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TRAINING INSTITUTE**

**FEDERAL TECHNICAL AND VOCATIONAL TRAINING INSTITUTE**

**FACULTY OF CIVIL TECHNOLOGY DIVISION**

**DEPARTEMENT OF WOOD SCIENCE TECHINOLGY**

**M.SC. THESIS**

**ON**

**INVESTIGATING MATERIAL AND VALUE FLOW ANALYSIS OF SAWMILLING  
OF CUPRESSUS LUSITANICA IN THREE SAWMILLS OF GELAN AND ADDIS  
ABABA.**

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**Federal Technical and Vocational Training Institute**

**School of Graduate Studies**

**Investigating Material and Value Flow Analysis of Saw milling of *Cupressus Lusitanica* In  
Three Sawmills of Gelan And Addis Ababa**

**A Thesis Submitted to the Department of Wood Technology in Partial  
Fulfillment of the Requirements for the Degree of Master of Science in Wood  
Technology**

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**June/2024**

**APPROVAL PAGE**

**APPROVAL SHEET I**

This is to certify that the thesis proposal prepared by **Esayas Tilahun Gosaye**, with entitled **“Investigating Material and Value Flow Analysis of Saw Milling of *Cupressus Lusitanica* In Three Sawmills of Gelan and Addis Ababa ”** and Submitted in fulfillment of the requirements for the degree of master of science in Wood Technology and Management, that complies with the regulation of the Technical and Vocational Training Institute that meets the accepted standards with respect to the originality and quality.

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## THESIS APPROVAL SHEET II

As member of the boards of examiners of the MSc Thesis Open Defense Examination, we certify that we have read, evaluated the Thesis prepared by **Esayas Tilahun Gosaye** and examined the candidate. We recommended that the These is be accepted as fulfilling the Thesis requirement for the Degree of Master of Science in Wood Science Technology.

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## **DECLARATION**

This work is the result of my own investigation. All sources of materials used for the thesis have been duly acknowledged.

**Esayas Tilahun Gosaye**

**Signature**\_\_\_\_\_

**Date**\_\_\_\_\_

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Investigating Material and Value Flow Analysis of Saw milling of *Cupressus Lusitanica* In Three  
Sawmills of Gelan And Addis Ababa

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**ABSTRACT**

*Ethiopian sawmills' low-capacity utilization is mostly attributable to their antiquated equipment, which produced a high amount of waste and a low recovery rate. Cupressus lusitanica is widely used in Ethiopia for lumber, construction, furniture making, poles, and posts. 90.76% of the timber produced by the sawmilling company had a mean preference score of Value flow contributed to the saw milling industrial process. The saw milling process of Cupressus lusitanica in the industry faces various challenges and bottlenecks in material flow optimization within the saw mills. This study aimed to assess the status of material flow within sawmills, identify existing issues, and explore opportunities for improvement in Gelan and Addis Ababa sawmill sawmilling area Ethiopia cross sectional study design were conducted to assess the co-workers and managers their response. The total benefits ( = Strongly Disagree, 25% = Disagree, 28% = Neutral, 21% = Agree and 26% N=90) respondents reported overall intention regarding to material value flow. A survey was conducted among industry professionals to gather insights on the efficiency of material flow, alignment with sustainable forestry practices, and perceived bottlenecks. The results reveal a mixed perception among respondents regarding the optimization of material flow within the saw mills. While some believe that the current level of optimization is sufficient, a significant percentage of respondents expressed concerns about issues such as old machines, lack of spare parts, and inefficiencies in tracking and monitoring material flow. While some respondents see alignment, others disagree or strongly disagree with this assessment, indicating a need for improvement in sustainability practices. These challenges hinder the overall productivity and output of lumber in the saw milling process. Therefore this present study aligned for improvement include upgrading machinery, enhancing tracking systems, and implementing sustainable practices to optimize material flow in the saw milling process.*

