ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

AN ASSESSMENT OF REVERSE LOGISTICS: THE CASE OF SUR CONSTRUCTION PLC

A Thesis Submitted to Addis Ababa University School of Commerce, In Partial Fulfillment of the Requirement for the Award of Master of Arts Degree in Logistics and Supply Chain Management

By

Solomon G/hiwot

June, 2018

Addis Ababa, Ethiopia

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Approved by Board of Examiners and Advisor

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Examiner	Signature	Date

DECLARATION

I, Solomon G/hiwot, hereby declare that this study entitled **'An Assessment of Reverse Logistics: The Case of Sur Construction PLC''** is original work of my own. All information in this document has been obtained and presented in accordance with academic rules of ethical conduct.

Student Researcher

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Solomon G/hiwot

Date: May, 2017

LETTER OF CERTIFICATION

This is to certify that Solomon G/hiwot has carried out her research work on the topic entitled ‘**’An Assessment of Reverse Logistics: The Case of Sur Construction plc’** as a partial fulfillment of the requirement of Master of Arts Degree in Logistics and Supply Chain Management. This study fulfills requirements to obtain academic award of Master’s Degree in Logistics and Supply Chain Management.

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Advisor: Busha Temesgen (PhD)

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ABBREVIATION AND ACRONYMS

RL	Reverse Logistics
CSCM	Council of Supply Chain Management
LDAR	Logistics Department Annual Report
CLSC	Closed Loop Supply chain
RSCM	Reverse Supply Chain Management
SPSS	Statistical Package For Social Science Studies
ERP	Enterprise Resource Planning
GSCM	Green Supply Chain Management
SR	Store Requisition
PR	Purchase Requisition
GRV	Goods Receiving Voucher
SIV	Store Issue Vouchers
SRV	Store Return Voucher
M	Mean
SD	Standard deviation

ABSTRACT

Reverse logistics is the management of the end life of product and has advantages like improvement of competitiveness, regaining values, positive environmental impact and better image for an organization. It is also a new field compared to conventional or forward logistics. As a result utilization of reverse logistics in organization like Sur Construction PLC to lesser compare to forward logistics. Some of the main problem of the company related to reverse logistics was absence of recovery like remanufacturing, lack of official management or formal return and controlling system for used materials and lack of proper disposal system in the organization simply consider all returns as scrap and forward to bid of second hand market. As result the thesis aim to assess reverse logistics in terms of its drivers, process, activities to identify the opportunities and challenges in the organization and provide practical remedy to the organization.

The study applied descriptive research design and a sample of 66 was used to represent population of 200 and gathered both qualitative from stratified random sampling using probability proportional allocation from each stratum and quantitative data a applied both combination of convenience and purposive. Data was analyzed using Statistical Package for Social Sciences and Microsoft-excel percentages, frequency tables, used to carry out those descriptive statistical analyses.

The study found that the organization had the opportunity of massive used material generated from spare parts, tyre and other packages and scraps organized informally without proper documents and with mind setup of the second hand market and poor in recovering especially remanufacturing and disposal like land filling and incineration. The main challenges to adopt Reverse logistics in the company were top management commitment and management style, weak linkage with local manufacturing and wrong perception to local product (judge as poor quality). Finally, the researcher recommends to incorporate reverse logistics in the organization structure, waste material (that couldn't recover) apply proper disposal method like land filling and incineration especially for those toxic materials like drained oil from thousands of construction equipment's, and for better recovery (remanufacturing) either the company has to own its own remanufacturing workshop like recapping machine for tyre or form strong linkage with local manufacturer in addition to adjustment of workers mindset up to local products.

Key Words: RL (Drivers, process and activities), Remanufacturing, Disposal

CHAPTER ONE: INTRODUCTION

1.1. Background of the study

Reverse logistics (RL) starts with the products moving back in the supply chain (De Brito and Dekker, 2004). Typical reverse logistics activities would be the processes a company uses to collect used, damaged, unwanted (stock balancing returns), or outdated products, as well as packaging and shipping materials from the end-user. Once a product has been returned to a company, the firm has many recapturing value or proper disposal options from which to choose. Some of these reverse logistics activities are: reuse, resell, recondition, refurbish, remanufacture, repair, and recycle, cannibalization, return to supplier, sell via outlet, salvage, reclaim materials, incineration, and landfill (Rogers and Tibben-Lembke, 1999). According to Kokkinaki (2001), reverse logistics is necessary for the following reasons:

- Advancement of Competitiveness: efficient handling of returns leads to reduced costs, increased profits and improved customer service.
- Regaining values: efficient reverse logistics can capture values from reusing products or parts or recycling materials.
- Positive environmental impact: legislations acts, also called "producer responsibility laws," require manufacturers to develop a policy for the collection and reuse of products at the end of their life cycle.

De Brito and Dekker (2004) also mentioned that companies carry on reverse logistics because of economic benefits, legislation and corporate citizenship. Economic benefits are related with decreasing the use of raw materials, decreasing waste materials, obtaining valuable spare parts and other financial opportunities like second hand market. The legislation refers to any jurisdiction indicating that a company should recover its products or take them back (Peters, 2009). Since the strict legislations about the environmental issues express the extended producer responsibility, companies are entitled to recover their products or accept them back. Lastly, an organization performs reverse logistics due to corporate citizenship, which refers to the set of values or principles that an organization holds to be responsible with RL activities. The motivations behind the implication (implementation) of RL activities lay on both being

legally obliged and trying to establish an image the consumers desires as an environmentally responsible organization (De Brito and Dekker, 2004).

RL should not be viewed as a costly side-show to normal operations; rather it should be seen as an opportunity to build competitive advantage **(**Genchev,2009). The consolidation of RL functions under the organized structure of logistics center would provide a wide range of opportunities and benefits for the organizations. Despite the interest in re-use, recycling and general environmental concerns, many industries suffer from not having a well-organized RL network that is connected to the traditional forward logistics (Ballou, 2007; Love et al., 2004).

1.2. Statement of problem

Sur Construction PLC has different departments which help to run its projects effectively & efficiently. One such a department in the organization is, therefore, the logistic department. According to the report of this department, LDAR (2016/17), among the various construction inputs, the company purchased and provided to projects are worth of birr 51million for spare parts, about birr 76 million for tyre and 26 million for oil and lubricants, etc. (http://www.sur.com.et).

The byproduct obtained from such massive amount of material purchase of the organization, like used & damaged spare parts & tyres, damaged spare part components, wastages, scraps, etc at the end of product life revealed that the company considered all types of by-products as a scrap and sold them without implementing proper reverse logistics process (recovering and disposing). This has made the company to gain insignificant economic benefit yet. They also affect the company's competitive advantages, and many more. Those facts are some of the several reasons which motive the researcher to look on reveres logistics or the backward movement and management of materials specifically in spare part, tyre and lubricants in the organization.

As per the pilot findings obtained from pilot survey conducted on the organization from reveres logistics concept perspective, the researcher identifies several gaps which the company, Sur Construction PLC, need to bridges. The first is that the absence of recovering, particularly, remanufacturing of spare parts namely bushing, rubbers, etc; recapping of tyre of heavy & light duty trucks, etc. For instance, tyre is one of the major construction inputs which the company

purchases in record numbers every year. The company has a round 5,660 pieces annual consumption and spends an amount which worth's about birr 42 million (LDAR, 2017). On top of this problem, the company has also lack of official or formal return system for used items/materials. Contrary to tight control system in material purchase, receiving, issuance and transfer, the company has no tight and official way of returning or collecting mechanism for used materials from ultimate users or consumers. As a result, at the end of project life, informally various used components are always organized from user departments for direct sales (disposed) without recovering decisions. The other problem identified as a gap is polluting the environment at various project areas. Because of lack of proper disposal system in the organization, some of its waste materials are creating a huge negative effect to the environment. Specially, replaced service components like oil filter, fuel filters and burned oil drained from hundreds of light and heavy construction equipments have always been found polluting lands/farms, and destroying the environment in many areas the company engaged. These problems are, hence, calling for a solution. This study uses the concept of reverse logistics as an approach to address these aforementioned problems practiced in the organization.

1.3. Research questions

This study attempted to answer the following questions

1. How does RL look like in Sur Construction PLC in terms of RL drivers?
2. How does RL look like in Sur Construction PLC in terms of RL processes?
3. How does RL look like in Sur Construction PLC in terms of RL activities?
4. What possible challenges are there to implement RL in Sur Construction PLC?
5. What possible prospects are there to implement RL in Sur Construction PLC?
6. What mechanisms are there to implement RL in Sur Construction PLC?

1.4. Research objectives

1.4.1. General objectives

Generally the objective of the study is to assess the reverse logistics at Sur Construction PLC and suggest practical remedy for identified problems from reveres logistics perspective.

1.4.2. Specific objectives

The specific objectives are:-

1. To examine how reverse logistics looks like in Sur Construction PLC in terms of RL drivers.
2. To examine how reverse logistics looks like in Sur Construction PLC in terms of RL processes.
3. To examine how reverse logistics looks like in Sur Construction PLC in terms of RL activities.
4. To investigate challenges in implementing reverse logistics in Sur Construction PLC
5. To investigate prospects in implementing reverse logistics in Sur Construction PLC
6. To investigate mechanisms that helps to adopt RL in Sur Construction PLC.

1.5. Significance of the study

Reverse logistics have been found playing an important role in almost any firm. Organization like Sur Construction PLC, which deploys variety and mass inputs, demands the managements of end-of-life products.

The study is believed to have number of significance.

(a). Principally, it will contribute to the efforts being made towards reducing material purchase budget, reduce inventory stock out and enhance availability. On top this, it will create better working green environment through daily practice of reverse logistics activities such as waste collection, parts collection, inspection, selection, sorting, direct recovery, reprocessing, redistribution, and disposal, refurbishing, recycle, reuse, etc. This is to say, it serves as backbone to the organization operational and strategically activities.

(b). The study is the first of its kind to be carried out in Sur Construction PLC. Accordingly, it could pave ways for further studies in the same sector as well as other business undertakings

in a more equipped manner to use existing, abundant resources effectively & efficiently. Hence, from this angle, the study can shed some light on the dynamic move of construction industry sector in most region of Ethiopia,

(c). Moreover, the study could also serve as a source of secondary data for different researchers, who are willing to conduct research in future in reverse logistics.

