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	NITRATE	126.561[a]	3	42.187	2.859	.063
	AMMONIA	8.166E-005[b]	3	2.722E-005	.688	.570
	PHOSPHATE	.029[c]	3	.010	4.174	.019
	NITROGEN	.012[d]	3	.004	2.829	.065
	TDS	19557.458[e]	3	6519.153	6.787	.002
	ALKALINITY	5465.458[f]	3	1821.819	1.497	.246
	PH	1.984[g]	3	.661	2.959	.057
	EC	20833.667[h]	3	6944.556	1.721	.195
	ZINC	.057[i]	3	.019	13.644	.000
	NITRITES	1.247[j]	3	.416	2.514	.088
	BOD	336.833[k]	3	112.278	7.824	.001
	COD	37605.500[l]	3	12535.167	4.038	.021
	DETERGENTS	28.333[m]	3	9.444	5.397	.007
	CADMIUM	.000[n]	3	.000	3.667	.030
	MERCURY	.001[o]	3	.000	6.951	.002
Intercept	NITRATE	14342.370	1	14342.370	971.908	.000
	AMMONIA	.016	1	.016	405.260	.000
	PHOSPHATE	2.954	1	2.954	1254.280	.000
	NITROGEN	1.123	1	1.123	779.867	.000
	TDS	3079517.042	1	3079517.042	3206.077	.000
	ALKALINITY	1370426.042	1	1370426.042	1126.462	.000
	PH	1426.658	1	1426.658	6384.973	.000
	EC	17367210.667	1	17367210.667	4302.880	.000
	ZINC	1.027	1	1.027	731.048	.000
	NITRITES	239.339	1	239.339	1447.502	.000
	BOD	23940.167	1	23940.167	1668.304	.000
	COD	2523313.500	1	2523313.500	812.753	.000
	DETERGENTS	1802.667	1	1802.667	1030.095	.000
	CADMIUM	.000	1	.000	9.000	.007
	MERCURY	.001	1	.001	20.610	.000
LOCATION	NITRATE	126.561	3	42.187	2.859	.063
	AMMONIA	8.166E-005	3	2.722E-005	.688	.570
	PHOSPHATE	.029	3	.010	4.174	.019
	NITROGEN	.012	3	.004	2.829	.065
	TDS	19557.458	3	6519.153	6.787	.002
	ALKALINITY	5465.458	3	1821.819	1.497	.246
	PH	1.984	3	.661	2.959	.057
	EC	20833.667	3	6944.556	1.721	.195
	ZINC	.057	3	.019	13.644	.000
	NITRITES	1.247	3	.416	2.514	.088
	BOD	336.833	3	112.278	7.824	.001
	COD	37605.500	3	12535.167	4.038	.021
	DETERGENTS	28.333	3	9.444	5.397	.007
	CADMIUM	.000	3	.000	3.667	.030

	MERCURY	.001	3	.000	6.951	.002
	NITRATE	295.138	20	14.757		
	AMMONIA	.001	20	3.957E-005		
	PHOSPHATE	.047	20	.002		
	NITROGEN	.029	20	.001		
	TDS	19210.500	20	960.525		
	ALKALINITY	24331.500	20	1216.575		
	PH	4.469	20	.223		
Error	EC	80723.667	20	4036.183		
	ZINC	.028	20	.001		
	NITRITES	3.307	20	.165		
	BOD	287.000	20	14.350		
	COD	62093.000	20	3104.650		
	DETERGENTS	35.000	20	1.750		
	CADMIUM	.001	20	3.750E-005		
	MERCURY	.001	20	3.417E-005		
	NITRATE	14764.070	24			
	AMMONIA	.017	24			
	PHOSPHATE	3.030	24			
	NITROGEN	1.164	24			
	TDS	3118285.000	24			
	ALKALINITY	1400223.000	24			
	PH	1433.111	24			
Total	EC	17468768.000	24			
	ZINC	1.112	24			
	NITRITES	243.892	24			
	BOD	24564.000	24			
	COD	2623012.000	24			
	DETERGENTS	1866.000	24			
	CADMIUM	.002	24			
	MERCURY	.002	24			
	NITRATE	421.700	23			
	AMMONIA	.001	23			
	PHOSPHATE	.077	23			
	NITROGEN	.041	23			
	TDS	38767.958	23			
	ALKALINITY	29796.958	23			
	PH	6.453	23			
Corrected Total	EC	101557.333	23			
	ZINC	.086	23			
	NITRITES	4.554	23			
	BOD	623.833	23			
	COD	99698.500	23			
	DETERGENTS	63.333	23			
	CADMIUM	.001	23			
	MERCURY	.001	23			

a. R Squared = .300 (Adjusted R Squared = .195)
b. R Squared = .094 (Adjusted R Squared = -.042)
c. R Squared = .385 (Adjusted R Squared = .293)

d. R Squared = .298 (Adjusted R Squared = .193)
e. R Squared = .504 (Adjusted R Squared = .430)
f. R Squared = .183 (Adjusted R Squared = .061)
g. R Squared = .307 (Adjusted R Squared = .204)
h. R Squared = .205 (Adjusted R Squared = .086)
i. R Squared = .672 (Adjusted R Squared = .623)
j. R Squared = .274 (Adjusted R Squared = .165)
k. R Squared = .540 (Adjusted R Squared = .471)
l. R Squared = .377 (Adjusted R Squared = .284)
m. R Squared = .447 (Adjusted R Squared = .364)
n. R Squared = .355 (Adjusted R Squared = .258)
o. R Squared = .510 (Adjusted R Squared = .437)

4.9.2 Means for Households Locations

Table 4.11: Mean results for household locations

Dependent Variable	LOCATION	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
NITRATE	NYALENDA	22.450	1.568	19.179	25.721
	MANYATTA	28.083	1.568	24.812	31.355
	BANDANI	24.750	1.568	21.479	28.021
	KORANDA	22.500	1.568	19.229	25.771
AMMONIA	NYALENDA	.026	.003	.020	.031
	MANYATTA	.024	.003	.019	.029
	BANDANI	.025	.003	.019	.030
	KORANDA	.029	.003	.024	.034
PHOSPHATE	NYALENDA	.375	.020	.334	.417
	MANYATTA	.392	.020	.351	.434
	BANDANI	.332	.020	.290	.373
	KORANDA	.304	.020	.262	.345
NITROGEN	NYALENDA	.218	.015	.185	.250
	MANYATTA	.251	.015	.218	.283
	BANDANI	.188	.015	.156	.220
	KORANDA	.209	.015	.177	.242
TDS	NYALENDA	398.167	12.653	371.774	424.559
	MANYATTA	372.333	12.653	345.941	398.726
	BANDANI	330.500	12.653	304.107	356.893
	KORANDA	331.833	12.653	305.441	358.226
ALKALINITY	NYALENDA	252.333	14.239	222.630	282.036
	MANYATTA	234.833	14.239	205.130	264.536
	BANDANI	252.667	14.239	222.964	282.370
	KORANDA	216.000	14.239	186.297	245.703
PH	NYALENDA	7.388	.193	6.986	7.791
	MANYATTA	7.718	.193	7.316	8.121
	BANDANI	7.568	.193	7.166	7.971
	KORANDA	8.165	.193	7.762	8.568
EC	NYALENDA	814.833	25.936	760.731	868.936
	MANYATTA	869.833	25.936	815.731	923.936
	BANDANI	888.000	25.936	833.898	942.102
	KORANDA	830.000	25.936	775.898	884.102
ZINC	NYALENDA	.241	.015	.209	.273
	MANYATTA	.159	.015	.127	.191
	BANDANI	.158	.015	.127	.190
	KORANDA	.269	.015	.237	.301
NITRITES	NYALENDA	3.300	.166	2.954	3.646
	MANYATTA	3.398	.166	3.052	3.745
	BANDANI	3.135	.166	2.789	3.481
	KORANDA	2.798	.166	2.452	3.145
BOD	NYALENDA	28.833	1.547	25.607	32.059
	MANYATTA	38.000	1.547	34.774	41.226

	BANDANI	30.333	1.547	27.107	33.559
	KORANDA	29.167	1.547	25.941	32.393
	NYALENDA	305.833	22.747	258.383	353.283
COD	MANYATTA	390.333	22.747	342.883	437.783
	BANDANI	315.000	22.747	267.550	362.450
	KORANDA	285.833	22.747	238.383	333.283
	NYALENDA	9.167	.540	8.040	10.293
DETERGENTS	MANYATTA	10.167	.540	9.040	11.293
	BANDANI	8.000	.540	6.873	9.127
	KORANDA	7.333	.540	6.207	8.460
	NYALENDA	-1.735E-018	.003	-.005	.005
CADMIUM	MANYATTA	.005	.003	.000	.010
	BANDANI	-1.735E-018	.003	-.005	.005
	KORANDA	.010	.003	.005	.015
	NYALENDA	.000	.002	-.005	.005
MERCURY	MANYATTA	.012	.002	.007	.017
	BANDANI	.010	.002	.005	.015
	KORANDA	5.667E-019	.002	-.005	.005

4.9.3 Grand Mean For Households Service Providers

Table 4.12: Mean results for households service providers

Dependent Variable	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
NITRATE	24.446	.784	22.810	26.082
AMMONIA	.026	.001	.023	.029
PHOSPHATE	.351	.010	.330	.371
NITROGEN	.216	.008	.200	.233
TDS	358.208	6.326	345.012	371.405
ALKALINITY	238.958	7.120	224.107	253.810
PH	7.710	.096	7.509	7.911
EC	850.667	12.968	823.615	877.718
ZINC	.207	.008	.191	.223
NITRITES	3.158	.083	2.985	3.331
BOD	31.583	.773	29.970	33.196
COD	324.250	11.374	300.525	347.975
DETERGENTS	8.667	.270	8.103	9.230
CADMIUM	.004	.001	.001	.006
MERCURY	.005	.001	.003	.008

4.9.4 Multiple Comparisons (LSD post hoc analysis) in Locations For Households Service Providers

Table 4.13: Results of households locations

Dependent Variable	(I) LOCATION	(J) LOCATION	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
NITRATE	NYALENDA	MANYATTA	-5.6333*	2.21788	.019	-10.2597	-1.0069
		BANDANI	-2.3000	2.21788	.312	-6.9264	2.3264

		KORANDA	-.0500	2.21788	.982	-4.6764	4.5764
		NYALENDA	5.6333*	2.21788	.019	1.0069	10.2597
	MANYATTA	BANDANI	3.3333	2.21788	.148	-1.2931	7.9597
		KORANDA	5.5833*	2.21788	.020	.9569	10.2097
		NYALENDA	2.3000	2.21788	.312	-2.3264	6.9264
	BANDANI	MANYATTA	-3.3333	2.21788	.148	-7.9597	1.2931
		KORANDA	2.2500	2.21788	.322	-2.3764	6.8764
		NYALENDA	.0500	2.21788	.982	-4.5764	4.6764
	KORANDA	MANYATTA	-5.5833*	2.21788	.020	-10.2097	-.9569
		BANDANI	-2.2500	2.21788	.322	-6.8764	2.3764
		MANYATTA	.0014	.00363	.711	-.0062	.0089
	NYALENDA	BANDANI	.0007	.00363	.856	-.0069	.0082
		KORANDA	-.0034	.00363	.356	-.0110	.0041
		NYALENDA	-.0014	.00363	.711	-.0089	.0062
	MANYATTA	BANDANI	-.0007	.00363	.849	-.0083	.0069
AMMO		KORANDA	-.0048	.00363	.201	-.0124	.0028
NIA		NYALENDA	-.0007	.00363	.856	-.0082	.0069
	BANDANI	MANYATTA	.0007	.00363	.849	-.0069	.0083
		KORANDA	-.0041	.00363	.272	-.0117	.0035
		NYALENDA	.0034	.00363	.356	-.0041	.0110
	KORANDA	MANYATTA	.0048	.00363	.201	-.0028	.0124
		BANDANI	.0041	.00363	.272	-.0035	.0117
		MANYATTA	-.0172	.02802	.546	-.0757	.0412
	NYALENDA	BANDANI	.0435	.02802	.136	-.0149	.1019
		KORANDA	.0716*	.02802	.019	.0131	.1300
		NYALENDA	.0172	.02802	.546	-.0412	.0757
	MANYATTA	BANDANI	.0607*	.02802	.042	.0023	.1192
PHOSP		KORANDA	.0888*	.02802	.005	.0303	.1472
HATE		NYALENDA	-.0435	.02802	.136	-.1019	.0149
	BANDANI	MANYATTA	-.0607*	.02802	.042	-.1192	-.0023
		KORANDA	.0281	.02802	.329	-.0304	.0865
		NYALENDA	-.0716*	.02802	.019	-.1300	-.0131
	KORANDA	MANYATTA	-.0888*	.02802	.005	-.1472	-.0303
		BANDANI	-.0281	.02802	.329	-.0865	.0304
		MANYATTA	-.0330	.02191	.148	-.0787	.0128
	NYALENDA	BANDANI	.0298	.02191	.189	-.0159	.0755
		KORANDA	.0085	.02191	.702	-.0372	.0542
		NYALENDA	.0330	.02191	.148	-.0128	.0787
	MANYATTA	BANDANI	.0627*	.02191	.010	.0170	.1084
NITRO		KORANDA	.0414	.02191	.073	-.0043	.0872
GEN		NYALENDA	-.0298	.02191	.189	-.0755	.0159
	BANDANI	MANYATTA	-.0627*	.02191	.010	-.1084	-.0170
		KORANDA	-.0213	.02191	.343	-.0670	.0244
		NYALENDA	-.0085	.02191	.702	-.0542	.0372
	KORANDA	MANYATTA	-.0414	.02191	.073	-.0872	.0043
		BANDANI	.0213	.02191	.343	-.0244	.0670
		MANYATTA	25.8333	17.89343	.164	-11.4917	63.1584
	NYALENDA	BANDANI	67.6667*	17.89343	.001	30.3416	104.9917
		KORANDA	66.3333*	17.89343	.001	29.0083	103.6584
		NYALENDA	-25.8333	17.89343	.164	-63.1584	11.4917
	MANYATTA	BANDANI	41.8333*	17.89343	.030	4.5083	79.1584
		KORANDA	40.5000*	17.89343	.035	3.1749	77.8251
TDS		NYALENDA	-67.6667*	17.89343	.001	-104.9917	-30.3416
	BANDANI	MANYATTA	-41.8333*	17.89343	.030	-79.1584	-4.5083
		KORANDA	-1.3333	17.89343	.941	-38.6584	35.9917
		NYALENDA	-66.3333*	17.89343	.001	-103.6584	-29.0083
	KORANDA	MANYATTA	-40.5000*	17.89343	.035	-77.8251	-3.1749
		BANDANI	1.3333	17.89343	.941	-35.9917	38.6584
		MANYATTA	17.5000	20.13765	.395	-24.5064	59.5064
	NYALENDA	BANDANI	-.3333	20.13765	.987	-42.3397	41.6731
ALKALI		KORANDA	36.3333	20.13765	.086	-5.6731	78.3397
NITY		NYALENDA	-17.5000	20.13765	.395	-59.5064	24.5064
	MANYATTA	BANDANI	-17.8333	20.13765	.386	-59.8397	24.1731