**Keywords:** - *Cupressus Lusitanica*, Sawmill, Recovery, Value Flow, Lumber, Production flow

## ACRONYMS

ANOVA	Analysis of Variance
SCA	Sustainable Competitive Advantage
L	Length
DBH	Diameter Breast Height
CL	<i>Cupressus Lusitanica</i>
FAS	First and second
CM	Centimeter
M	Meter
M <sup>3</sup>	Cubic Meter
MM	Millimeter
VFA	Value Flow Analysis
GC	Gelan City
SM	Saw Milling
MFA	Material Flow Analysis
VSM	Value Stream Mapping
AA	Addis Ababa

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# CHAPTER ONE

## Introduction

### 1.1 Background of the study

A sawmill is a kind of industrial plant that converts logs into lumber and other wood products using transporters, handling devices, machines, and tools (Sui et al., 2020)(Wang and Haller, 2024). In the primary and secondary wood processing industries, sawing is one of the most often utilized machining methods. Band and circular sawing have received the majority of study attention. Circular saws are the most often used tool type in wood machining, despite the fact that band saws have a narrower kerf (Nasir and Cool, 2020a) Circular saw performance has a big impact on the recovery and quality of lumber in sawmills (Hambisa et al., 2023). A sawmill is a sophisticated production system that uses a network of conveyors and buffer zones to connect many machine centers for a sequence of manufacturing activities aimed at producing dimensional lumber products from raw logs (Das et al., 2021). At any given time while in the manufacturing following , the intermediate products (i.e., work in process) are either a) being processed at a machine center, b) traveling between machine centers and buffer areas, or c) accumulating in a buffer area awaiting to be processed (Nasir and Cool ,2020a). The throughput of such mass-production systems, essentially represented by the intermediate products' movement (both in terms of volume and speed) through the system, is dependent on the processing capacities of the machine centers (including the human/operator (Stafford and De Lange, 2018) . the conveyor speeds, and the capacities of buffer areas. Often the production is limited by bottlenecks, defined here as processes whose limited capacities reduce the capacity of the whole system. Identifying these bottlenecks and finding solutions to reduce or eliminate them is a problem that sawmills must address when seeking to increase production during periods of strong demand (Das et al., 2021). To alleviate bottlenecks, sawmills often invest in a new machine center (with typically higher capacities) and then find out that the bottleneck just moves somewhere else. Portuguese cypress, or *Cupressus lusitanica*, is processed via a crucial step in the timber industry: saw milling. This particular tree species is prized for its superior wood, which is utilized in building, furniture manufacturing, and other woodworking endeavors. (Nasir and Cool ,2020b).The process of saw milling converts *Cupressus lusitanica* logs into lumber and other wood products that are utilized in a variety of industries (Das et al., 2021).For the saw milling process to be exact and effective in milling the

wood (Wang and Haller, 2024). specialized machinery and knowledgeable labor are needed. All things considered, saw milling *Cupressus lusitanica* is essential to producing valuable wood products for a variety of uses, (Das et al., 2021). *Cupressus lusitanica*, also known as Portuguese cypress, is a popular species for saw milling due to its durability and attractive appearance. In this report, we will examine the saw milling process of *Cupressus lusitanica* in three sawmills operated by Industry. A methodology called Value Flow Analysis (VFA) can be applied to measure the value produced by a system and enhance procedures.(Wongnaa et al., 2022). It is a lean manufacturing tool that aids in locating wasteful and value-adding processes inside a process. VFA seeks to maximize the value stream through productivity gains, quality enhancements, lead time reductions, and waste elimination. (Hulusjö, 2013) Value Stream Mapping (VFA) is a process optimization tool that entails mapping the value stream, analyzing the flow of value, finding waste, and creating a plan to optimize the value stream and remove waste.(Parobek et al., 2014) By providing high-quality goods or services on time, the VFA method aids businesses in cutting expenses, boosting productivity, and improving customer happiness. However, VFA can also be applied as a method to choose KPIs (Key Performance Indicators) that quantify the value produced by a system at each phase (input, process, output, and outcome). (Makkonen, 2019). This method places a strong emphasis on choosing KPIs that accurately reflect the accomplishment of goals, using a variety of measures to assess inputs, processes, outputs, and results. Value Flow Analysis offers a framework for choosing KPIs to gauge the value produced by a system, making it a valuable tool for companies looking to streamline their operations and boost profitability(Chakraborty,2015). Organizations can focus improvement efforts and get rid of waste sources by identifying places where value is added and waste occurs (Palátová , 2019). Additionally, by choosing the appropriate to A crucial component of Value Flow Analysis (VFA) is Value Stream Mapping (VSM). It is a visual tool that is used to map out the whole process of producing a good or service, beginning to end. VSM facilitates the identification of the many process phases as well as the movement of resources, data, and personnel inside the system. Finding the process's points of waste and value addition is also helpful (Wang and Haller, 2024). VSM's primary goal is to give users a thorough understanding of the value stream, which facilitates the discovery of areas for improvement (Sui et al., 2020) It enables companies to observe the movement of information and materials through the system, as well as the duration of time required to finish each stage of the procedure. This makes it easier to spot any bottlenecks, duplications, or