1.6. Scope of the study

According to Rogers and Tibben-Lembke (1999), RL is a wider concept and it covers activities, namely reuse, resell, recondition, refurbish, remanufacture, repair, recycle and cannibalization, etc. Despite its tremendous use, this study focuses on remanufacturing, reuse, disposal of return materials mainly to spare parts, tyre, and lubricants in Sur Construction PLC.

Finally, this research geographically focuses in the organization head office ,located in Addis Ababa; its branch office, located in Mekelle, a central location of ware house and workshops of the organization; and one existing and giant project Soroka-**A**brahjira asphalt road project.

1.7. Limitations of the study

The study is anticipated to have the following predicament as limitation:-

(a) Even though reverse logistics covers the flow of materials and information from point of destination to origin, this paper emphasizes only on handful of various construction inputs or materials, such as spare parts, tyre, and lubricants at organization level; and not covered the whole construction inputs and the integration with other parties involve in supply chain networks.

(b) Currently, the organization has about 10 existing and new projects. Following this, actual performance of reverse logistic like identifying, collecting, sorting, return management, reuse, wastage management has been done at project **sites** which are located too far from Addis Abeba. Finance and time are, therefore, other challenges to limit the study to head office worker at Addis Abeba, Mekelle branch and Soroka-**A**brahjira asphalt road projects.

(c) Though Sur Construction PLC is one of the biggest local construction companies and covers varies of construction activities , it will be a challenge to use the finding of the

study to generalize into the entire industry sector for different reasons, stated in (a) and (b) above.

1.8. Organization of the study

In the first chapter, brief introduction about background, problems, significance and objectives of the study was introduced and discussed. Following this, review of literature related to the concept and practice of reveres logistics from different sources had been made in chapter two. Subsequently, design of the study about data collection instrument and method of analysis was stated in the third chapter. Chapter four showed the results and discussion of the survey. Finally, following the result of the analysis, summaries and conclusions of the main findings of the study, appropriate recommendations that were done by the company and other stakeholders, had been done in the last chapter, chapter five.

CHAPTER TWO: LITERATURE REVIEW

2.2. Concepts and definition of reverse logistics

The common phenomenon of Logistics is that it moves downstream that is from supplier to manufacturer, to distributor, to retailer and finally to the Customer / Consumer, this is called Logistics or Forward Logistics. Reverse Logistics refers to the movement of goods upstream, i.e. from the end point of usage to the initiation point in order to add more value or to dispose it. Remanufacturing, Refurbishing and Recycling activities are also the part of Reverse Logistics. Reverse Logistics gain more importance now-a-days because it reduces operational cost by reusing products or services. Also by implementing efficient reverse logistics strategies companies can gain more trust of their customers which result in more business and hence it become an integral part of any business. Also company can gain both social and economic benefits by implementing reverse logistics. Reverse Logistics gained importance in companies because it reduces operating cost by reusing products or services.

Terms such as closed-loop supply chain management (CLSCM); reverse supply chain management (RSCM); green logistics and green supply chain management (GSCM); recycling; and returns management are sometimes serves as synonyms of reverse logistics.

RL is sometimes considered as a subset of Closed Loop Supply Chains (CLSC). CLSC is the integration of both the Forward Supply Chain and Backward Logistics (Blumberg, 2005).

According to Rogers et al. (2002), returns management is part of supply chain management, which includes reverse logistics. Returns management includes the informational support of the entire returns process, including arrangements for transportation and physical handling (Norek, 2002).

RL is also closely related to green logistics in terms of overlapping goals with regard to issues of reuse, manufacturing and waste disposal (Pienaar, 2009). According to the Reverse Logistics Executive Council (RLEC), green logistics attempts to measure and minimize the ecological impact of logistics activities. Green logistics is thus a part of reverse logistic

Reverse Logistics Definition:

RL has been defined as the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin, for the purpose of recapturing value or proper disposal (Rogers and Tibben-Lembke, 1999).

According to Arrieta (2015), RL is defined as the process of moving goods from the point of usage or consumption for the purpose of recapturing value, or proper disposal; including activities such as remanufacturing and refurbishing, processing of returned damaged products, seasonal inventory, recalls (return implemented because of safety or quality reasons), recycling programmers, hazardous material programmers, obsolete equipment disposition and asset recovery

The Council of Supply Chain Management Professionals (CSCMP, 2010) defines RL as a specialized segment of logistics focusing on the movement and management of products and resources after the sale and after delivery to the customer.

Depending on the type of reverse process employed, products may not necessarily be returned to their point of origin, but to a different point for recovery (De Brito and Dekker, 2003), at the same time as various authors are of the view, the entire process of RL starts at the point of consumption, However this could be misleading because RL could also start at retailers and distributors (who are not consumers of the products).

2.3. Reverse logistic processes

Roberta P. & Pier Paolo Carrus (2012) stated in Reverse Logistics and the Role of Fourth Party Logistics, the main reverse logistic processes are the following:

- Collection;
- Examination and processing;
- Re-processing or direct recovery; and
- Redistribution

Collection: is the first process that is, all those activities that are necessary for reclaiming returned products, surplus or by-products and transporting them to a point of recovery where they will be subjected to further examination and processing i.e. their quality is assessed and a decision is made on the type of recovery (Roberta P. & Pier Paolo Carrus, 2012).

Examination and processing (inspection/selection and sorting): where a decision must be reached as to whether a product (or parts of it) will be re -used, remanufactured recycled or disposed. Physical inspection is necessary for determining further processing for most commercial products (Roberta P. & Pier Paolo Carrus, 2012)..

Recovery: Once a product has been returned to a company, the firm has many disposal options from which to choose. If the quality is "as-good-as-new," products can be fed into the market almost immediately through direct recovery. Direct recovery involves three options: re-use; re-sale and re-distribution. Re-use refers to cases where returned products have such a good quality that they can be re-used almost immediately in the same or an alternative market. This happens for re-usable packages, containers and most leased or rented equipment. The second option is the re-processing that includes the following recovery options repair (at product level), refurbishing (at module level), remanufacturing (at component level), retrieval (at part level), recycling, and incineration. (Roberta P. & Pier Paolo Carrus, 2012).

Re-distribution refers to logistics activities required to introduce a product into a market and transfer it to customers (Roberta P. & Pier Paolo Carrus, 2012).

2.4. Reverse logistics activities

In reverse logistics all the activities that a company carries out to collect the used, damaged, unwanted, or outdated products, as well as packaging and shipping materials from the end-user or reseller can be considered as reverse logistics activities. Due to the diversity of products in the reverse flow, there are various alternatives of reverse logistics activities namely as; reutilization, repair, renovation, reprocessing, cannibalization or recycling (Thierry et al., 1995).

Direct reuse: In this reverse logistics process the physical and quality property of products is unchangeable. Though, it is not always feasible some of the returned products may be reused "as-is" condition for the same or different purpose without involving in production process instead with slight cleaning and limited repair (de Brito& Dekker, 2003). Examples of such products are the means of transportation; pallets, containers, packages or boxes. It is the best possible option as it involves the least energy use and no wastage of material.

Repair: is defined as the process of returning a used product to its original working condition through fixing or replacing broken parts. Transformation (repair) of the product can occur at the user or in a repair shop; it involves limited disassembly, reassembly and limited effort. Generally quality of repaired products perceived less quality those new products (Thierry et al., 1995; Diaz; Alvarez; Gonzalez 2004).

Refurbishing: Refurbishing is similar to remanufacturing, however, it brings returned products are brought up to specified quality level, less than the level of new "virgin" products. The product is disassembled into modules and after those modules are inspected they are fixed or replaced. Also upgrading the technology of the product can be associated with refurbishing. After the process the quality of the product is improved substantially (Thierry et al., 1995; Diaz; Alvarez; Gonzalez 2004).

Remanufacturing: Remanufacturing is more than refurbishing; it brings the quality of returned used items up to the quality standards of the new similar items and provides products at lower cost, and is an additional source of replacement parts (Bras & McIntosh,1999). Remanufacturing involves the removal and replacement of all high wear-and-tear parts to extend the life span of these products. It requires high level of disassembly, sorted, inspected and classified as either good or defective. Defective subassemblies are repaired, machined, or substituted with approved quality ones.

Cannibalization or Reclaim is unlike the previous options, where it uses a small proportion or limited parts of the returned unit in the recovery process or in other reverse logistics activities (i.e. repair, refurbish, remanufacture). Reclaim is the process of extracting parts from returned products, testing them, and then the good ones are reused in new products the

remaining subassemblies of the returned product are either recycled or disposed. There is no strict quality standard for cannibalization it depends on the process where parts will be reused. This practice is common in the automotive.

Recycling is the process of turning material back to its original configuration from used and non-functioning products. In the previous processes the identity and functionality of returned products are retained as much as possible. But recycling reuses the materials in production of new parts, thus the identity of product is lost. The retrieved material can be used either in the production of similar products or in different lower grade products. The success and effectiveness of recycling programs depend on the willingness of customers, their communities, and governmental legislations (Alter, 1993).

Incineration and land filling; Disposal with energy recovery makes use of the caloric value in the disposed products and reduces its volume to reduce space consumed of the landfill. Economic advantages can be gained from incineration, if the rising energy is reused. Direct disposal in the landfill, is the last and most undesirable harmful option and can be seen as an option, in case of providing no gain to the company even being involved in recovery process.

2.5. Drivers of reverse logistics practices

Commonly, organization performs reverse logistics practices mainly because of internal or external factors.

Internal drivers

Internal drivers of RL practices relate to the factors that motivate the organization to have an RL operation, by increasing revenue and profit through cost-saving initiatives (Hsu, Tan &MohamadZailani 2016; Stoyanov 2012).