		KORANDA	18.8333	20.13765	.361	-23.1731	60.8397
		NYALENDA	.3333	20.13765	.987	-41.6731	42.3397
	BANDANI	MANYATTA	17.8333	20.13765	.386	-24.1731	59.8397
		KORANDA	36.6667	20.13765	.084	-5.3397	78.6731
		NYALENDA	-36.3333	20.13765	.086	-78.3397	5.6731
	KORANDA	MANYATTA	-18.8333	20.13765	.361	-60.8397	23.1731
		BANDANI	-36.6667	20.13765	.084	-78.6731	5.3397
		MANYATTA	-.3300	.27291	.241	-.8993	.2393
	NYALENDA	BANDANI	-.1800	.27291	.517	-.7493	.3893
		KORANDA	-.7767*	.27291	.010	-1.3459	-.2074
		NYALENDA	.3300	.27291	.241	-.2393	.8993
	MANYATTA	BANDANI	.1500	.27291	.589	-.4193	.7193
		KORANDA	-.4467	.27291	.117	-1.0159	.1226
PH		NYALENDA	.1800	.27291	.517	-.3893	.7493
	BANDANI	MANYATTA	-.1500	.27291	.589	-.7193	.4193
		KORANDA	-.5967*	.27291	.041	-1.1659	-.0274
		NYALENDA	.7767*	.27291	.010	.2074	1.3459
	KORANDA	MANYATTA	.4467	.27291	.117	-.1226	1.0159
		BANDANI	.5967*	.27291	.041	.0274	1.1659
		MANYATTA	-55.0000	36.67962	.149	-131.5123	21.5123
	NYALENDA	BANDANI	-73.1667	36.67962	.060	-149.6790	3.3457
		KORANDA	-15.1667	36.67962	.684	-91.6790	61.3457
		NYALENDA	55.0000	36.67962	.149	-21.5123	131.5123
	MANYATTA	BANDANI	-18.1667	36.67962	.626	-94.6790	58.3457
		KORANDA	39.8333	36.67962	.290	-36.6790	116.3457
EC		NYALENDA	73.1667	36.67962	.060	-3.3457	149.6790
	BANDANI	MANYATTA	18.1667	36.67962	.626	-58.3457	94.6790
		KORANDA	58.0000	36.67962	.130	-18.5123	134.5123
		NYALENDA	15.1667	36.67962	.684	-61.3457	91.6790
	KORANDA	MANYATTA	-39.8333	36.67962	.290	-116.3457	36.6790
		BANDANI	-58.0000	36.67962	.130	-134.5123	18.5123
		MANYATTA	.0813*	.02164	.001	.0362	.1265
	NYALENDA	BANDANI	.0822*	.02164	.001	.0370	.1273
		KORANDA	-.0282	.02164	.208	-.0733	.0170
		NYALENDA	-.0813*	.02164	.001	-.1265	-.0362
	MANYATTA	BANDANI	.0008	.02164	.970	-.0443	.0460
		KORANDA	-.1095*	.02164	.000	-.1546	-.0644
ZINC		NYALENDA	-.0822*	.02164	.001	-.1273	-.0370
	BANDANI	MANYATTA	-.0008	.02164	.970	-.0460	.0443
		KORANDA	-.1103*	.02164	.000	-.1555	-.0652
		NYALENDA	.0282	.02164	.208	-.0170	.0733
	KORANDA	MANYATTA	.1095*	.02164	.000	.0644	.1546
		BANDANI	.1103*	.02164	.000	.0652	.1555
		MANYATTA	-.0983	.23477	.680	-.5880	.3914
	NYALENDA	BANDANI	.1650	.23477	.490	-.3247	.6547
		KORANDA	.5017*	.23477	.045	.0120	.9914
		NYALENDA	.0983	.23477	.680	-.3914	.5880
	MANYATTA	BANDANI	.2633	.23477	.275	-.2264	.7530
NITRIT		KORANDA	.6000*	.23477	.019	.1103	1.0897
ES		NYALENDA	-.1650	.23477	.490	-.6547	.3247
	BANDANI	MANYATTA	-.2633	.23477	.275	-.7530	.2264
		KORANDA	.3367	.23477	.167	-.1530	.8264
		NYALENDA	-.5017*	.23477	.045	-.9914	-.0120
	KORANDA	MANYATTA	-.6000*	.23477	.019	-1.0897	-.1103
		BANDANI	-.3367	.23477	.167	-.8264	.1530
		MANYATTA	-9.1667*	2.18708	.000	-13.7288	-4.6045
	NYALENDA	BANDANI	-1.5000	2.18708	.501	-6.0622	3.0622
		KORANDA	-.3333	2.18708	.880	-4.8955	4.2288
		NYALENDA	9.1667*	2.18708	.000	4.6045	13.7288
BOD	MANYATTA	BANDANI	7.6667*	2.18708	.002	3.1045	12.2288
		KORANDA	8.8333*	2.18708	.001	4.2712	13.3955
		NYALENDA	1.5000	2.18708	.501	-3.0622	6.0622
	BANDANI	MANYATTA	-7.6667*	2.18708	.002	-12.2288	-3.1045

		KORANDA	1.1667	2.18708	.600	-3.3955	5.7288
		NYALENDA	.3333	2.18708	.880	-4.2288	4.8955
	KORANDA	MANYATTA	-8.8333*	2.18708	.001	-13.3955	-4.2712
		BANDANI	-1.1667	2.18708	.600	-5.7288	3.3955
		MANYATTA	-84.5000*	32.16960	.016	-151.6046	-17.3954
	NYALENDA	BANDANI	-9.1667	32.16960	.779	-76.2713	57.9379
		KORANDA	20.0000	32.16960	.541	-47.1046	87.1046
		NYALENDA	84.5000*	32.16960	.016	17.3954	151.6046
	MANYATTA	BANDANI	75.3333*	32.16960	.030	8.2287	142.4379
		KORANDA	104.5000*	32.16960	.004	37.3954	171.6046
COD		NYALENDA	9.1667	32.16960	.779	-57.9379	76.2713
	BANDANI	MANYATTA	-75.3333*	32.16960	.030	-142.4379	-8.2287
		KORANDA	29.1667	32.16960	.375	-37.9379	96.2713
		NYALENDA	-20.0000	32.16960	.541	-87.1046	47.1046
	KORANDA	MANYATTA	-104.5000*	32.16960	.004	-171.6046	-37.3954
		BANDANI	-29.1667	32.16960	.375	-96.2713	37.9379
		MANYATTA	-1.0000	.76376	.205	-2.5932	.5932
	NYALENDA	BANDANI	1.1667	.76376	.142	-.4265	2.7598
		KORANDA	1.8333*	.76376	.026	.2402	3.4265
		NYALENDA	1.0000	.76376	.205	-.5932	2.5932
	MANYATTA	BANDANI	2.1667*	.76376	.010	.5735	3.7598
DETER		KORANDA	2.8333*	.76376	.001	1.2402	4.4265
GENTS		NYALENDA	-1.1667	.76376	.142	-2.7598	.4265
	BANDANI	MANYATTA	-2.1667*	.76376	.010	-3.7598	-.5735
		KORANDA	.6667	.76376	.393	-.9265	2.2598
		NYALENDA	-1.8333*	.76376	.026	-3.4265	-.2402
	KORANDA	MANYATTA	-2.8333*	.76376	.001	-4.4265	-1.2402
		BANDANI	-.6667	.76376	.393	-2.2598	.9265
		MANYATTA	-.0050	.00354	.173	-.0124	.0024
	NYALENDA	BANDANI	.0000	.00354	1.000	-.0074	.0074
		KORANDA	-.0100*	.00354	.010	-.0174	-.0026
		NYALENDA	.0050	.00354	.173	-.0024	.0124
	MANYATTA	BANDANI	.0050	.00354	.173	-.0024	.0124
CADMI		KORANDA	-.0050	.00354	.173	-.0124	.0024
UM		NYALENDA	.0000	.00354	1.000	-.0074	.0074
	BANDANI	MANYATTA	-.0050	.00354	.173	-.0124	.0024
		KORANDA	-.0100*	.00354	.010	-.0174	-.0026
		NYALENDA	.0100*	.00354	.010	.0026	.0174
	KORANDA	MANYATTA	.0050	.00354	.173	-.0024	.0124
		BANDANI	.0100*	.00354	.010	.0026	.0174
		MANYATTA	-.0117*	.00337	.002	-.0187	-.0046
	NYALENDA	BANDANI	-.0100*	.00337	.008	-.0170	-.0030
		KORANDA	.0000	.00337	1.000	-.0070	.0070
		NYALENDA	.0117*	.00337	.002	.0046	.0187
	MANYATTA	BANDANI	.0017	.00337	.627	-.0054	.0087
MERCU		KORANDA	.0117*	.00337	.002	.0046	.0187
RY		NYALENDA	.0100*	.00337	.008	.0030	.0170
	BANDANI	MANYATTA	-.0017	.00337	.627	-.0087	.0054
		KORANDA	.0100*	.00337	.008	.0030	.0170
		NYALENDA	.0000	.00337	1.000	-.0070	.0070
	KORANDA	MANYATTA	-.0117*	.00337	.002	-.0187	-.0046
		BANDANI	-.0100*	.00337	.008	-.0170	-.0030

Based on observed means.
The error term is Mean Square(Error) = 3.417E-005.
*. The mean difference is significant at the .05 level.

4.9.5 Results For LDC Households Service Providers

The researcher saw it better to make a conclusion foe six parameters which included Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Nitrate, Nitrite, Total Phosphate and PH

NITRATE

There was no significant difference among the four households for nitrates, (F (3, 20) =2.86, p=0.063, n^2p=42.89 (Table 17).

Post hoc testing (Table 20) revealed no significance difference between pairs of locations with Manyata (M= 28.08) and Bandani (M=24.75) having more nitrates in waste water (Table 18) than Nyalenda (M=22.45) and Koranda (M= 22.50). For the Nitrates, the observed trend was that Manyatta had the highest mean of 28.08 followed by Bandanin with a mean of 24.75, then Korando with 22.50, and lastly Nyalenda with a mean of 22.45.

AMMONIA

There was no significant difference among the four households for ammonia, (F (4, 20) =0.69, p=0.57, n^2p=2.72 (Table 17). Post hoc testing (Table 20) revealed no significance difference between pairs of locations with Koranda (M= 0.029) and Nyalenda (M=0.026) having more ammonia in waste water (Table 18) than Bandani (M=0.025) and Manyata (M= 0.024). when looked at

TOTAL PHOSPHATE

There was a significant difference among the four households for phosphates, (F (3, 20) =4.17, p=0.02, n^2p=0,01 (Table 17). Post hoc testing (Table 20) revealed no significance difference between pairs of locations with Manyata (M= 0.392) and Nyalenda (M=0.375) having more phosphates in waste water (Table 18) than Bandani (M=0.332) and Koranda (M= 0.304). The result showed that Manyatta had the highest mean of 0.392 followed by Nyalenda with 0.375 and Bandan with a mean of 0.332 and with the lowest mean was Korando with 0.304.