delays so that such areas can be improved. The value stream is divided into many phases or tasks in the VSM process. The amount of value added and waste produced at each stage are then determined by analyzing it step by step. The time needed for each task as well as the movement of supplies and data between them are also identified by VSM. Organizations can determine where waste is happening and where value is being added by using the VSM process (Sui et al., 2020). This aids in setting priorities for improvement and locating chances to streamline procedures, cut expenses, and boost general productivity. The value stream is well understood because to VSM, Organizations can determine where waste is happening and where value is being added by using the VSM process (Palátová, 2019). This aids in setting priorities for improvement and locating chances to streamline procedures, cut expenses, and boost general productivity. In order to optimize value flow and remove waste, it is essential to have a thorough understanding of the value stream, which is what VSM offers (Sui et al., 2020). By taking into account the dynamic nature of material cycles and reflecting how material stocks and flows change and interact over extended time periods, dynamic material flow analysis goes beyond traditional material flow analysis. Research on dynamic material flow analysis of wood in Germany, the largest wood producer, is rare, let alone studies that cover the entire wood supply chain. Most studies, on the other hand, either focus on static analyses for specific years or only cover limited portions of the supply chain. (Nasir and Cool, 2020a). The study was to analyze an existing sawmill and determine the potential improvement in production throughput that can be achieved by reducing or eliminating bottlenecks, through finding optimal combinations of process and machine parameters, for a given raw material and product profitable (Proceedings, 2021). The 35-meter-tall, evergreen *Cupressus lusitanica* tree has a dense, conical crown. Although branches are widely dispersed, they finish in pendulous branchless. trunk, little, 70 cm across. The reddish-brown bark on the trunk exfoliates in long, narrow strips before becoming rougher with time. by the formation of numerous tiny fissures. Small, decussate, adpressed, acute, sessile, scale leaves with bent tips cover the branchless. Hence, present study has dealt with material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa

## **1.2 Statement of the problems**

The statement of the problem is to investigate the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills located in Gelan and Addis Ababa. This research aims to identify and analyze the flow of materials and value throughout the saw milling process,

specifically focusing on the processing of *Cupressus lusitanica* timber. The specific problems to be addressed in this study include (Hambisa et al., 2023).

### **1.2.1 Material Flow Analysis:**

The first problem is to understand how *Cupressus lusitanica* timber is sourced, processed, and utilized within the three sawmills in Gelan and Addis Ababa. This involves identifying the sources of timber, examining the different stages of processing (e.g., debarking, cutting, drying), and determining how waste materials are managed (Makkonen , 2019).

### **1.2.2 Value Flow Analysis:**

The second problem is to assess the economic value generated at each stage of the saw milling process for *Cupressus lusitanica* timber. This includes analyzing the costs associated with sourcing and processing the timber, as well as evaluating the revenue generated from selling various products (e.g., lumber, wood chips) (Ngobi and Mugabi , 2024). by addressing these problems through a comprehensive investigation into material and value flow analysis, this research aims to provide insights into how sawmills in Gelan and Addis Ababa can optimize their operations while minimizing environmental impact when processing *Cupressus lusitanica* timber (Capuano, 2023).

## **1.3 Research objectives:**

### **1.3.1 Main Objectives:**

The objective of investigating the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills .

### **1.3.2 Specific objectives for this investigation may include:**

1. To analyze the material flow within the selected sawmills during the saw milling process of *Cupressus lusitanica*.
2. To evaluate the value flow from raw materials (logs) to finished products (lumber) in terms of economic value added at each stage.
3. To the primary materials used in the saw milling process of *Cupressus lusitanica* in the three sawmills.