Economic drivers: Traditionally, organizations had an open-loop supply chain that focused mainly on the forward flow of products and services; however, in today's organizations, incorporating RL practices into a closed-loop supply chain may allow for cost saving and revenue opportunities (Das & Dutta 2013).From an economical perspective, recover reused

products and treat them so they could enter the market again (depending on the recovery options applied to the reuse product) is most of the times cheaper than creating a whole new product (Fleischmann, 2000). Remanufacturing may have the advantage of shortening the lead-time, where the demand of spare parts is supplied by remanufacturing returned parts instead of initiating a resupply with a substantial lead-time (Minner, 2003). Different reasons why reverse logistics economically recommended are to decreasing the use of raw materials, decreasing waste materials, obtaining valuable spare parts and financial opportunities (second hand market).

Competitive drivers: RL practices allow the organization to remain competitive by reducing inventory levels through product recovery, thus reducing the organizations' inventory carrying costs (Barcos et al. 2013).

Operational performance drivers: By effectively managing RL practices, organizations can reduce transportation, waste disposal as well as inventory carrying costs (Dues, Tan & Lim 2013; Sobral, Sousa Jabbour&ChiappettaJabbour 2013).

Reducing bullwhip effect motives: In the traditional forward supply chain, the bullwhip effect is the amplification of order variance in a supply chain from a downstream stage to an upstream stage. Zhou et al. (2004) and Zhou & Disney (2006) are perhaps the only studies that discussed the bullwhip effect in a reverse logistics context. The authors showed that the returned products can reduce the bullwhip effect, experienced by absorbing demand fluctuations in the forward chain, to the extent that reverse logistics is more cost efficient than a traditional one, even if variable costs of recovery are higher than that of producing a new product.

External drivers

External drivers of RL focus on the triple bottom line, and typically enable the organization to enhance customer value perceptions (Diabat & Govindan 2011; Stoyanov 2012). The following section discusses the possible external drivers for RL practices.

Legislation: According to Thierry et al. (1995) underline the responsibility of governmental action in supporting organizations towards reuse activities. It is stated that governments could take legislative actions such as banning the disposal of certain products, and obliging companies to take back their products at the end of their use. An example would be the producer responsibility laws, which are a set of legislative acts in the European Union (EU) by which companies are responsible for collecting and reusing their products (Guide and Wassenhove, 2001).

Environmental drivers: Environmental management is a key strategic issue that has the potential of impacting organizational performance (Dey, LaGuardia & Srinivasan 2011; Diabat & Govindan 2011). Reuse, recovery and effective waste management may enable the organization to improve their image, as customers are more sensitive towards environmental issues and sustainability (Bernon et al., 2011; Zhu &Geng 2013).

Social responsibility and corporate citizenship drivers: Corporate Social Responsibility is expected by customers (Chan et al., 2012). Corporate citizenships represent this set of values that will push companies to be involved in reverse logistics (De Brito and Dekker, 2004). The motivations behind the implication of RL activities lay on both being legally obliged and trying to establish an image the consumers desires as an environmentally responsible organization.

2.6. Challenges in reverse logistics

According to Min, Kim and Ha (2006) reverse logistics is by its very nature a complex process and a specialized area of any supply chain. It does not matter what the product is, how it is sold or who the customers are; every organization needs to focus on recovering the maximum value from returns. However, the under mentioned problems to RL practices affect its proper performance.

Financial barriers on Reverse logistics: Having adequate financial funds are essential to carry out reverse logistics activities as the necessary technology, programmes, information and education are significant in reverse logistics. However, setting up an advanced technological and information systems is an expensive initiative for the businesses. The

information systems that are critical to track and trace product returns and recoveries are critical to the success of RL operations, but require large amounts of capital and resources to implement and maintain (Bernon et al. 2011).

An effective RL operation requires personnel to be trained; however, this training requires financial support that the organization may not possess or want to dedicate to RL, thus creating great difficulty in managing the RL practices (Sarkis, Zhu & Lai 2011). Education and training are major requirements for success in an organization; therefore, the more well-trained staff available, the greater the efficiency of the RL operation (Creutz & Larsson 2012).

Top managements posture and Management style on Reverse logistics: It is crucial for management to fully support reverse logistics process, however, management lacked reversed logistics policy, failed to support financial requirement of the reverse logistics process, lack of commitment to environmental issues, negative corporate attitudes towards environmental friendly activities, inadequate company culture and inconsistent top management support represent some of the internal barriers that challenges RL implementation (Zilahy, 2004 and Hillary, 2004). Additional, management may also not be committed to RL because they are not aware of the resulting benefits that could ensue (Hazen et al., 2012).

Thus this indicates that top management's posture and management styles of businesses are important to carry out activities concerning the environmental impacts, and allowing appropriate resources including RL experts to the effective performance of RL practices (Creutz& Larsson, 2012).

Costs related to reverse logistics. One of the biggest pressures on organizations with regard to reverse logistics is the internal mandate to reduce costs (Pollock, 2010). Organizations do not plan for products to 'fail' and enter the reverse logistics stream. In a perfect world, products are manufactured and sold to customers and do not become part of the reverse logistics process. Therefore, initially, reverse logistics is not considered as a revenue-generating process, which consequently results in very few resources being allocated to this part of the supply chain (Rogers & Tibben-Lembke, 2001).However, some organizations have seized the opportunity to generate income from their reverse logistics processes. The increase

in costs for processing returns is higher compared with a forward sale and it could cost up to three times more to process the reverse logistics of a new item than it would to process the forward logistics to sell it (Norman, 2007).

Insufficient information systems: Insufficient investment in information technology and a lack of information systems are major barriers to the successful management and implementation of reverse logistics (Ravi & Shankar, 2004). Many enterprise resource planning (ERP), customer relationship management (CRM) and warehouse management systems (WMS) are not set up efficiently to take back products (Norman, 2007). Most organizations live with labour-intensive, manual, inefficient, and often undisciplined reverse logistics processes (Thrikutam & Kumar, 2004). Very few organizations have successfully automated information systems in the return process, and the resources allocated to these systems are also stretched to the limit and are unavailable for reverse logistics applications (Rogers &Tibben-Lembke,1998).

Government support and policy: Government policy and financial support can play a major role in an organization's RL practices, as the lack of enforceable environmental laws established by the government reduces the incentive and motivation for organizations to perform RL practices (Ganjali et al. 2014; Ho et al. 2012). A lack of tax policies and financial support from government to subsidize RL has acted as a disincentive for organizations to invest and or collaborate in RL practices, as the products brought back into the reverse chain create high degrees of tax complexity and exposure (Abdulrahman et al. 2014). It is therefore government policy that has the greatest external influence on an organization's RL practices (Lai & Wong 2012).

Lack of functional integration: RL practices often face a challenge of functional communication and cooperation (Abdulrahman et al. 2014). Internal integration builds on the premise that various functions in the organization should work collaboratively as a single entity, ensuring that mutually acceptable outcomes are achieved and contribute to the continued success of the RL practices (Bernon et al. 2013). Differing views on the importance of RL are, however, shared; resulting in poor functional integration, as well as higher product return rates (Abdulrahman et al. 2014). If the functions that are involved in RL practices do not understand

the end goal of RL, competing goals and objectives will be set across departments (Badenhorst 2013a).

Cooperation of the Supply Chain Partners (Dealers, Distributors, and Retailers): Among the supply chain partners, cooperation and trust are the utmost important elements that need to be emphasized in SCM. Without the support of supply chain partners that the company is in relation with, it's difficult to carry out reverse logistics activities. Company return policies can facilitate the returns from customer to producer and lead to risk sharing between them (Ravi and Shankar, 2005). Non-cooperation of supply chain partners to RL practices and organizational policies are one of the main barriers to RL, and if removed, the chances of effective RL practices will be much greater (Ho et al. 2012). Considerable time, money and effort are spent on developing a complex product return system that relies on supply chain collaboration and integration to perform effectively; however, poor integration between supply chain partners can result in the return system being a key cost driver (Bernon et al. 2013).

Problems with Product Quality: Product quality plays a crucial role in reverse logistics activities because when a product is recovered or reproduced, the quality cannot be the same as a new product. The perception of poorer quality product acts as a barrier for the companies because in the eyes of customer, it is expected that the same quality level must be offered after processing the returned products. (Ravi and Shankar, 2004).

Lack of Awareness about Reverse Logistics: Researches of Post and Altman (1994), present that there is a lack of awareness about reverse logistics activities in the firms. Even if they are aware of the potential outcomes of reverse logistics activities, they are paying less attention regarding to other operational activities within the company. Consequently, the possible outcomes of reverse logistics activities are thought to be short-term and temporary