NITROGEN

There was no significant difference among the four households for nitrogen, (F (3, 20) =2.83, p=0.065, n^2p=0.004 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Manyata (M= 0.251) having more nitrogen in waste water (Table 18) than Nyalenda (M=0.218), Koranda (M= 0.208) and Bandani (M=0.188).

TDS

There was a significant difference among the four households for TDS, (F (3, 20) =6.79, p=0.002, n^2p=6519.15 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Nyalenda (M= 398.17) and

Manyata (M=372.33) having TDS in waste water (Table 18) than Koranda (M=331.83) and Bandani (M= 330.50).

ALKALINITY

There was no significant difference among the four households for alkalinity, (F (3, 20) =1.50, p=0.5, n^2p=1821.82 (Table 17). Post hoc testing (Table 20) revealed no significance difference between pairs of locations with Bandani (M= 252.67), Nyalenda (M=252.33), and Manyata (M=234.83) having high alkalinity in waste water (Table 18) than Koranda (M= 216.00).

pH

There was no significant difference among the four households for pH, (F (3, 20) =2.96, p=0.057, n^2p=0.66 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Koranda (M= 8.17) and Manyata (M=7.72) having high pH in waste water (Table 18) than Bandani (M=7.57) and Nyalenda (M= 7.39). The observed trend for PH was that Korando had the highest mean of 8.17, followed by Manyatta with a mean of 7.72, Bnadani with a mean of 7.57, and Nyalenda with a mean of 7.39.

EC

There was no significant difference among the four households for Electric conductivity of waste water, (F (3, 20) =1.72, p=0.2, n^2p=6944.56 (Table 17). Post

hoc testing (Table 20) revealed no significance difference between pairs of locations with Bandani (M= 888.00) and Manyata (M=869.83) having high EC in waste water (Table 18) than Koranda (M=830.00) and Nyalenda (M= 814.83).

ZINC

There was a significant difference among the four households for Zinc, (F (3, 20) =13.64, p=0.000, n^2p=0.02 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Koranda (M= 0.27) and Nyalenda (M=0.24) having more Zinc in waste water (Table 18) than Bandani (M=0.16) and Manyata (M= 0.159).

NITRITES

There was no significant difference among the four households for nitrites, (F (3, 20)=2.51, p=0.089, n^2p=0.42 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Manyata (M= 3.4) and Nyalenda (M=3.3) having more nitrites in waste water (Table 18) than Bandani (M=3.14) and Koranda (M= 2.8). The findings were that Manayatta had the highest mean of 3.4, Nyalenda with a mean of 3.3, Bandani with a mean of 3.14, and Korando with the lowest mean of 2.8.

BOD

There was a significant difference among the four households for BOD, (F (3, 20) =7.82, p=0.001, n^2p=112.28 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Manyata (M= 38.00) having more BOD in waste water (Table 18) than Bandani (M=30.33), Koranda (M= 29.17) and Nyalenda (M=28.83). The result showed that manyatta had the highest mean of 38.00, followed by Bandani with 30.33, Korando with a mean of 29.17, and Nyalenda with a mean of 28.83.

COD

There was a significant difference among the four households for COD, (F (3, 20) = 4.03, p=0.021, n^2p=12535.17 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Manyata (M= 390.33) having more COD in waste water (Table 18) than Bandani (M=315.33), Nyalenda (M=305.83) and Koranda (M= 285.83). The result showed that manyatta had the highest mean of 390.33, followed by Bandani with 315.33, Nyalenda with a mean of 305.83, and Korando with a mean of 285.83.

DETERGENTS

There was a significant difference among the four households for detergents, (F (3, 20) =5.4, p=0.007, n^2p=9.44 (Table 17). Post hoc testing (Table 20) revealed a

significance difference between pairs of locations with Manyata (M= 10.17) and Nyalenda (M=9.17) having more detergents in waste water (Table 18) than Bandani (M=8.00) and Koranda (M= 7.33).

CADMIUM

There was a significant difference among the four households for Cadmium, (F (3, 20)=5.4, p=0.03, n^2p=0.0 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Manyata (M= 0.05) and Koranda (M= 0.01) having more cadmium in waste water (Table 18) than Nyalenda (M= -1.74) and Bandani (M= -1.74).

MERCURY

There was a significant difference among the four households for Mercury, (F (3, 20) =6.95, p=0.002, n^2p=0.0 (Table 17). Post hoc testing (Table 20) revealed a significance difference between pairs of locations with Koranda (M= 5.67) having more mercury in waste water (Table 18) than Manyata (M= 0.012), Bandani (M=0.01) and Nyalenda (M=0.00).

4.9.6 Univariate Tests (ANOVA) For Commercial Service Providers

Table 4.14: The results of the parameter discharged by households LDC service providers

Dependent Variable		Sum of Squares	Df	Mean Square	F	Sig.
NITRATE	Contrast	319.290	3	106.430	31929.000	.000
	Error	.027	8	.003		
AMMONIA	Contrast	.000	3	.000	85.974	.000
	Error	1.339E-005	8	1.673E-006		
PHOSPHATE	Contrast	.462	3	.154	1810040.585	.000
	Error	6.800E-007	8	8.500E-008		
NITROGEN	Contrast	.356	3	.119	1383540.359	.000
	Error	6.867E-007	8	8.583E-008		
TDS	Contrast	36530.250	3	12176.750	36530.250	.000
	Error	2.667	8	.333		
ALKALINITY	Contrast	266967.000	3	88989.000	266967.000	.000
	Error	2.667	8	.333		
PH	Contrast	63.678	3	21.226	94337.432	.000
	Error	.002	8	.000		
ZINC	Contrast	.102	3	.034	101574.000	.000
	Error	2.667E-006	8	3.333E-007		
EC	Contrast	1505902.333	3	501967.444	397.231	.000
	Error	10109.333	8	1263.667		
NITRITES	Contrast	22.105	3	7.368	1037.788	.000
	Error	.057	8	.007		
BOD	Contrast	182.333	3	60.778	4.144	.048
	Error	117.333	8	14.667		
COD	Contrast	27366.667	3	9122.222	40.543	.000
	Error	1800.000	8	225.000		
DETERGENTS	Contrast	.004	3	.001	.387	.766
	Error	.028	8	.004		
MERCURY	Contrast	2.500E-005	3	8.333E-006	.333	.802
	Error	.000	8	2.500E-005		
CADMIUM	Contrast	2.500E-005	3	8.333E-006	.333	.802
	Error	.000	8	2.500E-005		

The F tests the effect of LOCATION. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

4.9.7 Mean Comparisons For Commercial Service providers

Table 4.15: Results for commercial service providers

Dependent Variable	LOCATION	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
NITRATE	BELLAIRE	37.633	.033	37.556	37.710
	FLUSH	49.633	.033	49.556	49.710
	WHITE ROSE	38.633	.033	38.556	38.710
	BLUE SEAL	46.833	.033	46.756	46.910
AMMONIA	BELLAIRE	.032	.001	.031	.034

	FLUSH	.019	.001	.017	.020
	WHITE ROSE	.033	.001	.032	.035
	BLUE SEAL	.024	.001	.023	.026
	BELLAIRE	.528	.000	.528	.528
PHOSPHATE	FLUSH	.657	.000	.656	.657
	WHITE ROSE	.982	.000	.981	.982
	BLUE SEAL	.966	.000	.965	.966
	BELLAIRE	.999	.000	.998	.999
NITROGEN	FLUSH	1.182	.000	1.181	1.182
	WHITE ROSE	.751	.000	.750	.751
	BLUE SEAL	.794	.000	.794	.795
	BELLAIRE	1652.333	.333	1651.565	1653.102
TDS	FLUSH	1520.333	.333	1519.565	1521.102
	WHITE ROSE	1540.333	.333	1539.565	1541.102
	BLUE SEAL	1623.333	.333	1622.565	1624.102
	BELLAIRE	1207.333	.333	1206.565	1208.102
ALKALINITY	FLUSH	1402.333	.333	1401.565	1403.102
	WHITE ROSE	1625.333	.333	1624.565	1626.102
	BLUE SEAL	1456.333	.333	1455.565	1457.102
	BELLAIRE	5.233	.009	5.213	5.253
PH	FLUSH	9.310	.009	9.290	9.330
	WHITE ROSE	9.983	.009	9.963	10.003
	BLUE SEAL	4.907	.009	4.887	4.927
	BELLAIRE	.435	.000	.435	.436
ZINC	FLUSH	.192	.000	.192	.193
	WHITE ROSE	.237	.000	.237	.238
	BLUE SEAL	.312	.000	.312	.313
	BELLAIRE	1431.000	20.524	1383.672	1478.328
EC	FLUSH	1633.000	20.524	1585.672	1680.328
	WHITE ROSE	852.333	20.524	805.006	899.661
	BLUE SEAL	824.333	20.524	777.006	871.661
	BELLAIRE	.840	.049	.728	.952
NITRITES	FLUSH	.473	.049	.361	.586
	WHITE ROSE	3.667	.049	3.554	3.779
	BLUE SEAL	2.957	.049	2.844	3.069
	BELLAIRE	38.667	2.211	33.568	43.765
BOD	FLUSH	34.000	2.211	28.901	39.099
	WHITE ROSE	42.667	2.211	37.568	47.765
	BLUE SEAL	44.000	2.211	38.901	49.099
	BELLAIRE	320.000	8.660	300.029	339.971
COD	FLUSH	336.667	8.660	316.696	356.637
	WHITE ROSE	433.333	8.660	413.363	453.304
	BLUE SEAL	316.667	8.660	296.696	336.637
	BELLAIRE	.833	.034	.754	.912
DETERGENTS	FLUSH	.873	.034	.794	.952
	WHITE ROSE	.867	.034	.788	.946
	BLUE SEAL	.833	.034	.754	.912
	BELLAIRE	.003	.003	-.003	.010
MERCURY	FLUSH	.000	.003	-.007	.007
	WHITE ROSE	.003	.003	-.003	.010
	BLUE SEAL	.003	.003	-.003	.010
	BELLAIRE	.000	.003	-.007	.007
CADMIUM	FLUSH	.003	.003	-.003	.010
	WHITE ROSE	.003	.003	-.003	.010
	BLUE SEAL	.003	.003	-.003	.010

4.9.8 Multiple Comparisons (LSD- Post hoc) Of Industrial Entities For Commercial Service providers

Continuation of results for the commercial service providers

Dependent Variable	(I) LOCATION	(J) LOCATION	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
NITRATE	BELLAIRE	FLUSH	-12.0000*	.04714	.000	-12.1087	-11.8913
		WHITE ROSE	-1.0000*	.04714	.000	-1.1087	-.8913
		BLUE SEAL	-9.2000*	.04714	.000	-9.3087	-9.0913
	FLUSH	BELLAIRE	12.0000*	.04714	.000	11.8913	12.1087
		WHITE ROSE	11.0000*	.04714	.000	10.8913	11.1087
		BLUE SEAL	2.8000*	.04714	.000	2.6913	2.9087
	WHITE ROSE	BELLAIRE	1.0000*	.04714	.000	.8913	1.1087
		FLUSH	-11.0000*	.04714	.000	-11.1087	-10.8913
		BLUE SEAL	-8.2000*	.04714	.000	-8.3087	-8.0913
	BLUE SEAL	BELLAIRE	9.2000*	.04714	.000	9.0913	9.3087
		FLUSH	-2.8000*	.04714	.000	-2.9087	-2.6913
		WHITE ROSE	8.2000*	.04714	.000	8.0913	8.3087
AMMONIA	BELLAIRE	FLUSH	.0135*	.00106	.000	.0111	.0160
		WHITE ROSE	-.0012	.00106	.301	-.0036	.0013
		BLUE SEAL	.0078*	.00106	.000	.0054	.0103
	FLUSH	BELLAIRE	-.0135*	.00106	.000	-.0160	-.0111
		WHITE ROSE	-.0147*	.00106	.000	-.0171	-.0123
		BLUE SEAL	-.0057*	.00106	.001	-.0081	-.0033
	WHITE ROSE	BELLAIRE	.0012	.00106	.301	-.0013	.0036
		FLUSH	.0147*	.00106	.000	.0123	.0171
		BLUE SEAL	.0090*	.00106	.000	.0066	.0114
	BLUE SEAL	BELLAIRE	-.0078*	.00106	.000	-.0103	-.0054
		FLUSH	.0057*	.00106	.001	.0033	.0081
		WHITE ROSE	-.0090*	.00106	.000	-.0114	-.0066
PHOSPHATE	BELLAIRE	FLUSH	-.1286*	.00024	.000	-.1292	-.1281
		WHITE ROSE	-.4537*	.00024	.000	-.4542	-.4531
		BLUE SEAL	-.4377*	.00024	.000	-.4383	-.4372
	FLUSH	BELLAIRE	.1286*	.00024	.000	.1281	.1292
		WHITE ROSE	-.3250*	.00024	.000	-.3256	-.3245
		BLUE SEAL	-.3091*	.00024	.000	-.3096	-.3086
	WHITE ROSE	BELLAIRE	.4537*	.00024	.000	.4531	.4542
		FLUSH	.3250*	.00024	.000	.3245	.3256
		BLUE SEAL	.0159*	.00024	.000	.0154	.0165
	BLUE SEAL	BELLAIRE	.4377*	.00024	.000	.4372	.4383
		FLUSH	.3091*	.00024	.000	.3086	.3096
		WHITE ROSE	-.0159*	.00024	.000	-.0165	-.0154
NITROGEN	BELLAIRE	FLUSH	-.1832*	.00024	.000	-.1838	-.1827
		WHITE ROSE	.2481*	.00024	.000	.2475	.2487
		BLUE SEAL	.2043*	.00024	.000	.2037	.2049
	FLUSH	BELLAIRE	.1832*	.00024	.000	.1827	.1838
		WHITE ROSE	.4313*	.00024	.000	.4308	.4319
		BLUE SEAL	.3875*	.00024	.000	.3870	.3881
	WHITE ROSE	BELLAIRE	-.2481*	.00024	.000	-.2487	-.2475
		FLUSH	-.4313*	.00024	.000	-.4319	-.4308
		BLUE SEAL	-.0438*	.00024	.000	-.0444	-.0432
	BLUE SEAL	BELLAIRE	-.2043*	.00024	.000	-.2049	-.2037
		FLUSH	-.3875*	.00024	.000	-.3881	-.3870
		WHITE ROSE	.0438*	.00024	.000	.0432	.0444
TDS	BELLAIRE	FLUSH	132.0000*	.47140	.000	130.9129	133.0871