## **1.4 Research questions**

1. How to analyze the material flow within the selected sawmills during the saw milling process of *Cupressus lusitanica*?
2. What is evaluate the value flow from raw materials (logs) to finished products (lumber) in terms of economic value added at each stage?
3. What are the primary materials used in the saw milling process of *Cupressus lusitanica*.in the three sawmills?

## **1.5 Research Hypothesis**

Hypothesis: Implementing a material and value flow analysis in the saw milling process of *Cupressus lusitanica* will lead to increased efficiency, reduced waste, and improved profitability for the sawmill operation. This hypothesis suggests that by closely examining the flow of materials and value throughout the saw milling process, potential inefficiencies and areas for improvement can be identified and addressed. By optimizing the process, it is expected that waste it was be minimized, production to more streamlined, and overall profitability was enhanced.

## **1.6 Significance/Justification of the Study**

The significance and justification of the study investigating the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa are as follows.

### **1.6.1 Economic Importance:**

Understanding the material and value flow in saw milling operations is crucial for assessing the economic viability and efficiency of the process. This study was provide valuable insights into the cost-effectiveness and profitability of saw milling *Cupressus lusitanica*, which is important for decision-making and resource allocation (Greenland , 2002).

### **1.6.2 Resource Management:**

The data collection analyzing the material flow in saw milling operations, this study can help identify potential areas for resource optimization and waste reduction. Efficient use of raw materials and by-products can lead to sustainable practices and environmental conservation (Das et al., 2021).

### **1.6.3 Industry Development:**

The findings of this study can contribute to the development and improvement of the saw milling industry. By identifying bottlenecks and inefficiencies in material and value flow, recommendations can be made to enhance productivity, quality, and competitiveness (Mulkey and Dow , 2021).

### **1.6.4 Academic Contribution:**

They were add to the body of knowledge on saw milling processes, particularly focusing on *Cupressus lusitanica*. It will provide valuable data for future research on wood processing, supply chain management, and industrial engineering Investigating the material and value flow analysis of saw milling *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa is significant for its potential economic, environmental, social, academic, and policy implications (Young , 2020).This research has relevance for various stakeholders involved in wood processing industries as well as for broader sustainable development goals.

### **1.7 Scope of the study**

This study aimed to assess the material and value flow analysis of the sawmilling process of *Cupressus lusitanica* at three sawmills situated in Addis Ababa and Gelan. Examining the material and value flow analysis of saw milling was the aim of the study. Additionally, this study's goal was to evaluate This study also discusses the variables affecting the *Cupressus lusitanica* flow value.

### **1.8 Limitation of the study**

The limitation of this research is Investigating the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa. depending on this investigating the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills.

## CHAPTER TWO

### 2.1 Literature review

Sawmilling is the process of turning logs into lumber, producing slabs, sawdust, and offcuts as byproducts (Rawat et al.,2023). By chopping wood into sizes that may be used to meet human demand, sawing technology is the automation of man's early actions toward human settlement and progress (Borz et al., 2021). Lumber is a solid wood product created by cutting logs longitudinally, according to. According to (Nasir and Cool ,2020), lumber is defined as the end result of a sawing and planing mill; it is not further processed beyond sawing, resaving, lengthwise passing through a conventional planing machine, crosscutting to length, and matching. The timber has mostly been flat, meaning that the boards have been sawn roughly in line with the yearly rings. Thus, a solid, rectangular piece of wood is called lumber (Nasir and Cool , 2020).

Sawing patterns: -and its types Sawing patterns are the series of cuts needed to split a wood into lumber, and they encompass a variety of cutting patterns and sawing techniques. The primary sewing patterns include can't sawing, quarter sawing, grade sawing, rear sawing, and live sawing (Wambar et al., 2015). The sawing designs that follow are based on a system that uses a hearing to cut the ultimate board thickness and then sends the boards or flitch to an eager to maximize volume and/or grade recovery, with the option of additional grade/volume recovery at the trim/cross-cut saw (Makkonen , 2019).