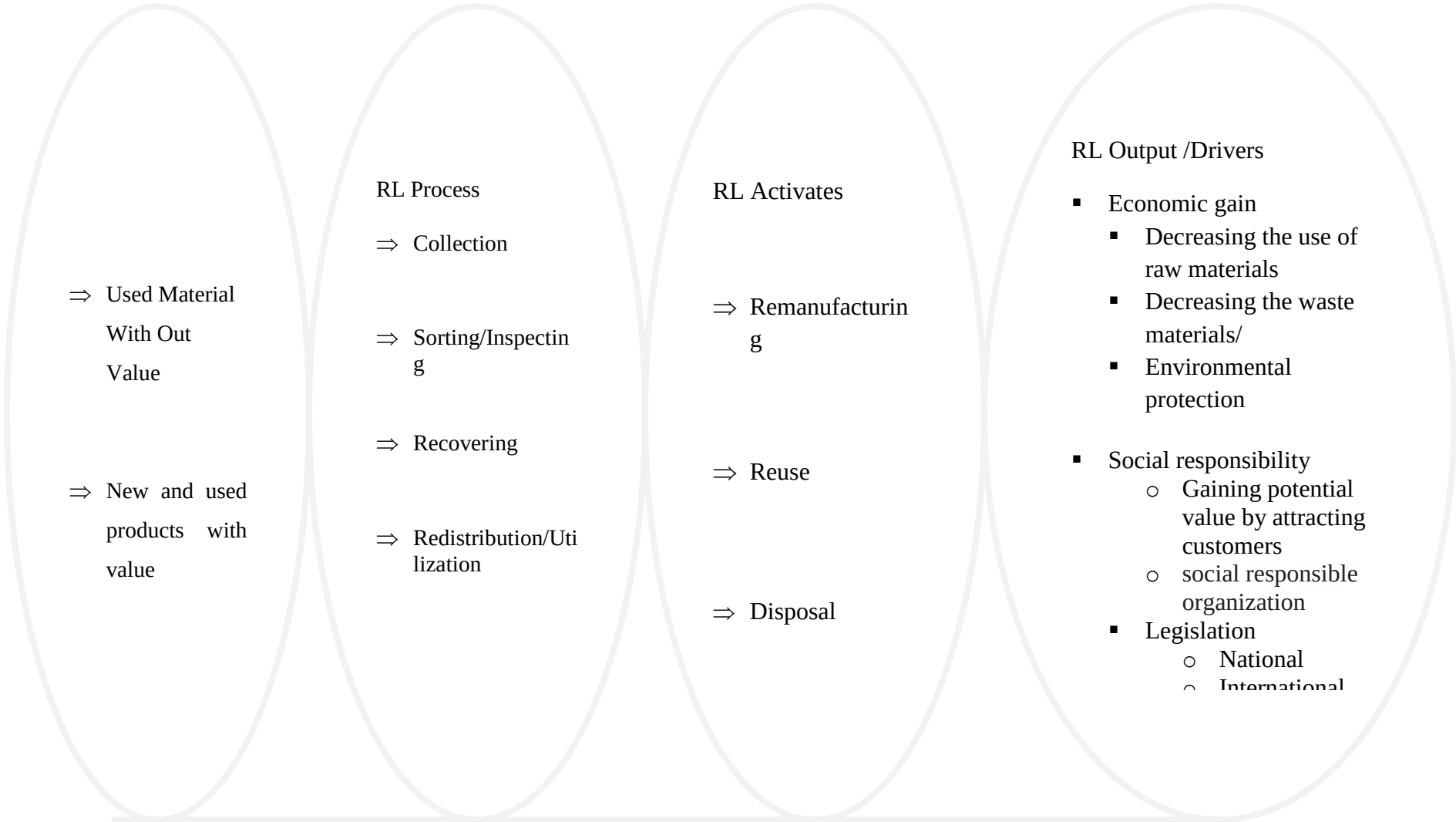
Uncertainties related to product returns: Returns come from different locations and in different conditions, with different disposal options (Richardson, 2006). A great deal of uncertainty surrounds product returns in terms of the kind of product, the quantities, when the product returns will take place, where in the supply chain the return will take place, and what the condition and quality of the returned products will be. The majority of product returns are

unplanned and therefore unpredictable (Mason, 2002). Product returns can therefore take on a wide variety of forms and can come from various organizations in the supply chain. Return processing is highly dynamic and inconsistent and is complex because it involves irregular material flows (Hart, 2008).

Lack of accurate forecasting: The lack of accurate forecasting between supply chain partners acts as a major barrier for RL because of the difficulties in planning for the quantities and diversity of products that need to flow through the reverse chain (Sharma et al. 2011). Product returns are the most common aspect of RL; however, they introduce uncertainty into the organization, as the timing, disposition, condition, quality and quantity of the returns are unknown (Badenhorst, 2013b).

Decisions that are accompanied by accurate information play an effective role in the management and improvement of product flows, and enable a more efficient and profitable RL operation (Govindan et al. 2015). Efficient information systems are capable of providing the end-to-end visibility that is needed to reduce forecasting uncertainty (Rahman & Subramanian 2012).

2.7. CONCEPTUAL FRAMEWORK



Source: Conceptual framework derived from ---Utilizing the input-processes-output (IPO) model (M. Brito, R. Dekker ,2014)

Conceptually, to adopt RL organization initially should have return material from destination that will be supposed for recovering and disposal. Similarly the conceptual frame work indicates that those used materials without value, new materials with value and used materials products with value that returned from the supply chain will be sorted and inspected properly and select and forward to appropriate recovering actions like remanufacturing, reuse and dispose. Outcomes obtained like economic benefit, social benefit and rules and regulation from environment perspectives can be also act as driving forces to adopt this RL. In general opportunities to implement RL like evaluating the volume of return, way of RL, benefit of RL and obstacles and mechanism of solving those obstacles are the objective of the study.

2.8. Reverse Logistics researches and related findings

Internationally, a number of studies have been done especially in manufacturing industries; yet, the construction industry has not kept pace in gaining the benefits of RL compared to the manufacturing industry. One reason for this might be due to the insubstantial RL literature in the construction field as opposed to the manufacturing context.

company increase the flow of returns of the product due to product recalls, warranty returns, service returns, end-of-use returns, end-of-life returns, and so on (Ravi and Shankar, 2005). A study done on the role of RL in the concept of logistics centers depicts that in general, on a global scale the value of returns is estimated to be around $43 billion per year, representing an average of 15%-20% of all goods sold (Genchev, 2009).

Research done on RL for the construction industry: lessons from the manufacturing context confirm that, implementing RL practices in the construction field may result in reusing and recycling up to 85% of the total weights of buildings. Even more, some studies have estimated that the costs of construction activities that apply RL concepts would be reduced by 30%-50% (M. Gorgolewski, 2008).

Further, in construction industries the calculations by Guy and McLendon verified that taking in to account the revenues out of reusing and reselling the recovered items and the disposal costs, overall costs of construction by implementing RL could be around 37% less than traditional demolition and sending the whole items to landfills. (B. Guy and S. McLendon, 2002).

A study done by Nawari (2006) titled: “The Effect of Reverse Logistics of an Organization: Competition, Cost and the Environment”, found that Gartner, estimation on improper handling of

return goods to be about 30-35% erode of potential profits. However, Vanderlande studies done by Stek (2012) titled: "Using reverse logistics for failed spare parts: A new opportunity for Vanderlande Industries", found that reverse logistics management had led to 54% increase in profits.

Regarding legislation, governments could take legislative actions such as banning the disposal of certain products, and obliging companies to take back their products at the end of their use (Thierry et al. 1995). However, a study done by Sirak Wondimu (2016), research made in measuring performance of reverse logistics system in PET(Polyethylene terephthalate) bottles recovery in East African Bottling Company in Ethiopia, the survey findings indicate that, no government enforcing rules and policies for companies operating in any industry to recovery post-consumer packages such as PET bottles.

A study done by Ilias P. Vlachos (2014) Reverse Food Logistics during the Product Life Cycle indicates that remanufactured products incur 40-60% less costs than new products and save 85% of the energy needed to start from scratch since remanufacturing expands the life cycle of the product (Kumar and Putnam, 2008).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Description of the Study Area

This study was conducted in SUR Construction P.L.C., whose headquarter is located in Addis Ababa and branch office in Mekelle. It is the largest and Grade one (GC-1) leading local construction company in Ethiopia which has been massively involved in the construction of all kinds of Civil Engineering Construction works comprising but not limited to all types of Roads, Universities, Commercial and Social buildings, Industrial buildings, Sport Centers, Air ports, Hydropower, Irrigation and Dam Projects**.** The research targeted to study the assessment of reverse logistics in Sur Construction PLC at head office Addis Abeba, Mekelle branch and Soroka-Abrahjira asphalt road projects especially in the management and utilization of material after once reached in the ultimate users in one of the major construction inputs know as equipment which includes Tyre, spare parts and lubricants.

3.2 Research approach

Research Approaches are study techniques employed to undertake research process, and to solve the given problem. Depending on the objective of the research, it is possible to use one of the three research approaches, namely: Qualitative, Quantitative and Mixed-Research Approaches. This study, however, adopted a Mixed-Research method as its general framework to guide the process of data collection, make analyses and interpretation of the findings.

This approach ensures the triangulation and validation of information, obtained from all the actors, during the course of data collection and analyzes different types of objectives put forward in objective.

The mixed methods research design creates a wider picture by enhancing the depth and insight given by numbers through inclusion of dialogue and narratives (O'Leary, 2010).

3.3 Research design

Research design is a master plan which provides a methods and procedure for collecting and analyzing the needed information (Bryman, 2008). Depending on the objective of the given research, it is possible to have several research designs. The study applied descriptive research design because it helps to assess and analyze the existing conditions and problems of the company to the perceptive of reverse logistics practice. Further the research design adopted a cross-sectional mixed research design; involving gathering both qualitative and quantitative data from multiple sources of information, as its general framework to guide the process of data collection, make analyses and interpretation of the findings.

3.4 Population and sample

3.4.1 Study Population

According Human resource departments of Sur Construction PLC, the company has a total of 142 management and senior permanent staffs working at various levels and departments in different locations, of which 65 work at head office level; 37 work in Mekelle, and 40 work at Soroka Abrhajira project.

The target population for this research is all company's management and senior staff members under the department of Maintenance, Equipment administration, logistics, finance and Construction who involve directly or indirectly in reverse logistics practices at head office, branch office in Mekelle and Soroka Abrhajira project.

3.4.2 Sample

Due to the nature of construction industry, majority of the employees works at different projects which are found too far from Addis Ababa, the headquarter. It is, hence, time consuming and costly to directly study all employees working in the organization. This, hence, calls for taking a

representative sample to study the underline issues in the company. The representative sample for this study, hence, encompasses part of management and senior staff members under the department of Maintenance, Equipment administration, logistics, finance and Construction taken from head office, branch office in Mekelle and Soroka Abrhajira project.

3.4.3 Sampling Technique

(a). Quantitative Study: The sample design planned to make use of for interviews of quantitative study (distributing survey questionnaire) is stratified random sampling, in which case each site, Addis Ababa, Mekelle and Soroka-Abrhajira project, is taken as stratum. Long list of the employee prepared from company profiles and used as a sample frame. Sample of employees drawn using probability proportional allocation from each stratum. The rationale for choosing this technique is its simplicity and it also gives assurance that the population is evenly sampled.