		WHITE ROSE	112.0000*	.47140	.000	110.9129	113.0871
		BLUE SEAL	29.0000*	.47140	.000	27.9129	30.0871
		BELLAIRE	-132.0000*	.47140	.000	-133.0871	-130.9129
	FLUSH	WHITE ROSE	-20.0000*	.47140	.000	-21.0871	-18.9129
		BLUE SEAL	-103.0000*	.47140	.000	-104.0871	-101.9129
		BELLAIRE	-112.0000*	.47140	.000	-113.0871	-110.9129
	WHITE ROSE	FLUSH	20.0000*	.47140	.000	18.9129	21.0871
		BLUE SEAL	-83.0000*	.47140	.000	-84.0871	-81.9129
		BELLAIRE	-29.0000*	.47140	.000	-30.0871	-27.9129
	BLUE SEAL	FLUSH	103.0000*	.47140	.000	101.9129	104.0871
		WHITE ROSE	83.0000*	.47140	.000	81.9129	84.0871
		FLUSH	-195.0000*	.47140	.000	-196.0871	-193.9129
	BELLAIRE	WHITE ROSE	-418.0000*	.47140	.000	-419.0871	-416.9129
		BLUE SEAL	-249.0000*	.47140	.000	-250.0871	-247.9129
		BELLAIRE	195.0000*	.47140	.000	193.9129	196.0871
	FLUSH	WHITE ROSE	-223.0000*	.47140	.000	-224.0871	-221.9129
ALKALINITY		BLUE SEAL	-54.0000*	.47140	.000	-55.0871	-52.9129
		BELLAIRE	418.0000*	.47140	.000	416.9129	419.0871
	WHITE ROSE	FLUSH	223.0000*	.47140	.000	221.9129	224.0871
		BLUE SEAL	169.0000*	.47140	.000	167.9129	170.0871
		BELLAIRE	249.0000*	.47140	.000	247.9129	250.0871
	BLUE SEAL	FLUSH	54.0000*	.47140	.000	52.9129	55.0871
		WHITE ROSE	-169.0000*	.47140	.000	-170.0871	-167.9129
		FLUSH	-4.0767*	.01225	.000	-4.1049	-4.0484
	BELLAIRE	WHITE ROSE	-4.7500*	.01225	.000	-4.7782	-4.7218
		BLUE SEAL	.3267*	.01225	.000	.2984	.3549
		BELLAIRE	4.0767*	.01225	.000	4.0484	4.1049
	FLUSH	WHITE ROSE	-.6733*	.01225	.000	-.7016	-.6451
PH		BLUE SEAL	4.4033*	.01225	.000	4.3751	4.4316
		BELLAIRE	4.7500*	.01225	.000	4.7218	4.7782
	WHITE ROSE	FLUSH	.6733*	.01225	.000	.6451	.7016
		BLUE SEAL	5.0767*	.01225	.000	5.0484	5.1049
		BELLAIRE	-.3267*	.01225	.000	-.3549	-.2984
	BLUE SEAL	FLUSH	-4.4033*	.01225	.000	-4.4316	-4.3751
		WHITE ROSE	-5.0767*	.01225	.000	-5.1049	-5.0484
		FLUSH	.2430*	.00047	.000	.2419	.2441
	BELLAIRE	WHITE ROSE	.1980*	.00047	.000	.1969	.1991
		BLUE SEAL	.1230*	.00047	.000	.1219	.1241
		BELLAIRE	-.2430*	.00047	.000	-.2441	-.2419
	FLUSH	WHITE ROSE	-.0450*	.00047	.000	-.0461	-.0439
ZINC		BLUE SEAL	-.1200*	.00047	.000	-.1211	-.1189
		BELLAIRE	-.1980*	.00047	.000	-.1991	-.1969
	WHITE ROSE	FLUSH	.0450*	.00047	.000	.0439	.0461
		BLUE SEAL	-.0750*	.00047	.000	-.0761	-.0739
		BELLAIRE	-.1230*	.00047	.000	-.1241	-.1219
	BLUE SEAL	FLUSH	.1200*	.00047	.000	.1189	.1211
		WHITE ROSE	.0750*	.00047	.000	.0739	.0761
		FLUSH	-202.0000*	29.02489	.000	-268.9315	-135.0685
	BELLAIRE	WHITE ROSE	578.6667*	29.02489	.000	511.7351	645.5982
		BLUE SEAL	606.6667*	29.02489	.000	539.7351	673.5982
EC		BELLAIRE	202.0000*	29.02489	.000	135.0685	268.9315
	FLUSH	WHITE ROSE	780.6667*	29.02489	.000	713.7351	847.5982
		BLUE SEAL	808.6667*	29.02489	.000	741.7351	875.5982

		BELLAIRE	-578.6667*	29.02489	.000	-645.5982	-511.7351
	WHITE ROSE	FLUSH	-780.6667*	29.02489	.000	-847.5982	-713.7351
		BLUE SEAL	28.0000	29.02489	.363	-38.9315	94.9315
		BELLAIRE	-606.6667*	29.02489	.000	-673.5982	-539.7351
	BLUE SEAL	FLUSH	-808.6667*	29.02489	.000	-875.5982	-741.7351
		WHITE ROSE	-28.0000	29.02489	.363	-94.9315	38.9315
		FLUSH	.3667*	.06880	.001	.2080	.5253
	BELLAIRE	WHITE ROSE	-2.8267*	.06880	.000	-2.9853	-2.6680
		BLUE SEAL	-2.1167*	.06880	.000	-2.2753	-1.9580
		BELLAIRE	-.3667*	.06880	.001	-.5253	-.2080
	FLUSH	WHITE ROSE	-3.1933*	.06880	.000	-3.3520	-3.0347
NITRITES		BLUE SEAL	-2.4833*	.06880	.000	-2.6420	-2.3247
		BELLAIRE	2.8267*	.06880	.000	2.6680	2.9853
	WHITE ROSE	FLUSH	3.1933*	.06880	.000	3.0347	3.3520
		BLUE SEAL	.7100*	.06880	.000	.5513	.8687
		BELLAIRE	2.1167*	.06880	.000	1.9580	2.2753
	BLUE SEAL	FLUSH	2.4833*	.06880	.000	2.3247	2.6420
		WHITE ROSE	-.7100*	.06880	.000	-.8687	-.5513
		FLUSH	4.6667	3.12694	.174	-2.5441	11.8774
	BELLAIRE	WHITE ROSE	-4.0000	3.12694	.237	-11.2107	3.2107
		BLUE SEAL	-5.3333	3.12694	.126	-12.5441	1.8774
		BELLAIRE	-4.6667	3.12694	.174	-11.8774	2.5441
	FLUSH	WHITE ROSE	-8.6667*	3.12694	.024	-15.8774	-1.4559
BOD		BLUE SEAL	-10.0000*	3.12694	.013	-17.2107	-2.7893
		BELLAIRE	4.0000	3.12694	.237	-3.2107	11.2107
	WHITE ROSE	FLUSH	8.6667*	3.12694	.024	1.4559	15.8774
		BLUE SEAL	-1.3333	3.12694	.681	-8.5441	5.8774
		BELLAIRE	5.3333	3.12694	.126	-1.8774	12.5441
	BLUE SEAL	FLUSH	10.0000*	3.12694	.013	2.7893	17.2107
		WHITE ROSE	1.3333	3.12694	.681	-5.8774	8.5441
		FLUSH	-16.6667	12.24745	.211	-44.9093	11.5760
	BELLAIRE	WHITE ROSE	-113.3333*	12.24745	.000	-141.5760	-85.0907
		BLUE SEAL	3.3333	12.24745	.792	-24.9093	31.5760
		BELLAIRE	16.6667	12.24745	.211	-11.5760	44.9093
	FLUSH	WHITE ROSE	-96.6667*	12.24745	.000	-124.9093	-68.4240
COD		BLUE SEAL	20.0000	12.24745	.141	-8.2427	48.2427
		BELLAIRE	113.3333*	12.24745	.000	85.0907	141.5760
	WHITE ROSE	FLUSH	96.6667*	12.24745	.000	68.4240	124.9093
		BLUE SEAL	116.6667*	12.24745	.000	88.4240	144.9093
		BELLAIRE	-3.3333	12.24745	.792	-31.5760	24.9093
	BLUE SEAL	FLUSH	-20.0000	12.24745	.141	-48.2427	8.2427
		WHITE ROSE	-116.6667*	12.24745	.000	-144.9093	-88.4240
		FLUSH	-.0400	.04853	.434	-.1519	.0719
	BELLAIRE	WHITE ROSE	-.0333	.04853	.512	-.1453	.0786
		BLUE SEAL	.0000	.04853	1.000	-.1119	.1119
		BELLAIRE	.0400	.04853	.434	-.0719	.1519
	FLUSH	WHITE ROSE	.0067	.04853	.894	-.1053	.1186
DETERGENTS		BLUE SEAL	.0400	.04853	.434	-.0719	.1519
		BELLAIRE	.0333	.04853	.512	-.0786	.1453
	WHITE ROSE	FLUSH	-.0067	.04853	.894	-.1186	.1053
		BLUE SEAL	.0333	.04853	.512	-.0786	.1453
		BELLAIRE	.0000	.04853	1.000	-.1119	.1119
	BLUE SEAL	FLUSH	-.0400	.04853	.434	-.1519	.0719
		WHITE ROSE	-.0333	.04853	.512	-.1453	.0786

		FLUSH	.0033	.00408	.438	-.0061	.0127
	BELLAIRE	WHITE ROSE	.0000	.00408	1.000	-.0094	.0094
		BLUE SEAL	.0000	.00408	1.000	-.0094	.0094
		BELLAIRE	-.0033	.00408	.438	-.0127	.0061
	FLUSH	WHITE ROSE	-.0033	.00408	.438	-.0127	.0061
MERCURY		BLUE SEAL	-.0033	.00408	.438	-.0127	.0061
		BELLAIRE	.0000	.00408	1.000	-.0094	.0094
	WHITE ROSE	FLUSH	.0033	.00408	.438	-.0061	.0127
		BLUE SEAL	.0000	.00408	1.000	-.0094	.0094
		BELLAIRE	.0000	.00408	1.000	-.0094	.0094
	BLUE SEAL	FLUSH	.0033	.00408	.438	-.0061	.0127
		WHITE ROSE	.0000	.00408	1.000	-.0094	.0094
		FLUSH	-.0033	.00408	.438	-.0127	.0061
	BELLAIRE	WHITE ROSE	-.0033	.00408	.438	-.0127	.0061
		BLUE SEAL	-.0033	.00408	.438	-.0127	.0061
		BELLAIRE	.0033	.00408	.438	-.0061	.0127
	FLUSH	WHITE ROSE	.0000	.00408	1.000	-.0094	.0094
CADMIUM		BLUE SEAL	.0000	.00408	1.000	-.0094	.0094
		BELLAIRE	.0033	.00408	.438	-.0061	.0127
	WHITE ROSE	FLUSH	.0000	.00408	1.000	-.0094	.0094
		BLUE SEAL	.0000	.00408	1.000	-.0094	.0094
		BELLAIRE	.0033	.00408	.438	-.0061	.0127
	BLUE SEAL	FLUSH	.0000	.00408	1.000	-.0094	.0094
		WHITE ROSE	.0000	.00408	1.000	-.0094	.0094

Based on observed means.
The error term is Mean Square(Error) = 2.500E-005.
*. The mean difference is significant at the .05 level.

4.9.9 Results For Commercial LDC Service Providers

The researcher saw it better to conclude eight parameters which included Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Nitrate, and Total Phosphate PH. Cadmium(CD), Detergents , Mercury (Hg).