Sawing procedure: - The sawing process involves many different variables that affect cutting forces, tool wear, power consumption, surface quality, etc. These variables can be divided into three primary categories: Work piece (1), feed (2), and tool (3). These factors are presented in this part, and the next ones go into how to use them for process characterization and monitoring (Ngobi and Mugabi , 2024).

Live cutting: - Also referred to as straightforward or through-and-through cutting. This is arguably the most widely utilized approach in a number of nations. It's the quickest and most straightforward way to make timber ( Uganda , 2021) .

Can't Sawing: - Using this technique, the outside of the log on faces 1, 2, 3, and 4 is cut into boards, and the residual section, known as a cant, is either sold unprocessed in can't form or sent to a secondary breakdown saw. To maintain the cant sawing straight, equal quantities of lumber should

be cut from each side, centered around the heart. Some species may not be good candidates for this approach due to excessive growth stress (Ngobi and Mugabi , 2024).

Quarter Sawing: - Lumber that has been quarter-sawn is described as having its growth layers oriented on the face, or largest portion, between 45 and 90 degrees. When the growth rings on a board are orientated in an angle ranging from 80 to 90 degrees, it is said to be fully quarter sawn (Das et al., 2021).

Grade Sawing: - This technique is also called "sawing around." Cutting around the center of a log to get the maximum amount of clean, defect-free timber as it opened up is the basic method of grade sawing. In the event that faults are found when opening up the log, it provides the option to switch to a higher-grade face and alter the cuts to optimize grade on medium- to high-quality logs (Das et al., 2021) This method must be used for sawing medium- to high-grade logs since it is the most efficient in determining the net worth of the majority of logs. The process is choosing the first exposed face, sawing it until the wood begins to spring back or the slope on that face becomes more difficult, and then moving on to the next face (Wang and Haller , 2024).

Back Sawing: - Sawmills frequently use back sawing to cut forest logs with bigger diameters. Defects in the pith and log should be minimized in every cut. In comparison to live-sawing, this sawing pattern yields superior value recovery, and in comparison, to the sawing-around approach, it offers a faster output rate. Sawing around and quartering is only suitable for big logs, and quarter sawing is mostly limited to hardwoods, according to the report (Muthukumar et al., 2019). Because some of the taper in the cant can be recovered as short boards during cant-sawing, but this taper is lost during live sawing as edgings, cant-sawing produces better volume yields than live sawing, (Ngobi and Mugabi, 2024). Additionally, live sawing increases the likelihood of massive spike knots, which lowers reappearance of higher grades (Boswell, 2023). Our research A firm's competitive advantage has been regarded as a central theme in the field of strategic management Although having multiple, and often definitions competitive advantage is commonly conceptualized as an ability to generate higher value for a firm's stakeholders compared to the value that its current or potential competitors offer (Nasir and Cool, 2020a).

This ability is a result of a firm's internal factors (strategy and organizational structure) and external factors. Competitive advantage is demonstrated in several ways. For example, customers may be willing to buy products or services at a profit despite the competitor being superior in size,

strength, product quality or distribution power (Lolila et al., 2021). Two dominant frameworks have been used to explain a firm's competitive advantage: the market-based view (MBV) and the resource-based view. Instead of competing frames, these views are complementary, "providing the greatest utility when employed together" (refer C. lusitanica BOARDS .pdf n.d.) (Stafford , 2018). Understanding these frameworks is important to comprehend the prevailing business logic in the wood products industry and these methods' suitability to meet the needs of today's business environment.<sup>16</sup> According to MBV, a firm's competitive advantage depends on its position within an industry and its ability to differentiate itself from its peers. By using the Five Forces Model (customers, suppliers, new entrants, substitute products and competitors), a firm can assess an industry's attractiveness relative to its structure (Y. S. Rawat and Tekleyohannes, 2021). The firm can also determine which of the three generic competitive strategies (low-cost leadership, differentiation or focus) can generate higher value than its competitors (Das et al., 2021). The creation of superior customer value requires different resources and strengths, managerial style and organizational arrangements in each of these generic strategies. Saw milling is a critical process in the timber industry, and understanding the material and value flow analysis of saw milling operations is essential for optimizing production efficiency and profitability (Wongnaa et al., 2022). This theoretical literature review aims to investigate the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa. Material flow analysis (MFA) is a systematic assessment of the flows and stocks of materials within a system, such as a sawmill. It provides insights into the input-output balance, resource efficiency, and waste generation within the saw milling process. Value flow analysis (VFA),(Sui et al., 2020) on the other hand, focuses on understanding the economic value added at each stage of production and identifying opportunities for cost reduction and revenue enhancement (Sui et al., 2020). *Cupressus lusitanica*, also known as Portuguese cypress, is a valuable timber species with high demand in various industries, including construction, furniture manufacturing, and paper production. (Nasir and Cool , 2020b). Therefore, analyzing the material and value flow of *Cupressus lusitanica* saw milling operations can provide valuable insights into the efficiency and sustainability of timber processing in Gelan and Addis Ababa. Previous research on material and value flow analysis in saw milling operations has primarily focused on species such as pine, oak, and spruce. However, there is a lack of literature specifically addressing *Cupressus lusitanica* saw milling processes. Therefore, this theoretical literature review will aim to fill this gap by synthesizing existing