Sampling Size

The sample size determination formula adopted for this study is a simplified formula provided by Solvin's formula (Unan, 2012), which is employed to determine the required sample size., at degree of variability or level of precision for sampling error, ε=9%) for a population of size N, given as follows. The formula is:

$$n = \frac{N}{1 + N(\varepsilon^2)}$$

Where:

n = sample size

N = population size

ε = the level of precision

Given the population of $N = 142$ and level of precision for sampling error, ε=9%, the sample size that must be drawn from the population of this study can be calculated as:

$$n = \frac{N}{1 + N(\varepsilon^2)} = \frac{142}{1 + 142(0.09^2)} = 66$$

Table 3.1. Sample Size for entire study area and each stratum

S.No	Project Site (stratum)	Project Site	Number of Employee	Total Sample Size
1	Head Office	Addis Ababa	65	30=66/142*65
2	Mekelle Branch	Mekelle	37	17=66/142*37
3	Sorok-Abrahajira	Project	40	19=66/142*40
Total			142	66

(b). Qualitative Study: There are four broad techniques often used to select a sample for a qualitative study: purposive sampling technique, quota sampling technique, judgment sampling technique and convenient sampling technique. The study, therefore, used a combination of convenience and purposive

3.5 Data sources and types

Data of both qualitative and quantitative nature were collected from primary and secondary sources to address the study objectives.

Primary data: the primary data is a fresh data, which researcher collects by means of one or more of the instruments, namely structural questionnaire (interview schedule), key informal interview, etc directly from the employees in the organization to study the RL practices, challenges and opportunities, etc in this regard.

Secondary data: the secondary data is, however, obtained using document analysis method, mainly from company documents, such as approved minutes, proposal, agreement documents, and annual progress reports, public records, published/unpublished manuscript, websites, books, journals, articles, previous studies and manuals of Sur Construction PLC.

3.6 Data collection instruments

Structured Questionnaires: Structured questionnaire was designed to gather mainly quantitative data pertaining to employees' demographics & socio-economic characteristics, asset holdings practices, resource management & RL practices, etc. The data collection tools were pre-tested before use in the actual field data collection exercise. The pre-testing exercise facilitates fine-tuning of the tools by removing inconsistencies, repetitions and redundancies. One of the key aspects that were emphasized during the pre-test exercise is testing the feasibility of generating the expected study results.

Key informant interview: interviews and discussion were made with Logistics and Maintenance department head, at head office. The key informant interview and discussion assisted to complement the survey questionnaire results.

3.7 Validity and reliability

The researcher exerted maximum effort to avoid researcher's bias and respondents answer without clearly understanding the questions by developing clear instruction on the questions, and preliminary question testing and repeatedly reframing the questions. In addition, the researcher tried to contact closely the respondents for any unclear issues using contact persons, telephone and electronic mail. At the end test of reliability Cronbach's alpha was conducted as a measure of internal scale consistency using SPSS (Statistical package for social science studies).

Cronbach's alpha reliability testing:

Cronbach's Alpha is designed as a measure of internal consistency of items in the questionnaire. It varies between **zero and one**. The closer alpha is to one, the greater the internal consistency of the items in the questionnaire. Total number of questions or items in the questionnaire is 53 including 44 testing variables or LIKERT scale variables and the rest items related to demographic variables. Hence, total "N" of items in the below Cronbach's Alpha test is 42.

To test the reliability (internal consistency) for multi-questions of the research instrument/questionnaires Cronbach's alpha was computed and from the reliability statistics table (**See Table 3.2**) the obtained Cronbach's Alpha value of 0.792, 0.801**, . . .,** and 0.839 for Type of Returns/Disposal in the company, ways of return the company practices**, . . .,** and improve RL

practices respectively in which all is > 0.700. Based on Cronbach's Alpha values it can be concluded that this research instrument has high level of reliability (internal consistency).

Table 3.2.:Cronbach's Alpha-Reliability Test

Question Type	**Cronbach's Alpha**	N of Items
Volume/Extent of return	0.792	4
Extent of return control	0.801	2
Reverse Logistics Process	0.787	5
Remanufacturing	0.844	4
Reuse	0.771	3
Disposal Exercise	0.728	3
Economic motives	0.830	3
Legislation	0.867	3
Social Responsibility	0.882	2
Challenges of Reverse Logistics	0.921	8
Improve RL practice	0.839	5

3.8 Data Analysis Method

Data Analysis for Quantitative Study (Analysis of Survey questionnaires): Various statistical quantities of mainly univariate analysis are intended to instrument to address these objectives set in this baseline study. The univariate analysis is predominantly made use of simply to characterize and summarize data that was collected, using descriptive statistics, namely tables, measures of central tendency/variation (mean, standard deviation), percentages, frequency tables, etc. SPSS statistical package used to carry out those descriptive statistical analyses.

Data Analysis for Qualitative Study (Analysis of Key informant interview): There are many different types of qualitative data analysis methods though the choice of the methods will depend on researcher's research topic, researcher's personal preferences and the time, equipment and finances available to researcher. As to this study was concerned, the qualitative data obtained from key informant interviews Logistics and Maintenance department heads was audio and

translated in to English. Then, the responses were categorized under relevant themes and features that are characteristics of the majority of the respondents and eventually analyzed by content analysis.

3.9 Ethical consideration

According to Leedy & Ormrod (2010), when taking a research four thing such as protection from harm, informed consent, right to privacy, and honesty should be considered. Accordingly the data of the research collected though interview and questionnaires organized freely without challenging respondent to any physical and psychological harm. Data collected from respondents with ethical manner, smooth communication and up on their willingness and consent basis. Up on the demand of the respondent Separate places and independency maintained so as to assure and respect privacy and confidentiality of respondents, as the same time during the data collection proper explanation about the purpose of the study, benefit of the study, the chance to ask any thing about the study and chance to feel free to refuse to reply any question informed in advance to participants. Finally the researcher organized response of the participants and analyzes and reports the findings in complete and honest fashion.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND INTERPRETATION

4.1. Introduction

In the previous chapter, details were provided regarding the research design, instruments used, population, sample size, sampling method, profile of organization, data collection procedure, etc. In this chapter, the statistical analysis of data, result of the study and discussion of findings have been presented.

Data collected from the employees in the company, after cleaning and checking for completeness of the filled in questionnaire formats, were coded and entered in to SPSS Statistical Software for analysis. The descriptive data analyses were performed to address the objectives set in the study. The descriptive data analysis was predominantly used simply to calculate mainly descriptive statistics and thereby characterize the variables in the study. To this end, frequencies, percentages, means and standard deviations have been computed and discussed in-depth below. Based on the calculated sample size, total 66 questionnaires distributed 62 were returned from which 3 were not correctly filled and rejected. Therefore, 59 were effectively used for analysis that shows response rate of 89%. The questionnaire comprised of seven sections and data generated will be presented as follows: The first section, Section 4.1., comprises of respondents' demographic data such as respondent's department, their years of experience, and educational level. The second section, Section 4.2., comprises of data describing about the extent of return, extent of control and RL processes. In the third section, Section 4.3., data obtained from the analysis of RL activities will be examined. Following this section, reverse logistic strategic importance and its drivers will be analyzed and discussed in Section 4.4 and Section 4.5 respectively. Then, Challenges of RL will be discussed in Section 4.5. Finally, analysis of data on mechanisms to improve reverse logistics will be explored in Section 4.6.

4.2 Demographic characteristics of employees in the company

4.2.1 Department Distribution

Employees in the company participating in this study were summarized as outlined in the Table 4.1 below. The result shows that the vast majority of the employees, i.e., 21(35.60%)

respondents, involved in the study were from Logistics Department, and this was followed by employees from maintenance & equipment administration (Production) department, which account 17(28.81%). The remaining respondents (35.59%) were from Construction and Finance department of the company. The study was, therefore, taking into account representative number of respondents from each department in company participated to examine and address the research objectives stated in the study.

Table4.1: Number and Percentage of employees in each department in the company

Employees' Departments in the Company	Employees in the Department	Employees in Percentage
Construction	12	20.34
Production (EAD & MMD)	17	28.81
Finance	9	15.25
Logistics	21	35.59
Total	59	100.00

Source: Own Survey, 2018

4.2.2 Work Experience Distribution

The findings shown in Table 4.2 reveal that the majority or 74.58% of the respondents had worked for more than five years; 18.64% of the respondents had a work experience of one to five years and the rest were worked blow one year. This show that most of the respondents stayed in the company for long period (above five years) and this indicates that respondents were seniors matured enough in their assignment to give appropriate feedback about their organization activities.

Table 4.2 Summary of (Number and Percentage) of respondents by Work Experience

Respondents Work Experience	Frequency	Percentage
Below one year	4	6.78
1-5 years	11	18.64
5 and above	44	74.58
Total	59	100.00

Source: Own Survey, 2018

4.2.3 Respondents' Level of Education

Knowledge of the respondent's level of education is important to relate it with implementation and practice of RL activities in the organization. Table 4.3 below summarizes the educational status of respondents in the organization. According to this result, the educational level of most respondents (89.83%) working in the company was BA/B.Sc holders. The result in the table also shows that there were a handful of respondents working in the company at diploma and master levels. As majority taskforce of the employees in the organization was qualified once, having BA/B.Sc and above, the organization can, therefore, use this, its employees educational level, as an opportunity to introduce the concepts and practices of RL like conventional logistics.

Table 4.3: Summary of Respondents in the company by Educational Status

Qualification	Frequency	Percentage
Certificate	0	0
Diploma	2	3.39
BA/B.Sc	53	89.83
MA/M.Sc	4	6.78
Total	59	100.00

Source: Own Survey, 2018

Likert scale data analysis and presentation and standard definition

The researcher were intended to indicate extent of returns materials, extent of return materials control, RL process, RL activities (remanufacturing, reuse and disposal), drivers of RL (economic, enforcement of legislation and social responsibility), challenges and mechanisms to improve reverse logistics in Sur construction PLC using aspects in a five point Likert scale that is 1 was given to "no at all extent", 2 to "small extent", , 3 to 'moderate extent', 4 to 'great extent' and 5 to 'very great extent'.

The scores of 'no extent have been taken to represent a variable which had a mean score of 0 to 1.5, the scores of 'small extent have been taken to represent a variable with a mean score of 1.5 to 2.5, the score of moderate extent have been taken to represent a variable which had a mean

score of 2.5 to 3.5, the score of great extent have been taken to represent a variable which had a mean score of 3.5 to 4.5 and the score of very great extent have been taken to represent a variable which had a mean score of above 4.5. (Derived from: Oxford,R L and Burry Stocks,1995)

4.3. Extent of returns, control and RL process

4.3.1 Extent of Return Materials

Reverse logistics is the term commonly used to describe end of life product management. This means that reverse logistics is mainly concerned with return or take-back products and materials from the point of consumption to the forward supply chain for the purpose of recycling, reuse, remanufacture, repair, refurbishing or safe disposal (Carter and Ellram, 1998).