NITRATE

There was a significant difference among the four commercials for nitrates, ($F(3, 8) = 31929.00$, $p<0.00$, $n^2p=106.43$ (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with Flush (M=49.63) and Blue seal (M= 46.83) having more nitrates in waste water (Table 23) than White house (M=38.63) and Bellaire (M= 37.63). The result indicates that the highest was

Flus dry cleaning outlet with a mean of 49.63 with Flush dry cleaning, followed by Blue seal with a mean of 46.83, White rose with a mean of 38.63, and the lowest, Bellaire with a mean of 37.63.

TOTAL PHOSPHATE

There was a significant difference among the four commercials for phosphates, (F (3, 8) =1810040.59, $p<0.00$, $n^2p=0.15$ (Table 21). Post hoc testing (Table 22) revealed no significance difference between pairs of industrial entities with Bellaire (M= 0.32) and White house (M=0.03) having more phosphates in waste water (Table 23) than Flush (M=0.02) and Blue seal (M= 0.02). The result showed that the highest being Bellaire cleaning outlet with a mean of 0.32, followed by Whiterose with a mean of 0.03, Blue Seal and Flush with a mean of 0.02 and a mean of 0.02 respectively.

pH

There was a significant difference among the four commercials for pH, (F (3, 8) =94337.43, $p<0.00$, $n^2p=21.23$ (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with White house (M=9.98) and Flush (M=9.31) having high levels of alkalinity in waste water (Table 23) than Bellaire (M= 5.23) and Blue seal (M= 4.91). The result showed that the highest was Whiterose cleaning outlet with a mean of 9.98, followed by Flush with a mean of 0.03, Bellaire with a mean of 5.23, and Blue seal with a mean of 4.91.

BOD

There was a significant difference among the four commercials for BOD, (F (3, 8) =4.14, $p<0.00$, $n^2p=60.78$ (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with Blue seal (M= 44.00) and White house (M=42.67) having more BOD in waste water (Table 23) than Bellaire (M= 38.67) and Flush (M=34.00). The observed trend was that the highest

mean 44.00 seen Whiterose seal cleaning outlet, followed by Whiterose with a mean of 042.67, Bellaire with a mean of 38.67, and Flus with a mean of 34.00.

COD

There was a significant difference among the four commercials for COD, (F (3, 8) = 40.54, $p<0.00$, $n^2p=9122.22$ (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with White house (M=433.33) and Flush (M=336.67) having more COD in waste water (Table 23) than Bellaire (M= 320.00) and Blue seal (M= 316.67). The findings showed that the highest mean 433.33 was with Whiterose dry cleaning outlet, followed by Flush with a mean of 336.67, Bellaire with a mean of 320.00, and Blue Seal with a mean of 316.67.

DETERGENTS

There was no significant difference among the four commercials for detergents, (F (3, 8) =0.39, p=0.76, $n^2p=0.01$ (Table 21). Post hoc testing (Table 22) revealed no significance differences between pairs of industrial entities with Blue seal (M= 0.93), White house (M=0.87), and Flush (M=0.87) having more detergents in waste water (Table 23) than Bellaire (M= 0.83). The observed trend of 0.93 was the highest with Blue Seal, a mean of 0.87 with Whiterose, a mean of 0.87 with Flush, and the lowest mean of 0.83 with Bellaire.

CADMIUM

There was no significant difference among the four commercials for Cadmium, (F (3, 8) =0.33, p=0.802, $n^2p=8.33$ (Table 21). Post hoc testing (Table 22) revealed no significance difference between pairs of industrial entities with White house (M=0.003), Blue seal (M= 0.003), and Flush (M=0.003) having more cadmium in

waste water (Table 23) than Bellaire (M= 0.00). From the findings, the highest mean 0.003 was with Whiterose, Blue Seal, and Flush respectively while with Bellaire the mean was 0.000.

MERCURY

There was no significant difference among the four commercials for Mercury, (F (3, 8) =0.33, p=0.802, n^2p=8.33 (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with Bellaire (M= 0.003), White house (M=0.003), and Blue seal (M= 0.003) having more mercury in waste water (Table 23) than Flush (M=0.00). For Mercury, 0.003 was the highest with Bellaire, Whiterose, and Blue Seal respectively and 0.000 mean was noticed with Flus.

EC

There was a significant difference among the four commercials for electrical conductivity of waste water, (F (3, 8) =397.23, p<0.00, n^2p=501967.44 (Table 21). Post hoc testing (Table 22) revealed no significance difference between pairs of industrial entities with Flush (M=1633.00) and Bellaire (M= 1431.00) having high EC in waste water (Table 23) than White house (M=852.33) and Blue seal (M= 824.33).

NITROGEN

There was a significant difference among the four commercials s for nitrogen, (F (3, 8) =1383540.36, p<0.00, n^2p=0.12 (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with Flush (M=1.18) and Bellaire (M= 1.00) having more nitrogen in waste water (Table 23) than Blue seal (M= 0.79) and White house (M=0.75).

AMMONIA

There was a significant difference among the four commercials for ammonia, (F (3, 8) =85.97, p<0.00, n^2p=0.00 (Table 21). Post hoc testing (Table 22) revealed no

significance difference between pairs of industrial entities with Bellaire (M= 28.08) and Flush (M=24.75) having more ammonia in waste water (Table 23) than Blue seal (M= 22.50) and White house (M=22.45).

TDS

There was a significant difference among the four commercials for TDS, (F (3, 8) =36530.25, p<0.00, n^2p=12176.75 (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with Bellaire (M= 1653.33) and Blue seal (M= 1623.33) having more TDS of water (Table 23) than White house (M=1540.33) and Flush (M=1520.33).

ALKALINITY

There was a significant difference among the four commercials for alkalinity, (F (3, 8) =266967.00, p<0.00, n^2p=88989.00 (Table 21). Post hoc testing (Table 22) revealed no significance difference between pairs of industrial entities with Blue seal (M= 1456.33) and White house (M=1625.33) having highier levels of alkalinity in waste water (Table 23) than Flush (M=1402.33) and Bellaire (M= 1207.33).

ZINC

There was a significant difference among the four commercials for Zinc, (F (3, 8) =101574.00, p<0.00, n^2p=0.034 (Table 21). Post hoc testing (Table 22) revealed a significance difference between pairs of industrial entities with Bellaire (M= 0.44) and Blue seal (M= 0.31) having more Zinc in waste water (Table 23) than White house (M=0.24) and Flush (M=0.19).

NITRITES

There was a significant difference among the four commercials for nitrites, (F (3, 8) =1037.79, p<0.00, n^2p=7.37 (Table 21). Post hoc testing (Table 22) revealed a

significance difference between pairs of industrial entities with White house (M=3.67) and Blue seal (M= 2.96) having more nitrites in waste water (Table 23) than Bellaire (M= 0.84) and +Flush (M=0.47).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This section summarizes the results of the study under the study objectives.

5.1.1 Cleaning Procedures Used by Laundry and Dry Cleaning Service Providers in Kisumu City

A minority (18%) of commercial LDC service providers practiced mending, 55% practiced starching and 45% practiced bluing. For the HSP, 11% were able to read and interpret care labels, 2% practiced mending, 4% practiced stain removal and none of them practiced starching and bluing. Sorting, soaking, washing, rinsing, drying, ironing/pressing, and storage were common LDC procedures practiced by household and commercial service providers. However, there were other procedures with varying percentages of adoption. This was an indication that there were no standard procedures followed by both categories of LDC service providers.

5.1.2 Levels of Consumer Satisfaction with Laundry and Dry Cleaning Services

Satisfaction is an individual feeling toward a product acquired or from the services received. Consumer satisfaction is a key objective in most service operations due to the benefits that it brings to individuals or organizations. Most (89%) of household consumers were satisfied with the general cleanliness of the laundered or dry cleaned clothes, 89% with a personal relationship with the service providers, 73% with a mode of communication, and 86% with tearing prevention whereas the majority (88%) with of shrinkage of the cloth , 87%with presence of creases,86% presence of stains 53% with packaging, 63% with the repair process, 59% with storage, 66% with fading

of fabric, 86% with the general outlook of environment, 52% with retention of color, 66% with burnt articles, and 86% with the inability to remove a stain. Extreme satisfaction were seen in reliability at 62% and accessibility at 79% and extreme dissatisfaction was in dress code at 79% by HSP. Commercial LDC consumers showed satisfaction in almost all aspects ranging from 53% to 88%. Dissatisfaction was only seen in three aspects which were repair of clothes at 60%, price charge at 60%, and dress code at 66%. Aggregate satisfaction of household consumers was low as compared to those of commercial consumers and aggregate dissatisfaction of household consumers were also higher than those of commercial consumers. The study looked at different aspects that make the consumer be satisfied or dissatisfied. The findings were that commercial LDC consumers were found to be satisfied with most LDC aspects with over 50% while most household LDC consumers were dissatisfied with most aspects with over 50%. This was further supported when most households' LDC consumers recommended further training for the LDC service providers. Studies by Michael *et al.*(2008), Shelly and Lakhwinder (2002), Shaffer (2008) Eskildsen and Dahlgaard (2000), Yung *et al*., (2006), and Poku *et al*. (2013) mentioned the benefits of consumer satisfaction and Jiao (2013), The National Business Research Institute (2016), Terhi (2013), Rothbard and Wilk (2011), Suree (2007) and Weeraya (2009) pointed out factors that influence consumer satisfaction. In summary, the study looked at aspects that could lead to consumer satisfaction/dissatisfaction while from the literature review, the different authors looked at the benefits of consumer satisfaction and factors that influence consumer satisfaction. Factors that influence consumer satisfaction such as price, accessibility, reliability, personal relationship, mode of communication, and general outlook of the working environment were found to be similar to some of the consumers' rating levels

of satisfaction in the study. This could be since consumer behaviour is the same in all regions of the world. Levels/stages of satisfaction differed from one individual consumer to another. In LDC, a consumer got satisfaction with different aspects and at different stages and this was why there were different percentages on different aspects, for example, one could be satisfied with the way his or her clothes were dried up and the other person could be satisfied with the way his or her clothes were ironed.

5.1.3 Awareness and Practices of Laundry and Dry Cleaning Service Providers towards Environmental and Self-Protection during Laundry and Dry Cleaning

Sustainable development goal number six is aimed at safe clean water and sanitation, composed of six major targets designed to ensure that by 2030 the goal should be achieved. The study established that the majority (73%) of the commercial and 83% of the household LDC service providers were not aware of sustainable development goal number six which was focusing on clean water and sanitation. This was shown by more than two-thirds (73%) of commercial LDC service providers stating that they were not aware of the SDG six goals and only 27% were aware. For household LDC service providers, only 17% reported being aware of SDG six as compared to 83% who reported being unaware.

SDG Six is a worldwide plan that was initiated to promote healthy living to all living creatures. Sanitation is a state of well- being and the observation of environmental hygiene practices and as the study found that a greater percentage of both household and commercial LDC service providers were not aware of SDG Six which the implication could be that they would not be in a position to have clean safe water and sanitation. This could also impact the environment negatively as they were more likely to dispose of wastes carelessly as well as not able to manage clean safe water

and sanitation. The majority of both commercial and household LDC service providers were not knowledgeable on the components of SDG six at 82% and 94% respectively. This was simply due to the vast majority reporting being unaware of SDG six. Comparing the proportion of the service providers unawareness of SDG six and the proportion of those who were not knowledgeable of the components of SDG six, the study observed that for the CSP, unawareness of SDG Six was 73% and for those who were not knowledgeable were 82% while for the HSP, unawareness was at 83% and those who were not knowledgeable were 94%.

For the HSP, those who were unaware of the SDG Six were seen to be higher than those who were unaware of the CSP by 10% and those who were not knowledgeable for the CSP were 82% and those who were not knowledgeable by the HSP were at 94%. The higher percentage of those who were not knowledgeable about the SDG Six components and those who were unaware of the SGD Six for both HSP and CSP was a clear indication that even those who were aware of the SDG six were not knowledgeable of the components, a finding that puts derailment on the realization of clean water and better sanitation.

5.1.4 Waste Disposal Practices Used by the Laundry and Dry Cleaning Service Providers in Kisumu City

The wastes that were generated during LDC services were for commercial service providers, 100% stated cases of dirty water, 36% stated lint, 82% stated waste solvents, 45% stated melted buttons, 64% stated spotting residue and 91% stated soil particles while for household LDC service providers, 100% reported cases of dirty water, none stated lint, 6% stated water solvents, none stated melted buttons, none stated spotting residue and 100% stated soil particles. The most common waste

generated for the two categories was dirty water at 100% and soil particles at 91% and 100% respectively. The Environmental protection agency, 2005, ChemTrac, 2010, Alemayehu, 2004 and the Ministry of Health, 2016 listed LDC waste as filter contents waste, filter and button trap contents waste, waste from water separator cleaning, spent filter waste, cartridge waste, separator water waste, chemicals, pressing waste, items pressing and equipment cleaning and maintenance operation produce waste, sludge, urine-diverting dry toilet waste, septic tank waste, domestic sewage waste, industrial waste, domestic sewage waste and industrial waste which were all different from those produced by LDC service providers in Kisumu City.