knowledge on MFA and VFA in saw milling operations while also considering the unique characteristics of *Cupressus lusitanica*. (Nasir and Cool ,2020a). The review will explore key factors influencing material and value flows in *Cupressus lusitanica* sawmills, including log procurement practices, log breakdown techniques, lumber grading systems, waste management strategies, and product distribution channels. Additionally, it will examine methods for quantifying material losses, energy consumption patterns, production costs, and revenue generation along the saw milling process. Furthermore, this literature review will critically evaluate existing methodologies for conducting MFA and VFA in sawmilling operations to identify best practices that can be applied to *Cupressus lusitanica* processing in Gelan and Addis Ababa sawmills. In conclusion, this theoretical literature review aims to provide a comprehensive understanding of material and value flows in *Cupressus lusitanica* saw milling operations in Gelan and Addis Ababa by synthesizing existing knowledge from related studies while also identifying areas for future research to improve sustainability and efficiency in timber processing industries(Das et al., 2021). The process of saw milling a wood log into large, marketable lumber used to make furniture and other wood-based items is known as saw milling. Logs are sawed lengthwise to produce lumber, a solid wood product. A sawmill is a type of industrial facility where logs are turned into lumber and other wood products using machinery, transporters, and handling devices.(Tymendorf , 2020) The recovery rate is calculated by dividing the total amount of wood used in product manufacture by the total amount of items produced. The majority of sawmills in Ethiopia waste 20–40% of the wood logs, which leads to a poor rate of recovery. Several factors influence the amount of lumber that may be produced from a given volume of logs, (Y. S. Rawat and Tekleyohannes 2021).

## **2.2 Species Description**

*Cupressus lusitanica* is an evergreen conifer tree with a conic to ovoid-conic crown, growing to 40 m tall. The foliage grows in dense sprays, dark green to somewhat yellow-green in cooler. ( De Lange, 2018). The leaves are scale-like, 2–5 mm long, and produced on rounded (not flattened) shoots. The seed cones are globes to oblong, 10–20 mm long, with four to 10 scales, green at first, maturing brown or grey-brown about 25 months after pollination. The cones may either open at maturity to release the seeds, or remain closed for several years, only opening after the parent tree is killed in a wildfire, allowing the seeds to colonize the bare ground exposed by the fire. The male cones are 3–4 mm long, and release pollen in late Winter / Early Spring (February–March in the

northern hemisphere). In most of its natural environment the rainfall occurs with more quantity in summer (Nasir and Cool, 2020b).