Thus, the table below depicts the type and extent of volume of end of life products or byproducts of Sur Construction PLC. Accordingly, respondents were asked to reflect their view on the extent to which the organization had generated its returns from inputs like Spare parts, tyre, lubricants, packages and others using five point Likert Scale, "1=Not at all", "2=Small Extent", "3=Moderate Extent", "4=Great Extent" and "5=Very Great Extent". The response data obtained from the questionnaires were summarized in the table 4.4

Table 4.4: The Volume/Extent of return by type (n=59)

Extent of return by type	Responses					Mean	SD
	NA	**SE**	**ME**	**GE**	VGE		
Replaced spare parts or component	0	8	11	25	15	3.80	0.39
Drained lubricants/Oil/	39	13	6	1	0	1.47	1.62
Used Tyres	0	6	20	21	12	3.66	0.41
Packages & Metal Scrap Materials	3	11	27	9	9	3.17	0.46

Note: NA=Not at all; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent

Source: Own Survey, 2018

The data result in Table 4.4 above illustrates majority of the respondents have expressed their agreement that great extent of returns or byproducts were obtained from replaced spare parts or components (M=3.80), used tyre (M= 3.66) obtained from thousands of heavy duty trucks and light duty construction equipment's, and moderate extent (M=3.17) from scrape metals & drum packages mainly from different lubricants and asphalt bitumen& metal scraps. Thus, the finding seems similar with the response obtained from the key informant interviewees of logistics and maintenance department heads of Sur Construction PLC regarding the type and volume of used byproducts, which they describes that, though there was no any or small extent (M=1.47) practice to return used oil from machinery and trucks, the company faces with large volume of end-of-life products (used products) that need the attention of RL.

4.3.2 Extent of Control for Used Material

The secondary data of Sur Construction PLC as well as the interview with logistic manager indicates that, the company has used a number of formal documents like store requisition (SR), purchase requisition (PR), goods receiving voucher (GRV), store issue vouchers (SIV), store return voucher (SRV) etc used for the purpose material management in the forward logistics. Taking this in to account respondents were requested questions stated in table 4.5 for used materials and their feedback was presented in the table below :

Table 4.5 Extent of return control (n=59)

Extent of control	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Used material return with proper documents	29	25	5	0	0	1.59	1.22
Used material issued with proper documents	24	30	5	0	0	1.67	1.18

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

The data showed in the table 4.5, majority of the respondents were (M=1.59) had the opinion that used materials /Second hand materials/ had been returned without appropriate used material return documents and similarly small extent" or mean value of (M=1.67) confirm that return of used materials had been issued without proper documents.

However, the interview with logistic manager as well as the secondary date disclosed that the company had second hand return and issuance voucher designed for this purpose, and some time the company also use dispatch vouchers, the problem was the implementation in properly utilize these documents.

Thus, one can summarize that against forward logistics weak control or less attention was given for used or second hand material during return and issuance processes.

4.3.3 Reverse Logistic Processes

According to Roberta P. & Pier Paolo Carrus (2012), the main reverse logistic processes are first there is collection, next there is the combined inspection/ selection/ sorting process, thirdly there is recovery, and finally there is redistribution.

Thus, having this understanding, the respondents were given a group of questions stated in table 4.8 to achieve the objective for rating of these questions its scale of usage degree that aims to study the current exercise of Sur Construction PLC related to reverse logistics process.

Table 4.6: Reverse Logistic Processes (n=59)

RL Processes	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Collection/Organizing	2	7	11	30	9	3.63	0.63
Sorting/Inspection-for sales	5	10	16	26	2	3.17	0.68
Sorting/inspection-for recovering	34	14	2	4	5	1.85	1.11
Recovering -Remanufacturing	41	9	6	2	1	1.52	1.24
Recovering -Reuse	4	3	16	25	11	3.61	0.63
Redistribution/Utilization	2	8	20	16	13	3.51	0.63

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

The data in table 4.6 explained that the practice of collection, reuse activities and redistribution/Utilization was exercised to great extent by the firms to the mean value of (M=3.63), (M=3.61) and (M=3.51) respectively. similarly, sorting/Inspection with mind setup of sale was performed in moderate extent (M=3.17), However, according to the respondent recovering related to remanufacturing activities were performed to no extent or mean value of

(M=1.52) and Sorting/inspection-for recovering indicated small extent (M=1.85) .Thus, the finding shows that, the organization is strong in collection, reuse, sorting/Inspection-for sales and utilization of recover product and weak in remanufacturing.

4.4. Reverse logistics activities

4.4.1. Remanufacturing

Remanufacturing is, therefore, one of the RL activities which provide the advantage to bring returned used items up to the quality standards of new and similar items, and provide products at lower cost, and an additional source of replacement parts (Bras & McIntosh,1999).Taking this advantage into consideration, those sampled respondents from the organization were also asked to indicate about the elements of reverse logistics activities in general and the condition of remanufacturing activities in particular in the company. Their response was measured and depicted in the table below.

Table 4.7: Reverse Logistics Activities: *Extent of Remanufacturing* (n=59)

Extent of Remanufacturing	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Setting up remanufacturing workshop	40	12	5	2	0	1.47	1.27
Setting up organization network with local manufacturing	3	30	19	6	1	2.52	0.85
positive perception to local remanufactured products in terms of quality	8	26	18	6	1	2.42	0.89
Setting up storage for used materials	0	2	20	24	13	3.81	0.63

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

Table 4.7 illustrated that the extent of remanufacturing elements. Accordingly the setting up storage for used materials in the table showed that with mean value of (M=3.81) of the respondents were of the opinion that the organization had perform to great extent to warehouse storage for used parts (second hand store). In contrary, responses from the other

questions indicate that for instance mean value (M=1.47) disclosed that the organization had no remanufacturing workshop, mean value (M=2.52) revealed that small extent the organization network with local manufacturing and mean value (M=2.42) indicates that small extent positive perception to local remanufactured products in terms of quality. On top of this, the interview result with maintenance departments assure that, the company has well equipped truck and machinery workshops (Garage) centrally located at Mekelle and at each projects suitable for repair. Thus, the finding shows us the organization lacks own manufacturing workshop at the same time the linkage and utilization of local manufacturer and the perception of workforce (Mechanics) towards local products (judge as poor quality) needs improvement.

4.4.2 Reuse

Depending on the physical condition of returned components, returned products may be reused "as-is" condition for the same or different purpose without involving in production process instead with slight cleaning and limited repair (de Brito& Dekker, 2003).

In the case, one can save time, money, energy and reduce wastage by utilize functional components from failed major components like engines, pumps, transmissions and others. This is also highly applicable in construction industry like Sur Construction PLC due to the availability of large in number and varieties of fleet size.

Table 4.8: Reverse Logistics Activities: *Extent of Reuse* (n=59)

Extent of Reuse	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Set quality standard for use	45	9	2	2	1	1.39	1.31
Inspecting and sorting for reuse	0	4	23	19	13	3.69	0.63
Capacity availability for reuse	0	0	24	21	14	3.83	0.63

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

Table 4.8 presented the majority of the respondents were (M= 3.69) had the opinion that the organization had perform to "great extent" in practicing inspecting & sorting products for reuse,

(M= 3.83) of the respondents also indicated that the organization had a great extent capacity for reuse. However, in relation to set quality standards for reuse, almost all the respondents' opinion (M=1.39) were that the organization had perform nothing in this regard. Thus, the finding seems to specify that the company exercise the reuse activity of RL without setting quality standard for reuse.

4.4.3 Disposal

Disposal with energy recovery makes use of the caloric value in the disposed products and reduces its volume to reduce space consumed of the landfill. Economic advantages can be gained from incineration, if the rising energy is reused. Direct disposal in the landfill is the last and most undesirable harmful option and can be seen as an option, in case of caloric providing no gain to the company even being involved in recovery process**.** Thus, in this regard the main attributes for disposal are land filling, incineration and direct sale /second hand market.

Accordingly, respondents were asked to put their views on the extent the organization has implemented disposal of products. The findings obtained were summarized as shown in the Table 4.9, given below.

Table 4.9: Reverse Logistics Activities: *Extent of* implementing *Disposal* (n=59)

***Extent of* implementing *Disposal* for used & waste materials**	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Land filling practice	18	28	13	0	0	1.92	1.08
Incineration practice	19	32	6	2	0	1.85	1.11
Direct Sales/Second Hand Market	2	1	13	27	16	3.92	0.64

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

Table 4.9 reveals that (M= 3.92) or the majority of the respondents were of the opinion that the organization had perform to "great extent" in using direct sales /second hand market/ to dispose used materials and packages. However, only small extent (M=1.92) respondents explained that the company used land fill to dispose material and respondents' with mean

value of (M=1.85) were that the organization had perform to small extent using incineration activates as one of the disposal method. This finding seems consistent with the result obtained from the key informant interview of the manager of logistics department in the company. Thus, this implies that, second hand market or selling is one the disposal method and source of income of the company, however, the company is poor in incineration and land filling especially for those toxic and environments pollute material like burned oil drain from thousands of construction equipment.

4.5. Drivers of reverse logistics activities

4.5.1. Economic Motive

Organization performs reverse logistics mainly because of the profit, obligatory forces or social pressure. According to this classification, the drivers are named as economics, legislation and corporate citizenship (de brito and dekker, 2004). Some of the main attributes related to economics are decreasing the cost of new raw material, increasing in profitability & enhancing stock availability, increasing in customer satisfaction & loyalty.