The study established that for the commercial service providers, 55% of the cases poured waste water on the compound, 45% wrapped the waste in papers/polythene bags for collection by City council workers, 73% poured waste water into the drainage and the household service providers, 51% of the cases burned their waste, 56% buried their waste, 98% poured waste water on the compound, 79% poured waste into the toilet and 96% used waste water for mopping. For both categories, there were varied ways of disposing of the stated wastes which were exactly what was practiced by LDC service providers on the ground.

The findings showed that most commercial LDC service providers knew how to dispose of the LDC waste while most household LDC service providers did not have waste disposal knowledge. This was also supported by the observation checklist, table 10, where the general cleanliness of the work place for the commercial service providers was either very clean/clean while for the household service providers was fairly clean/dirty, for the commercial service providers, waste disposal practices were fair compared to that of the household service providers which was poor as evidenced

in Table 4.1 and 4.2 respectively. There were varied ways of disposing of the waste produced by the two categories which could be due to a lack of standard regulations that govern LDC service providers' waste management practices.

5.1.5 Levels of Wastewater Physical-Chemical Parameters Disposed of from Laundry and Dry Cleaning Services in Relation to Environmental Pollution in Kisumu City

Table 5.1: Comparison of the Study Results from Households Effluents Discharges from Nyalenda A, Manyatta A, Korando B, and Bandani with NEMA/WHO Standards.

PARAMETERS	UNIT	NEMA/WHO STANDARDS OF DISCHARGE INTO ENVIRONMENT.	RANGE OF RESULTS FROM THE LAB (VALUE)	REMARKS
PH	pH Scale	6.5-8.5	7.39 – 8.17	All the analyzed parameters were within NEMA/ WHO standards for environmental discharges. Very high pH or very low pH (acidic) is not preferred due to corrosion and danger to aquatic life.
BOD	mgO/l	30	28.83 – 38.00	Most of the analyzed parameters were above the discharge levels to the environment hence further treatment is necessary before discharge
COD	mgO/l	50	305.83 -390.83	Almost all of the analyzed parameters were above the discharge levels to the environment hence further treatment is necessary before discharge to the environment.
NITRATE	mg/l	20	22.50 -28.80	All the analyzed parameters were above the discharge levels to the environment hence further treatment is necessary before discharge
NITRITE	mg/l	1	2.8 -3.4	All the analyzed parameters were above the discharge levels to the environment hence further treatment is necessary before discharge
TOTAL PHOSPHATE	mg/l	-	0.304 -0.392	All the analyzed parameters were within both the NEMA/WHO standards for both public sewer and environmental discharges

Nb: the effluent water must be further treated to be directly discharged into the environment though can be discharged to a public sewer. Most of the analysed parameters do not meet the who std of effluent discharge to the environment hence further measures must be taken to neutralise them

Table 5.2: Comparison of the Study Results from Commercial Effluents Discharges from Bellaire, Blue Seal, Flush, and White Rose with NEMA/WHO Standards.

PARAMETERS	UNIT	(NEMA/WHO STANDARDS) DISCHARGE INTO ENVIRONMENT	RANGE OF RESULTS FROM THE LAB (VALUE)	REMARKS
PH	pH SCALE	6.5-8.5	4.91 -9.98	Acidic or basic effluents were not fit to be discharged into the environment or public sewer. Very high pH or very low pH (acidic) is not preferred due to corrosion and danger to aquatic life.
Detergent (MBAS)	mgCaCO3/l	Nil	0.83 – 0.93	All the analyzed parameters were within the discharge levels to both the sewer and environment hence further treatment is not necessary before discharge.
BOD	mgO/l	30	34.00 – 44.00	All the analyzed parameters were above the discharge levels to the environment hence further treatment is necessary before discharge
COD	mgO/l	50	316.67 -433.33	Almost all of the analyzed parameters were above the discharge levels to the environment hence further treatment is necessary before discharge to the environment.
Mercury(Hg)	mg/l	0.0	0.000 – 0.003	All the analyzed parameters were within both the NEMA/WHO standards for environmental discharges. Mercury is a very toxic element that poses threat to utero and early life. Toxic to the central and peripheral nervous system. It can also cause neurological and behavioral disorders
Cadmium(Cd)	mg/l	0.01	0.000 – 0.003	All the analyzed parameters were within NEMA/WHO standards for environmental discharges. High levels of cadmium result in kidney problems and it's also carcinogenic.
Nitrate (NO3)	mg/l	20	37.63 – 49.63	All the analyzed parameters were above the NEMA/WHO standards for environmental discharges
Total Phosphate(TP)	mg/l	30	0.53 - 0.98	All the analyzed parameters were within both the NEMA/WHO standards for environmental discharges

NB: the effluent water must be further treated to be directly discharged into the environment though can be discharged to a public sewer. Most of the analysed parameters do not meet the who std of effluent discharge to the environment hence further measures must be taken to neutralise them

The study's major concern was the maximum levels of discharge from the selected parameters. For the households, the results were as follows: For nitrate, the mean ranges between22.50 – 28.80, for total phosphates the mean range was between 0.304 -0.392, for pH, the mean was between 7.39 -8.17 for nitrites, the mean was between 2.8 – 3.4 while for BOD, the mean was between 28.83 -38.00 and lastly, the mean for COD was between 305.83 -390.83.

Similarly, for the commercial LDC service providers, the results were as follows: For nitrate, the mean was between37.63 -49.63, for Total Phosphate, the mean was between 0.02 -0.32, and for the PH, the mean was between4.91 -9.98 and foe BOD, the mean was between34.00 -44.00 while for COD, the mean was between 316.67 – 433.33, and for detergents, the mean was between 0 .83 -0.93 while for the Cadmium the mean was between 0.000 -0.003 and lastly the mean of Mercury was between 0.000 -0.003.

Wastewaters always contain some elements which could either have high levels of discharge or low levels of discharge to the environment or the public sewer. When the levels of discharge are higher than that of NEMA/WHO standards, the effects on the environment are negative, and if within NEMA/WHO, the effects are positive and hence good for the environment. Most of the findings for the household effluent discharge levels were above NEMA/WHO standards for discharge to the environment while most of the commercial effluent discharges were found to be within the NEMA/WHO standards. High nitrates when compared with NEMA/WHO hence was found to be associated with a lot of dissolved organic matter within the laundry effluent. The high presence of nitrates was due to the use of detergents and disinfectants in the LDC. High levels of nitrate could be carcinogenic; the guideline

values of nitrite had not been fixed since nitrite was unstable and could be easily converted to nitrate. though high levels of nitrite values were found to be above 1mg/l which could result in high levels of nitrate which is carcinogenic.

Similarly, the effluents from the commercial LDC services were analyzed and the findings were as follows: PH values were found to be acidic or basic that were not fit to be discharged into the environment or public sewer. Very high pH or very low pH (acidic) was not preferred due to corrosions and danger to aquatic lives; detergents (MBAS) parameters analyzed were found to be within the discharge levels standards for both sewer and environment hence no further treatment was necessary before discharge. BOD values were found to be above the discharge levels to the environment hence further treatment was necessary before discharge; COD values were above the discharge levels to the environment hence further treatment was necessary before discharge to the environment; mercury(Hg) values were found to be within both NEMA/WHO standards for both public sewer and environmental discharges. Detergents were also found to be associated with the production of foul smell, polluting the air and consequently making the environment non-habitable, other elements /parameters were also found to be corrosive when produced above NEMA/WHO standards, a condition that makes them not suitable to be discharged directly to the environment without being treated. Most of the household's parameters were found to be above the effluents standards by NEMA/WHO and hence could have a negative impact on the environment whereas most sampled parameters from the commercial outlets were found to be within the effluents standards by NEMA/WHO and could impact the environment positively.

Mercury is a very toxic element that poses threat to utero and early life. In addition, it is toxic to the central and peripheral perverse system and could also cause neurological and behavioural disorders; Cadmium (CD) values were found to be within both the NEMA/WHO standards for both public sewer and environmental discharges. High levels of cadmium could result in kidney problems and it's also carcinogenic; nitrate (NO_3) was established to be of high levels which were associated with a lot of dissolved organic matter within the LDC effluent. The high presence of nitrates was due to the use of detergents and disinfectants in the laundry. High levels of nitrate can be carcinogenic, and lastly, total phosphate values were within both the NEMA/WHO standards for both public sewer and environmental discharges. From these findings, it was found that most parameters from households were above the effluent discharge standards of NEMA/WHO and hence were either acidic or basic or carcinogenic or corrosive or toxic which could be unsuitable for both human, aquatic life and even to the environment while almost all the parameters from the commercial outlets were found to be within the effluents discharge standards of NEMA/WHO. These findings agree with what is in the literature review where we find Han, Abel, Akkanen, and Werner (2017) associating wastewater effluent with pollution and damage to aquatic life. They said that the polluted water when passed into agricultural farms contaminates crops which usually end-up as food for human consumption and hence endangering life.

5.2 Conclusions

The study established that LDC service providers did not follow standard recommended procedures used when carrying out LDC services. Some LDC service providers skipped some very key procedures during the cleaning process. It was found that the commercial LDC service providers were more knowledgeable about LDC

procedures when carrying out LDC services and general understanding of fabrics characteristics and structures as compared to the household LDC service providers who did not have knowledge on LDC procedures and no understanding of fabric characteristics and structures. With knowledge and understanding of fabric characteristics and fabric structures, commercial service providers were found to be offering satisfactory services to consumers in nearly all the aspects of LDC services as compared to the household LDC service providers despite the fact that they were also not following the recommended standards of LDC procedures fully.

Some commercial LDC consumers however had dissatisfaction with aspects such as prices charged, accessibility, repair, and reliability offered by commercial LDC service providers. Consumers of the household LDC service providers were generally not satisfied with the services they obtain from household LDC service providers as the majority recommended further training on household LDC service providers.

Satisfaction/dissatisfaction of consumers varied from one consumer to another and with different LDC aspects as well. A greater percentage of both household and commercial LDC service providers were not aware of SDG Six. The majority of both commercial and household LDC service providers were not knowledgeable on the components of SDG six at 82% and 94% respectively. For the HSP, those who were unaware of the SDG Six were seen to be higher than those who were unaware of the CSP by 10% and those who were not knowledgeable for the CSP were 82% and those who were not knowledgeable by the HSP were at 94%. The higher percentage of those who were not knowledgeable about the SDG Six components and those who were unaware of the SGD Six for both HSP and CSP was a clear indication that even those who were aware of the SDG six were not knowledgeable on SDG Six

components, a finding that puts derailment on the realization of clean water and better sanitation.

The most common waste generated was dirty water for the two categories at 100% and the soil particles for the two categories at 91% and 100% respectively. The Environmental protection agency (2005), ChemTrac (2010), Alemayehu (2004), and Ministry of Health (2016) listed LDC waste as; filter contents waste, filter and button trap contents waste, waste from water separator cleaning, spent filter waste, cartridge waste, separator water waste, chemicals, pressing waste, items pressing and equipment cleaning and maintenance operation produce waste, sludge, urine-diverting dry toilet waste, septic tank waste, domestic sewage waste, and industrial waste. The study established that 55% of the commercial service providers poured waste water on the compound, 45% wrapped the waste in papers/polythene bags for collection by City council workers and 73% poured waste water into the drainage and for the household service providers, 51% of the cases burned their waste, 56% buried their waste, 98% poured waste water on the compound, 79% poured waste into the toilet and 96% used waste water for mopping. The findings showed that most commercial LDC service providers used better methods for disposing of waste while most household LDC service providers used wrong methods of waste disposal though, for both categories, there were varied ways of disposing of the stated wastes.

The levels of waste water chemical parameters disposed of from LDC services from both commercial and household LDC service providers had a negative impact on the general environment and aquatic life. The low and/or high PH values of the effluents were dangerous to the aquatic life due to their corrosive nature, while chemicals like nitrate, cadmium, and nitrite that were discharged above the minimum standards set

by NEMA and WHO were carcinogenic, and both biological oxygen demand (BOD) and chemical oxygen demand (COD), were also discharged in great quantities that were detrimental to the environment. The use of LDC agents, detergents, and disinfectants was posing a threat to the environment. The effluent was to be further treated to be directly discharged into the environment though could be discharged to a public sewer. Most of the analyzed parameters for the household did not meet the NEMA/WHO standard of effluent discharge to the environment hence further measures were to be taken to neutralize them while most of the analyzed parameters for commercial LDC meet NEMA/WHO standards.

5.3 Recommendations

1. Laundry and dry-cleaning service providers are trained on matters that are related to LDC procedures.
2. Training Institutions to organize seminars /road shows to educate consumers on their rights and responsibilities concerning LDC services.
3. Government training Institutions should educate LDC service providers on matters that are related to SDG Six.
4. Government to put in place standard regulations that govern LDC service providers on waste management practices.

5.4 Suggestions for Further Research

1. A similar study in other Cities in Kenya like Nairobi, Nakuru, and Eldoret.
2. A similar study in rural areas within the country.
3. Further study can be done to test the components of water disposed of other establishments in Kenya, such as hotels, hospitals, and Institutions to determine its effect on the environment.