Table 4.10: Reverse Logistics Activities: *Extent of Economic Motives affecting RL* (n=59)

Extent of Economic motives to affect RL	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Decreasing the cost of new raw material,	0	0	10	25	24	4.24	0.69
Increasing in Profitability &enhance stock availability	0	0	15	21	23	4.14	0.67
Increase in customer satisfaction and loyalty	0	0	28	17	14	3.76	0.63

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

Thus, respondents were asked to mark each question as stated in table 4.10 and the data that almost all of the respondents were of the opinion that the organization had perform to "great extent" with mean value to all economic element like decreasing the cost of new raw material (M=4.24), increasing in profitability & enhancing stock availability (M=4.14), and increasing in

customer satisfaction, loyalty (M=3.76). Besides to this, the data obtained from interview with logistic and maintenance manager explained that as business organizations the economic aspect will take lion's share to increase interests in reverse logistics compare to social responsibility and legislation. Thus, the finding result indicates that economic benefit is the major element or deriving force to implement RL in Sur Construction PLC.

4.5.2. Enforcement of Legislation for recovering or disposal

The legislation driver refers to any jurisdiction indicating that a company should recover its products or take them back (Peters 2009). For instance, producer responsibility laws, in the European Union (EU), state companies are responsible for collecting and reusing their products (Guide and Wassenhove, 2001).With this way of thinking, respondents were asked to indicate the intensity of legislation in their company to implement RL and the results are presented below in table 4.11.

Table 4.11: Reverse Logistics Activities: *Extent of Legislation to affect RL* (n=59)

Extent of Legislation to affect RL	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Company manual or policy enforce	7	9	28	11	4	2.93	0.73
Government rule and regulation	13	29	11	5	1	2.18	0.96
Professional ethics	9	11	23	13	3	2.83	0.76

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

From the data in table 4.11, the respondents were of the opinion that the government rule and regulations had contribute to small extent to enforce the company to recover/dispose its products with mean value of (M=2.18). On the other hand, the respondent revel that the company manual and policy with mean value of (M=2.93) and Professional ethics with mean value of (M=2.83) had contribute to moderate extent to manage materials to reuse or disposal after once the material reaches end of its life.

Thus, implies RL (recovery or dispose) was the issue and the responsibility of the companies and professionals and government value was small in this case.

4.5.3. Social Responsibility

Results presented in table 4.12 show that, the extent of elements of social responsibility in relation to RL implementation, as a result, respondents with mean value of (M=3.08) or moderate extent were reveal that values or principles that an organization holds to be responsible with RL (Social responsible) and equally (M=3.01) or moderate extent of respondent indicated that establish image an environmentally responsible organization. Further, the secondary data (company report) specified that the company participate in many social responsible activities like material and financial support to support clubs, women associations' etc. Therefore, from this result, one can conclude that, though, the company contributes a lot in social activates, the respondents view revealed that the vision of the company not yet internalized to great extent level in the angle of RL.

Table 4.12 Extent *of Social responsibility to affect practicing RL* (n=59)

Extent of* Social responsibility *to affect practicing RL	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Values and principles that an organization holds to be responsible with RL	3	14	25	9	8	3.08	0.69
Establish image an environmentally responsible organization.	3	14	27	9	6	3.01	0.71

Note: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent
Source: Own Survey, 2018

4.6 Reverse logistics and its challenges

According to Min, Kim and Ha (2006) reverse logistics is by its very nature a complex process and a specialized area of any supply chain. It does not matter what the product is, how it is sold or who the customers are; every organization needs to focus on recovering the maximum value from returns. However, this is not free of cost. It has problems which make

difficult to implement RL for a company. So, what follows are some of the challenges affecting the implementing RL for a company. Accordingly, the perception about challenges to implement RL for the company was measured from the sampled respondents and the result obtained is depicted in the table below

Table 4.13 Reverse Logistics Challenges: *Extent of Challenges to implement RL* (n=59)

Extent of Challenges to implement RL	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Financial Barriers	3	28	9	11	8	2.88	0.74
High cost with reverse logistics	4	21	13	12	9	2.79	0.77
Return dynamics and forecasting complexity	7	3	35	8	6	2.96	0.72
Lack of expertise in reverse logistics	7	21	12	12	7	2.85	0.75
Top management commitment and style	2	9	11	20	17	3.69	0.63
Lack of functional/Departmental integration	4	5	37	7	6	3.10	0.69
Perception of product problem with quality	2	8	13	25	11	3.59	0.63
Poor communication and cooperation with supply chain partners such as local manufacturer	3	7	11	25	13	3.64	0.63

Note*: NA=Not at all ; SE=Small Extent; ME=Moderate Extent; GE=Great Extent; VGE=Very Great Extent*

Source: Own Survey, 2018

From the results of the above table 4.13, the majority of the respondents have expressed their agreement that the great extent of challenges which the organization faced to implement RL were top management commitment and management style to reverse logistics with mean value of (M=3.69), poor communication and cooperation with local manufacturer had also a mean value of (M=3.64), and respondent revealed that wrong perception to product quality manufactured locally mean value of (M=3.59). However, respondent mentioned that internally lack of integration among departments , return dynamics and forecasting complexity ,financial barriers , Lack of expertise in reverse logistics and high cost related to reverse logistics had moderate extent or had mean value of (M=3.10) ,(M=2.96), (M=2.88), (M=2.85) and (M=2.79) respectively. This implies that, the main challenge to implement RL in the company was prioritized as top management commitment and management style, poor communication and

cooperation with supply chain partners such as local manufacturer and perception of product problems with quality respectively.

4.7. Mechanisms to improve reverse logistics

This section has questions related to mechanisms to improve reverse logistics considering in inputs like Spare parts, tyre and lubricants. Accordingly, respondents were asked to reflect their opinion from five options [1] Not at all up to [5] Very great extent and their responses were summarized in the table stated below

Table 4.14. Reverse Logistics Improvement: *Extent of elements to improve RL* (n=59)

Extent of RL to improve	Responses					Mean	SD
	NA	SE	ME	GE	VGE		
Top management commitment to reverse logistics	1	5	9	23	19	3.95	0.64
formation and engagement supply chain partners as strategic partners in reverse logistics (specially to local manufacturer)	1	4	10	27	17	3.93	0.64
Adopt appropriate technologies for reverse logistics to perform	6	15	21	9	8	2.97	0.65
Conduct formal training in RL and attitude change to local remanufacture products.	2	9	13	27	8	3.50	0.63
Outsourcing reverses logistics activities	7	23	12	8	9	2.81	0.81

Data in table 4.14 suggested by respondents indicates that, the a great extent methods that supports to improve reverse logistics in this specific company is the top management commitment to reverse logistics have a portion of (M=3.95) and formation and engagement supply chain partners as strategic partners in reverse logistics (specially to local manufacturer (M=3.93) and conduct formal training and attitude change to local products (M=3.50). however , moderate extent to the degree of adopt appropriate technologies for reverse logistics to perform had a mean value of (M= 2.97) and outsourcing reverses logistics activities had a mean value of (M=2.81). Additionally, from the result of interview questions, the logistic manager as well as the maintenance manager highlighting that to adopt the RL in Sur Construction PLC with

existing central workshop (Garage) at Mekelle for both for machineries and trucks, what is valuable to the company instead of formation new manufacturing workshop, it would be better to polish or improve the negative the attitude or perception of employees to products manufactured by local companies , second strength the week network or relationship with local potential manufacture and last but not least, the attention of top management to consider RL as conventional logistics is very vital.

From these findings, one can summarize that the main focus or game-changer to implement RL in Sur construction PLC is the role and attention of top management, formation and engagement supply chain partners as strategic partners in reverse logistics (specially to local manufacturer) and avoid negative mindset of works to local products is critical.

CHAPTER FIVE

SUMMARY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

RL is relatively a new science compare to conventional or forward logistics and in general research on reverse logistics is fundamental and provide economic significance and realize environmental protection and make organization to be social responsible in their daily activities. Sur Construction PLC is one of the largest and Grade one (GC-1) local construction company in Ethiopia which has been massively involved in the construction of all kinds of Civil Engineering Construction works and equipped with massive fleet size of heavy and light duty equipment's and research like RL in this industry is very essential because it enhance competitive advantage of the company by decreasing the cost of new raw material, increase business profitability & enhance stock availability , increase in customer satisfaction, loyalty and make organization to develop green image etc.

5.2 Summary of findings

Findings on the extent of returns, control and RL process

Thus, the finding obtained from questionnaire's and the key informant interviewees of logistics and maintenance department heads of Sur Construction PLC regarding extent of return for used materials, the company faces with large volume of end-of-life products (used products) that generated from replaced spare parts, used tyres and packages and metal, however, there was no any or small extent practice (M=1.47) to return used oil from machinery and trucks, Further, the findings result depict that, the company perform activates like informal collection for used materials, sorting/inspection, from angle of second hand market and reuse , however, weak control or weak in utilizing official document for used materials during used return and issuance and weak in recovering specifically remanufacturing (M=1.52).

Findings on RL activities

regarding logistics activates particularly remanufacturing, reuse and disposal the date explained that the organization lacks own manufacturing workshop (M=1.47), weak bond and utilization of local manufacturer (M=2.42), the perception of workforce (mechanics) towards local products (judge as poor quality) needs improvement, and poor in incineration and land filling especially for those toxic and environments pollute material, however the company gain economic advantage and means of disposal by commercialized used or end of life products in second hand market and exercise the reuse activity of RL without setting quality standard for reuse (M=1.39).

Findings on the drivers of reverse logistics activities

Literature and practice suggest that RL activities will soon be an obligation and not just an option activity, accordingly, the finding data shows that the economic benefit such as decreasing the cost of new raw material, increasing in Profitability & enhance stock availability and increase in customer satisfaction and loyalty can be the great extent force to implement reverse logistics, however, government role to enforce or to subsidize to recover or disposal activities are small extent of (M=2.18). Likewise, the company contributes a lot in social activates, however, the respondents view revealed that the vision of the company not yet internalized to great extent level to recovery or proper disposal used materials from social responsibility angle.

Findings on RL and its challenges

The main challenge to implement RL in the company was prioritized as top management commitment and management style (M=3.69), poor communication and cooperation with supply chain partners such as Local manufacturer (M=3.64) and perception of product Problems with Quality respectively (M=3.59).

Findings on mechanisms to improve RL

From these findings, one can summarize that the main focus or game-changer to implement RL in Sur Construction PLC is the role and attention of top management, avoid negative mindset of works to local products and comprehensive plan RL with conventional logistics is critical.