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APPENDICES

Appendix I: Questionnaire for the Laundry and Dry Cleaning Service Provider(s).

Dear Participant,

I am a Masters student from University of Eldoret conducting a research entitled "An assessment of laundry and dry cleaning practices among household and commercial service providers in Kisumu City." I therefore request you to spare a few minutes of your time and answer the following questions as honestly as possible. The responses you give will strictly be used for the purpose of this study. Once you have completed the questionnaires, kindly hand them back to me.

Thank you in advance.

Instructions

- **Do not write your name anywhere on this questionnaire**
- **Tick the answer where applicable, or**
- **Write the answers on the spaces provided**

PART A

1. LOCATION

1.1 Location of interview……..

2. SOCIAL DEMOGRAPHIC INFORMATION

Please tick or write where possible

2.1. Gender: Male [ ] Female [ ]

2.2. Age: Below 18 [ ] 18-35 [ ] 36-50 [ ] 51-60 [ ] 61 and above [ ]

2.3 .Marital status

Married [ ] Separated [ ] Single [ ] Widow [ ] Divorced [ ] Widower [ ]

2.4. Nationality: Kenyan [ ] other (specify)……....

2.5. Highest Level of education attained

Primary [ ] Secondary [ ] Tertiary [ ] Never went to school [ ]

2.6. For how long have you practiced laundry and dry cleaning services?

Less than a year [ ] 1-3 years [ ] 4-6 years [ ] 7-9 years [ ] 10 years and above [ ]

2.7. Type of laundry and dry cleaning. Commercial [ ] Household [ ]

2.8. Position in LDC outlet/household…….....

PART B

Q1. What exactly do you do during Laundry and dry-cleaning procedures? Tick all that apply.

a) Receiving garments [ ]

b) Mending [ ]

c) Stain removal [ ]

d) Sorting [ ]

e) Soaking [ ]

f) Washing [ ]

g) Rinsing [ ]

h) Starching [ ]

i) Bluing [ ]

j) Drying [ ]

k) Ironing/pressing [ ]

l) All of the above [ ]

Q2. a. How often do you practice the following Laundry procedures?

NO.	Practices	Always	Very frequently	Occasionally	Rarely	Never
1.	Repair					
2.	Sorting					
3.	Reading & interpreting care labels					
4.	Spotting					
5.	Soaking					
6.	Washing					
7.	Rinsing					
8.	Drying					
9.	Folding					
10.	Ironing					
11.	Pressing					
13	Storing					
14.	Other (specify)					

b. How often do you practice the following dry cleaning procedures?

No.	Practices	Always	Very frequently	Occasionally	Rarely	Never
1.	Emptying the pockets					
2.	Repair					
3.	Reading care labels					
4.	Sorting					
5.	Tagging					
6.	Spotting					
7.	Dry cleaning					
8.	Rinsing					
9.	Drying					
10.	Folding					
11.	Ironing					
12.	Pressing					
13.	Storing					
14.	Other (specify)					

Q3. Match the following fibers to their correct properties.

FIBERPROPERTIES

Cotton	Bad conductor of heat
Polyester	Excellent resiliency
Silk	Good conductor of heat
Wool	Excellent resistance to bleaches
Linen	Strongest natural fiber
Nylon	High natural luster

Q4. Indicate the ideal way of laundering the following fabrics.

i. Firm woven/knitted fabrics (white cotton and linen) …….....
.....……
…...

ii. Loose woven / knitted fabrics (loose colored cotton and linen) …….
…….....

iii. Felts fabrics…….....
……

Q5. Indicate the procedures of laundry and dry cleaning in the right sequence……
……

…….

…...

Q6. How do you prevent the following during laundry and dry cleaning?

i. Shrinking……...

ii. Tearing …….

iii. Fading……

…

iv. Stretching……..

Q7. How would you remove the following stains?

i. Tea (from white cotton and linen) ……

……

…

ii. Blood (from all washable fabrics) ……

……

……

iii. Oil (from all washable fabrics) ……

…….....

.....

iv. Rust (from cotton and linen) ……

……

…

v. Biro pen ink (from non-washable fabrics) ……

……

……

Q 8. What do the following symbols stand for?

Care Symbol	What Care Symbol and Instructions Mean
	
	
	
	
	
	
	
	
	
	

Q9. How often do you face the following challenges when carrying out laundry and dry cleaning services?

No.	Parameter	Always	Very frequently	Occasionally	Rarely	Never
1.	Interpretation of care labels					
2	Tools & Equipment					
3.	Detergents					
4.	Space for drying out					
5.	Space for disposing waste					
6.	Skin problems					
Itching						
Dryness						
Rashes						
7	Reaction by the detergents					
8	Posture problems					
Standing						
Bending						
Sitting						
Squatting						
9	Finance					
10	Source of water					

11.	Others (specify)					

PART C: Awareness and Practices of Laundry and Dry Cleaning Service Providers towards Environmental and Self Protection during LDC.

Q1. A. Are you aware of the Sustainable Development Goals (SDG)? Yes [ ] No [ ]

B. Do you know the components of SDG 6? Yes [ ] No [ ]

Q2. Are you aware that uncontrolled waste disposal is likely to cause environmental contamination? Yes [ ] No [ ]

Q3. Have you noticed any change on the environment where you usually dispose your laundry and dry cleaning wastes? Yes [ ] No [ ]

Q4. To what extent do you feel the necessity to practice safe waste disposal while doing laundry and cleaning?

Great extent [ ] To an extent [ ] Less extent [ ] No necessity at all [ ]

Q5. Lack of safe waste disposals mechanisms compromises the achievement of Sustainable Development Goal (SDG) in Kisumu City

Great extent [ ] To an extent [ ] Less extent [ ] No necessity at all [ ]

Q6. To what extent do you strive to use the minimum water possible while doing laundry and dry cleaning laundry?

Great extent [ ] To an extent [ ] Less extent [ ] No necessity at all [ ]

PART D: Waste Disposal

1. **What kind of waste do you get from your Laundry and Dry cleaning procedures?**
   a. Dirty/waste water [ ]
   b. Lint [ ]
   c. Waste solvents [ ]
   d. Melted buttons [ ]

e. Spotting residues [ ]

f. Soil particles [ ]

g. Others

(specify)…… …..…

…..…….

Q 2. What method (s) do you use to dispose the wastes that are produced during laundry and dry cleaning procedures? Tick all that apply.

a. Burning [ ]

b. Burying [ ]

c. Incinerating [ ]

d. Pouring waste water on the compound [ ]

e. Pouring waste water into the toilet/latrine [ ]

f. Pouring waste water on the drainage [ ]

g. Wrapping and waiting collection by the city council [ ]

h. Selling to metal dealers worn out tools and equipment [ ]

i. Pouring waste chemical into the drainage [ ]

j. Using waste water for mopping [ ]

k. Other

(specify)……

……...

PART E: Levels of wastewater physical chemical parameters disposed off from LDC

NO.	Parameters	Levels of wastewater physical chemical properties	NEMA/WHO Recommended STDS	Pollution Caused by the parameter	Remarks
1.	Ph				
2.	Nitrate				
3.	Nitrite				
4.	Total phosphate				
5.	BOD				
6.	COD				
7.	Detergents				
8.	Mercury				
9.	Cadmium				

Appendix II: Observation Checklist for Laundry and Dry Cleaning Service Provider(s)

1. Gender of service provider (s) Male [ ] Female [ ]
2. Ventilation in the Laundry and Dry cleaning room/area. Adequate [ ] Inadequate [ ]
3. Size of room/space allocated for Laundry / Dry cleaning: Adequate [ ] Inadequate [ ]
4. Work Layout: Good [ ] Average [ ] Fair [ ] Poor [ ]
5. General cleanliness of the work place: Very clean [ ] Clean [ ] fairly clean [ ] Dirty [ ] Very dirty [ ]
6. Storage of clean clothes: Very good [ ] Good [ ] Fair [ ] Poor [ ]
7. Personal protective equipment available in the laundry and dry cleaning room/ area Mask [ ] Gloves [ ] Overalls [ ] Dustcoats [ ] Boots [ ] Goggles [ ] Apron [ ] Cape [ ] Closed shoes [ ]

   Others

   (Specify) ……
8. Ways of disposing waste. Very good [ ] Good [ ] Fair [ ] Poor [ ] Very poor [ ]
9. Water source: Tapped [ ] Well [ ] Dam [ ] River/Stream [ ] Borehole [ ] Lake [ ] Rainwater [ ] Vendors [ ]
10. Tools and equipment used. Adequate [ ] Inadequate
11. Any written instructions for handling apparels, textiles or waste disposal Yes [ ] No [ ]
12. Availability of water. Available [ ] Not available [ ]
13. Water safety. Safe [ ] Unsafe [ ]

Appendix III: Questionnaire for the Commercial Laundry and Dry Cleaning Consumers

Dear Participant,

I am a Masters student from University of Eldoret conducting a research entitled "An assessment of laundry and dry cleaning practices among household and commercial service providers in Kisumu City." I therefore request you to spare a few minutes of your time and answer the following questions as honestly as possible. The responses you give will strictly be used for this study. Once you have completed the questionnaires, kindly hand them back to me.

Thank you in advance.

Instructions

- **Do not write your name anywhere on this questionnaire**
- **Tick the answer where applicable, or**
- **Write the answers on the spaces provided**

PART A

1.0 LOCATION

1.1 Location of interview……

2.0 SOCIAL DEMOGRAPHIC INFORMATION

Please tick or write where possible

2.1 **Gender:** Male [ ] Female [ ]

2.2. Age: Below 18 [ ] 18-35 [ ] 36-50 [ ] 51-60 [ ] 61 and above [ ]

2.3. Nationality: Kenyan [ ] other (specify)……..

2.4. Marital status

Married [ ] Separated [ ] Single [ ] Widow [ ] Divorced [ ] Widower [ ]

2.5. Level of education

Primary [ ] Secondary [ ] Tertiary [ ] Never went to school [ ]

2.6. Level of monthly income

[1.] Less than 10,000[ ] [2.] 10,000-19,000[ ] [3.] 20,000-29,000[ ] [4.] 30,000 and above [ ]

PART B

1. Which aspects of laundry and dry cleaning services are you satisfied with?

   .....

   ...

2. As a consumer, do you always get laundry and dry cleaning services at the right time?

   Yes [ ] No [ ]

3. a). Do you have any complaints about the laundry and dry cleaning Service Providers?

   Yes [ ] No [ ]

   b). If Yes in a) above, list the type of complaints…….

   ……

   ……

   c). Are the service provider(s) ready to listen to the complaints listed above?

   Yes [ ] No [ ]

   d). If NO, state reasons? .....

4. What challenges do you face as a consumer with the laundry and dry cleaning services.....
...?
5. Rate the competency level of your L & D service provider in cleaning your apparels/other textile items.
   i. Very competent [ ]
   ii. Competent [ ]
   iii. Needs further training [ ]
6. Rate the extent to which you are satisfied with Laundry and dry cleaning services based on the aspects listed in the table below?

PARAMETER	EXTREMELY SATISFIED	SATISFIED	DISSATISFIED	EXTREMELY DISSATISFIED
General cleanliness of the laundered or dry cleaned cloth				
Absence of stain				
Absence of creases				
Packaging				
Delivery				
Personal relationship with the service provider(s)				
Repair of clothes				
Storage				
Absence of fading to the clothes				
Absence of shrinkage to the clothes				
Price charged				
General outlook of the working environment				
Dress code of the service provider				
Reception				
Reliability				
Accessibility				
Mode of				

communication				
Retention of color				
Tearing				
Burnt article(apparel/textile)				

Appendix IV: Questionnaire for the Household Laundry and Dry Cleaning Consumers

Dear Participant,

I am a Masters student from University of Eldoret conducting a research entitled "An assessment of laundry and dry cleaning practices among household and commercial service providers in Kisumu City." I therefore request you to spare a few minutes of your time and answer the following questions as honestly as possible. The responses you give will strictly be used for this study. Once you have completed the questionnaires, kindly hand them back to me.

Thank you in advance.

Instructions

- **Do not write your name anywhere on this questionnaire**
- **Tick the answer where applicable, or**
- **Write the answers on the spaces provided**

PART A

1.0. LOCATION

l. Location of interview……

2.0.**SOCIAL DEMOGRAPHIC INFORMATION**

Please tick or write where possible

2.1 Gender: Male [ ] Female [ ]

2.2. Age: Below 18 [ ] 18-35 [ ] 36-50 [ ] 51-60 [ ] 61 and above [ ]

2.3. Nationality: Kenyan [ ] other (specify)……..

2.4. Marital status

Married [ ] Separated [ ] Single [ ] Widow [ ] Divorced [ ] Widower [ ]

2.5. Highest Level of education attained

Primary [ ] Secondary [ ] Tertiary [ ] Never went to school [ ]

2.6. Level of monthly income

[1]. Less than 10,000[ ] [2.] 10,000-19,000 [ ] [3.] 20,000-29,000[ ] [4.] 30,000 and above[ ]

PART B

1. Which aspects of laundry and dry cleaning services are you satisfied with?

.....

2. As a consumer, do you always get laundry and dry cleaning services at the right time? Yes [ ] No [ ]

3. a). Do you have any complaints about the services offered by laundry and dry cleaning Service Providers?

Yes [ ] No [ ]

b). If Yes in a) above, list the type of complaints……

……

c). Are the service provider(s) ready to listen to the complaints listed above?

Yes [ ] No [ ]

d). If NO, state reasons? .....

4. What challenges do you face as a consumer with the laundry and dry cleaning services.....?

5. Rate the competency level of your LDC service provider in cleaning your apparels/other textile items.

i. Very competent [ ]

ii. Competent [ ]

iii. Needs further training [ ]

6. Rate the extent to which you are satisfied with Laundry and dry cleaning services based on the aspects listed in the table below?

ASPECTS	EXTREMELY SATISFIED	SATISFIED	DIS-SATISFIED	EXTREMELY DISSATISFIED
General cleanliness of the laundered or dry cleaned cloth				
Absence of stain				
Absence of creases				
Packaging				
Personal relationship with the service provider(s)				
Repair of clothes				
Storage				
Absence of fading to the clothes				
Absence of shrinkage to the clothes				
General outlook of the working environment				
Dress code of the service provider				
Reliability				
Accessibility				
Mode of communication				
Loss of colour				
Tearing				
Burnt article (apparel/textile)				

Appendix V: Kisumu City 2009 Population and Housing Census Figures

	2009 POPULATION AND HOUSING CENSUS FIGURES				2016 PROJECTIONS			2018 PROJECTIONS			2019 PROJECTIONS		
	MALE	FEMALE	TOTAL	HOUSE HOLDS	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
DISTRICT: KISUMU EAST	**235676**	**237973**	**473649**	**115502**	**272582**	**275238**	**547820**	**284150**	**286919**	**571069**	290118	292945	**583063**
DIVISION: WINAM	***206424***	***205899***	***412323***	***102508***	***238748***	***238141***	**476889**	***248882***	***248248***	***497130***	254108	253462	**507570**
LOCATION: TOWN	**20344**	**20987**	**41331**	**10162**	**23530**	**24273**	**47803**	**24528**	**25304**	**49832**	25043	25835	**50878**
SUBLOCATIONS													
KALOLENI	6933	7873	14806	3658	8019	9106	**17125**	8359	9492	**17851**	8535	9692	**18226**
SOUTHERN	4729	4434	9163	2476	5470	5128	**10598**	5702	5346	**11048**	5821	5458	**11280**
NORTHERN	4804	4935	9739	2107	5556	5708	**11264**	5792	5950	**11742**	5914	6075	**11989**
BANDARI	3878	3745	7623	1921	4485	4331	**8817**	4676	4515	**9191**	4774	4610	**9384**
LOCATION: KONDELE	**40211**	**42366**	**82577**	**21419**	**46508**	**49000**	**95508**	48482	51080	**99561**	49500	52152	**101652**
SUBLOCATIONS													
MANYATTA 'A'	23503	24501	48004	12525	27183	28338	**55521**	28337	29540	**57877**	28932	30161	**59093**
NYAWITA	7526	7221	14747	4099	8705	8352	**17056**	9074	8706	**17780**	9264	8889	**18154**
MIGOSI	9182	10644	19826	4795	10620	12311	**22931**	11071	12833	**23904**	11303	13103	**24406**
LOCATION: KOLWA WEST	**45237**	**43414**	**88651**	**24439**	**52321**	**50212**	**102533**	54541	52343	**106885**	55687	53443	**109129**
SUBLOCATIONS													
NYALENDA 'B'	16189	16241	32430	8561	18724	18784	**37508**	19519	19581	**39100**	19929	19993	**39921**
NYALENDA 'A'	14829	13440	28269	8070	17151	15545	**32696**	17879	16204	**34083**	18254	16545	**34799**
MANYATTA 'B'	14219	13733	27952	7808	16446	15883	**32329**	17144	16558	**33701**	17504	16905	**34409**
LOCATION: KISUMU CENTRAL	**10482**	**8021**	**18503**	**3773**	**12123**	**9277**	**21400**	12638	9671	**22309**	12903	9874	**22777**
SUBLOCATIONS													
KORANDO 'A'	7366	4691	12057	2406	8519	5426	**13945**	8881	5656	**14537**	9068	5775	**14842**
KORANDO 'B'	3116	3330	6446	1367	3604	3851	**7455**	3757	4015	**7772**	3836	4099	**7935**

(Source: Kenya National Bureau of Statistics,2009)

Appendix VI: Guideline Values for Discharge into Public Sewers

PARAMETER	UNIT	GUIDLINE VALUE
PH	Ph	6.0-9.0
BOD (5 days at 20°C)	max mgO 2/l	500
COD	max mgO 2/l	1000
Colour	H azen units	<40
Temperature	max °C	20-35
Total suspended solids (TSS)	mg/l	250
Total non-volatile solids,	max mg/l	2000
Phenols	max mg/l	10
Detergents	mg/l	l 15
Oils/Grease,	where conventional treatment shall be used mg/l 10	10
Oils/Grease	where ponds is the final treatment mg/l	5
Ammonia Nitrogen	mg/l	20
Smell-substances that will be obnoxious to smell shall not be discharged into sewer	Nil	Nil
Arsenic (As)	mg/l	0.02
Cadmium (Cd)	mg/l	0.5
Cyanide	max mg/l	2.0
Copper (Cu),	max mg/l	1.0
Mercury (Hg),	max mg/l	0.05
Alkyl Mercury	max mg/l	0
Phosphates mg/l	max mg/l	30
Free and saline Ammonia as Nitrogen (N-N4/NH4)	max mg/l	4.0
Nickel (Ni)	max mg/l	3.0
Nitrates (NO3),	max mg/l	20
Lead (Pb)	max mg/l	1.0
Sulphide (S2-)	max mg/l	2.0
Phenols	max mg/l	10
Selenium (Se)	max mg/l	0.2
Zinc (Zn)	max mg/l	5.0
Total non-ferrous metal	max mg/l	10
Chlorides (Cl-)	max mg/l	1000

(Source: The Environmental Management and Co-ordination (Water Quality) Regulations, 2006)

N/B: The following chemicals should not be discharged into sewers: Calcium Carbide, Chloroform, condensing water, Degreasing solvents, radioactive residues, Inflammable solvents and substances likely to interfere with sewers

Appendix VII: Guideline Values for Discharge into the Environment

Parameter	Unit	Guideline value
1,1,1-trichloroethane	mg/l	3
1,1,2-trichloroethane	mg/l	0.06
1,1-dichloroethylene	mg/l	0.2
1,2-dichloroethane	mg/l	0.04
1,3-dichloropropene	mg/l	0.02
Alkyl Mercury compounds	mg/l	Nil
Ammonia, Ammonium compounds	mg/l	-
Arsenic	mg/l	0.02
Arsenic and its compounds	mg/l	0.1
Benzene	mg/l	0.1
PH	mg/l	6.5-8.5
BOD (5 days at 20ıC)	mg/l	30
COD,	mg/l	50
Temperature, max OC +3oC of ambient	mg/l	30
temperature of the	mg/l	30
water body	mg/l	
Boron	mg/l	1.0
Boron and its compounds – non marine	mg/l	10
Boron and its compounds – marine	mg/l	30
Cadmium	mg/l	0.01
Cadmium and its compounds	mg/l	0.1
Carbon tetrachloride	mg/l	0.02
Chromium VI	mg/l	0.05
Chloride	mg/l	250
Chlorine free residue	mg/l	0.1
Chromium total	mg/l	2
Cis-1,2-dichloro ethylene	mg/l	0.4
Copper	mg/l	1.0
Dichloromethane	mg/l	0.2
Dissolved Iron	mg/l	10
Dissolved Manganese	mg/l	10
E.coli Counts/100ml	mg/l	Nil
Flouride	mg/l	1.5
Flouride and its compounds (marine and non-marine)	mg/l	1.5
Lead	mg/l	0.01
Lead and its compounds mg/l 0.1	mg/l	0.1
n-Hexane extracts (animal and vegetable fats)	mg/l	30
Oil and grease	mg/l	Nil
Phenols	mg/l	0.001
Selenium	mg/l	0.01
Selenium and its compounds	mg/l	0.1

Hexavalent Chromium VI compounds	mg/l	0.5
Sulphide	mg/l	0.1
Simazine	mg/l	0.03
Total Suspended Solids	mg/l	30
Tetrachloroethylene	mg/l	0.1
Thiobencarb	mg/l	0.1
Thiram	mg/l	0.06
Total coliforms Counts	mg/l	30
Total Cyanogen mg/l ND	mg/l	Nil
Total Nickel	mg/l	0.3
Total Dissolved Solids	mg/l	1200
Colour Hazen Units (H.U)	Hazen	15
Detergents	mg/l	Nil
Total Mercury	mg/l	0.005
Trichloroethylene	mg/l	0.3
Zinc	mg/l	0.5
Whole effluent toxicity	mg/l	0
Total Phosphorous	mg/l	2
Total Nitrogen	mg/l	2

(Source: The Environmental Management and Co-ordination (Water Quality) Regulations, 2006)

N/B: The following chemicals should not be discharged to any watercourse: Calcium Carbonate, Chloroform, Condensing water, degreasing solvents

Appendix VIII: Letter of Introduction from University of Eldoret

University of Eldoret
flame of knowledge and innovation

P. O. Box 1125 - 30100, Eldoret, Kenya
E-mail: hod fcs@uoeld.ac.ke
Website: www.uoeld.ac.ke

DEPARTMENT OF FAMILY & CONSUMER SCIENCES

29Th November, 2019

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE:INTRODUCTORY LETTER FOR MATTHEWS ODEK (AGR/PGF/005/14)

This is to confirm that the above named is a student registered in the M. Sc Apparel and Fashion Design Program in the Department of Family & Consumer Sciences here at the University of Eldoret. As part of the requirements for the degree program, he is expected to carry out a research in his field of study. The title of his research proposal is 'An Assessment of Laundry and Dry cleaning practices among house-holds and commercial service providers in Kisumu City, Kenya.'

Kindly allow him to collect this data.

Sincerely,

DR. GERTRUDE M. WERE
AG. HEAD, DEPARTMENT OF FAMILY & CONSUMER SCIENCES

Appendix IX: Research Permit from NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **715552**

Date of Issue: **09/January/2020**

RESEARCH LICENSE

This is to Certify that Mr.. MATTHEWS ODEK of University of Eldoret, has been licensed to conduct research in Kisumu on the topic: AN ASSESSMENT OF LAUNDRY AND DRY CLEANING PRACTICES AMONG HOUSEHOLD AND COMMERCIAL SERVICE PROVIDERS IN KISUMU CITY, KENYA for the period ending : 09/January/2021.

License No: **NACOSTI/P/20/3221**

715552

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix X: Research Authorization from the County Government of Kisumu City

REPUBLIC OF KENYA

THE COUNTY GOVERNMENT OF KISUMU

Office of the County Secretary, Head of County Public Service and Secretary to the Executive Committee

CGK/CS/ADM/14/VOL.I/19 **24th January 2020**

MATTHEWS ODEK
ELDORET UNIVERSITY

REASEARCH AUTHORIZATION

This is to inform you that the County Government of Kisumu has authorized you to conduct an academic research within the County on the topic; **"An Assessment of Laundry and Dry-cleaning Practices Among Household and Commercial Service Providers in Kisumu City".**

This research is in partial fulfilment of the award of Master Degree. The period to conduct this research will last up to 09 January 2021.

HAGGAI H. KADIRI
FOR: COUNTY SECRETARY

Prosperity House (Former Nyanza Provincial Headquarters Building) 2nd Floor
P.O. Box 2738-40100 Kisumu. E-mail: countysecretary@kisumu.go.ke

Appendix XI: Research Authorization from Ministry of Education

REPUBLIC OF KENYA

MINISTRY OF EDUCATION
State Department of Early Learning & Basic Education

Telegrams:"schooling",Kisumu
Telephone: Kisumu 057 - 2024599
Email: countyeducation.kisumu@gmail.com

When replying please quote

COUNTY DIRECTOR OF EDUCATION
KISUMU COUNTY
PROVINCIAL HEADQUARTERS NYANZA
3RD FLOOR
P.O. BOX 575 – 40100
KISUMU

REF: CDE/KSM/GA/3/24/ IV/92

22nd January, 2020

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION
MATHEWS ODEK– NACOSTI/P/20/3221

The above named is from University of Eldoret.

This is to certify that he has been granted authority to carry out research on ***"An Assessment of Laundry and Dry Cleaning Practices among Household and Commercial Service Providers in Kisumu City, Kenya"*** for the period ending **9th January, 2021.**

Any assistance accorded to him to accomplish the assignment will be highly appreciated.

JAIRUS AMUTALA
For: COUNTY DIRECTOR OF EDUCATION
KISUMU COUNTY

Appendix XI: Similarity test

Turnitin Originality Report

AN ASSESSMENT OF LAUNDRY AND DRY CLEANING PRACTICES AMONG HOUSEHOLD AND COMMERCIAL SERVICE PROVIDERS IN KISUMU CITY, KENYA
by Matthews Ochieng

From Theses (Theses)

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