5.3 Conclusion

Thus, from the finding result research made on Sur Construction PLC we can conclude that the under mentioned points:-

From the finding one can conclude that the volume of replaced spare parts, used tyres , packages and metal ,excellent in collection/organizing/ of used components , setting up second hand store, sorting and inspecting with mindset up of disposal by selling, reuse or utilize from second hand store as spare, has been a good opportunities to the organization to adopt full RL operation.

Researcher can conclude that sales of return material in second hand market was the current exercise of the company related to RL to generate income and mean of disposal for used materials, however, the company is poor in alternative means of disposal like incineration and landfilling especially for used materials that have zero value, no remanufacturing activities and no standard for reuse activities.

From the finding the researcher can concluded that Sur Construction PLC can be driven to RL to gain economic benefits such as decrease the cost of new input material like spare parts, enhance stock availability of materials, enhance profitability, increase customer satisfaction, gain economic benefit from used material selling (Second hand market) and enhance profit margin of the organization. Regarding social responsibility, the secondary data (Company report) revealed that the organization participate and contribute considerable amount of finance and materials to different group of society like in to Sport clubs, women association etc. However, the organization not well done specifically to the RL that is prevention the environment from contamination from burned oil and waste like fuel and oil filters generated from thousand of

thousand equipment's specifically in projects. Moreover, government contribution in recovery and disposal was small extent, company manual or policy and professional ethics as legislation issue was reflected in the moderate extent. Therefore, from this the researcher can conclude that the company will have future assignment to improvement social responsibility and to incorporate as policy in the company manual (legislation) the issue of management of end of life materials.

Depending on the nature and various condition of the organization the challenge to implement RL may vary one from the other, among the main challenges mentioned in the questioner respondents revealed that top management commitment and management style, poor communication and cooperation with supply chain partners such as local manufacturer and perception of product Problems with Quality respectively are the main challenges of the company to adopt RL.

5.4 Recommendation

From the findings result and conclusions the researcher recommends the under mentioned points that will be serve as game changer in the organization to implement RL:-

As clearly indicated in the finding and conclusion, the top management commitment and management posture problem of the organization would be solved, like conventional or forward logistics, consider the significant contribution of RL in the competitive advantage of the company and the management of Sur Construction PLC should incorporate RL in the organizational structure either in level of department, division and service depending on job evaluation with appropriate staff, clear job description, and job specification.

RL process like collection/organizing, sorting/inspection (with mind set up of sale) and gaining economic advantage from sales of used materials are one and encouraging step to implement RL in the organization, however, the researcher propose to the organization the sorting and inspection step of RL Process should be followed with recovering step and actions to get more benefit instead of direct disposal by sales, likewise, those used material that cannot be recover and zero value or wastage, the company properly dispose either though incineration or land filling and in order to establish image of environmental responsible organizations.

Last but not certainly the least, the remarkable recommendation related to RL adoption specifically in remanufacturing is that, since the company is one of the largest local construction company relatively with capacity of thousands of light and heavy duty construction equipment, it is advisable that, primarily the company to possess central remanufacturing work shop for spare parts and recapping machine for tyre at company level or to form strong bond with local manufacture, besides, perform fundamental attitude change of workforce feeling local products as poor quality and enhance utilization and enjoy benefits obtained from RL like reduce purchase budget, purchase cost saving, enhance availability, shorter delivery time etc ,

5.5 Suggestion areas for further research

This research can be used as initial point for future researchers in the area of RL Specifically in construction industries, additional, some of the suggested researches to be conducted for future are:-

- Drain oil and recycling activities in construction equipment.
- Waste and disposal management in construction industries.

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APPENDIX -A

Questionnaires

This questionnaire is designed to conduct a research on the topic "An Assessment on Reverse logistics practices: the case of Sur Construction PLC'' as a partial fulfillment for MA degree in logistics and supply chain management. For the successful accomplishment of the study, your response have key role by being used as valuable input for the study. The information that you provide is strictly confidential and will be used only for academic purpose. Thus, you are kindly requested to genuinely fill the questionnaire

QUESTIONNAIRE FOR SUR CONSTRUCTION PLC

Part 1: Personal information

1. What is your department in the organization _____
2. Year of experience in the organization _____

   Below one year ☐ 1-5 years ☐

   5 and above ☐

3. Level Of Education

   ☐ Certificate ☐ BA/BSc

   ☐ Diploma ☐ MA/MSc

Part 2 A: Extent of returns, control and RL process.

4. Indicate the extent to which your organization has generated for the understated mentioned returns from inputs like Spare parts, tyre , lubricants ,packages and others. There are five options to answer here. **1** stands for "**Not at all**", 2 for "**Small extent**", **3** for "**Moderate extent**", **4** for "**Great extent**" and **5** for **"Very great extent**". Please put check mark "✓" on the box provided that reflect your idea

Volume/Extent of return by type	1	2	3	4	5
Replaced spare parts or components					
Drained lubricants/Oil/ from machineries/Trucks					
Used Tyres					
Packages (Drums ,containers,) & metal scraps materials					

Others please specify.....

.....

5. Indicate the extent to which your organization has implemented way of returning and controlling used material considering inputs like Spare parts, tyre and lubricants. There are five options to answer here.**1** stands for "Not **at all**", 2 for "**Small extent**", 3 for "**Moderate extent**", **4** for "**Great extent**" and **5** for "**Very great extent**". Please put check mark "✓" on the box provided that reflect your idea

Extent of Control system	1	2	3	4	5
Used materials return with proper documents					
Used materials issued with proper documents					

Others please specify.....

.....

6. Indicate the extent to which your organization has implemented the following reverse logistics Process considering inputs like Spare parts, tyre and lubricants. There are five options to answer here.**1** stands for "Not **at all**", 2 for "**Small extent**", 3 for "**Moderate extent**", **4** for "**Great extent**" and **5** for "**Very great extent**". Please put check mark **"✓"** on the box provided that reflect your idea

Reverse logistics Process	1	2	3	4	5
Collections/organizing					
Inspection & Sorting for sales purpose					
Recovering (Remanufacture)					
Recovering (Reuse)					
Redistribution/Utilization for recovered products.					

Others please specify.....

.....

Section B: reverse logistics activities

7. Indicate the extent to which your organization has implemented for the understated mentioned Reverse logistics activates considering inputs like Spare parts, tyre and lubricants. There are five options to answer here. **1** stands for "**Not at all**", **2** for "**Small extent**", **3** for "**Moderate extent**" , **4**for "**Great extent**" and **5** for"**Very great extent**". Please put check mark **"✓"** on the box provided that reflect your idea

Remanufacturing	1	2	3	4	5
Set up remanufacturing workshops					
Set up warehouses for storage of used parts					
the organization has network linkage with Local Manufacture					
Positive perception to local manufacturing products in terms of quality.					

Reuse					
Set quality standards for reuse					
Inspecting and sorting for reuse					
Capacity availability for re use					
Disposal exercise for used or waste materials					
Land filling for waste					
Incineration for waste					
Direct sales /Second hand market/ for used					

Others please specify.....

.....

Others please specify.....

.....

SECTION C: Drivers of reverse logistics activities

8. Indicate the extent to which your organization level of practicing the reverse logistics has affected the following performance indicators. Considering inputs like Spare parts, tyre and lubricants. There are five options to answer [1] Not at all [2] Small extent [3] Moderate extent [4] Great extent [5] Very great extent. Please put check mark "✓" on the box provided that reflect your idea.

Economic/Competitiveness	1	2	3	4	5
Decreasing the cost of new raw material,					
Increase in Profitability &enhance stock availability					
Increase in Customer satisfaction, loyalty					
Legislation					
Role of government rule and regulations					
Company manual and policy					
Professional ethics					
Social responsibility					
Values or principles that an organization holds to be responsible with RL (Social responsible)					
Establish image an environmentally responsible organization.					

Others please specify.....

.....

SECTION D: Challenges reverse logistics

9. This section has questions related to challenges that are faced in practicing reverse logistics considering inputs like Spare parts, tyre and lubricants. There are five options to answer [1] Not at all [2] Small extent [3] Moderate extent [4] Great extent [5] Very great extent. Please put check mark "✓" on the box provided that reflect your idea

Challenges reverse logistics	1	2	3	4	5
Financial barriers on Reverse logistics					
High cost related to reverse logistics					
Return dynamics and forecasting complexity					
Lack of expertise in reverse logistics					
Top management commitment and management style					
Lack of functional integration					
Perception of product Problems with Quality					
Poor communication and cooperation with supply chain partners such as Local manufacturer					

Others please specify.....

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SECTION E: Mechanisms to improve reverse logistics

10. This section has questions related to mechanisms to improve reverse logistics considering inputs like Spare parts, tyre and lubricants. There are five options to answer [1] Not at all [2] Small extent [3] Moderate extent [4] Great extent [5] Very great extent. Please put check mark "✓" on the box provided that reflect your idea

Improve reverse logistics practices	1	2	3	4	5
Top management commitment to reverse logistics					
formation and engagement supply chain partners as strategic partners in reverse logistics (specially to local manufacturer)					
Adopt appropriate technologies for RL to perform					
Conduct formal training in RL and attitude change to loacal remanufacture products					
Outsourcing reverses logistics activities					

Others please specify.....

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APPENDIX –B

Interview check list

Checklist for Key Informant Interview for logistics and maintenance department heads, etc in the companies:

1. What kind of RL organization structure, system and policy/manual/ your company have?
2. What activates are performed in relation to recovery (reuse, manufacturing) especially related to e tyre, spare parts and lubricants and who is responsible departments?
3. How much is its significant of return materials for used tyre and spare ?
4. How do you manage return and issuance of used materials?
5. What is your organization principle to environment protection and how does it manage wastages created from replaced components parts, tyres and burned lubricants?
6. What is your attitude towards local manufacturing? Are you willing to pay for local manufacturing products? Do you have remanufacturing work shop for spare, tyre etc?
7. What drivers to implement RL in your organization (economical, legislation and social responsibility)?
8. What are the challenges to implement RL in your organization?
9. What do you suggest to the company to improve RL Practices?