### **2.3 The use of *Cupressus lusitanica***

*Cupressus lusitanica* is a 35-meter-tall evergreen tree with a thick, conical crown. Yeferenji-tid is the Amharic name for it. Pendulous branch lets are the result of widely distributed branches (Tesfaye, 2022). The evergreen coniferous tree *Cupressus lusitanica* Mill. is sometimes known as the Mexican cypress or East African cypress. It is a member of the Cupressaceae family. This tree may reach a height of 25–30 m and is grown as an ornamental in gardens and commercial forestry plantations in tropical and temperate regions of the world. Its trunk has a diameter of 70 cm .The linear distance, measured across the main axis of the tree, from ground level to the highest tip of the crown is the overall height of the tree (Gelan, 2019). It is native to Central America, growing between 1200 and 3000 meters above sea level. The trunk's reddish-brown bark appears in long, narrow strips that peel off, and then many tiny cracks start to show. Branch lets are covered in small, decussate, pressed, acute, sessile scale leaves with flexed ends (Kipkore, 2019). The medium-density wood of *Cupressus lusitanica* is used for ordinary construction and furniture manufacture. It was reported to be a valuable species for pulp and paper production. According to (.refer C. lusitanica BOARDS .pdf n.d.). the composition, structure, and properties of wood differ significantly depending.

### **2.4 Sawmill industries**

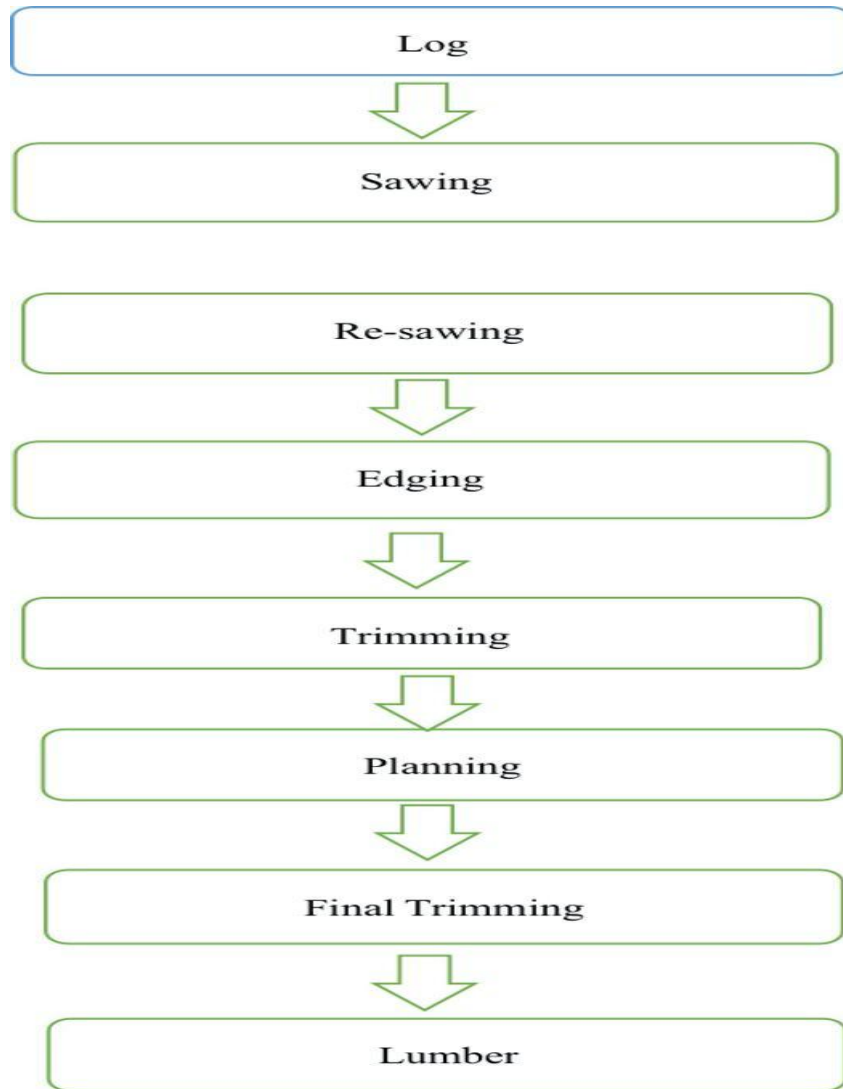
Sawmill is an industry where saw milling activity is performed. Sawing is the process of converting logs into lumber, (Onyango et al., 2021). Sawing technology is the mechanization of man's earliest activities towards human settlement and development by cutting wood into sizes useful for satisfying human demand (Boswell , 2023). Sawmill is a wood-processing industry equipped with various wood-processing machines. These machines include band saws and circular saws. In the sawmill industry, the wood has to be converted into various sizes that will maximize profit and satisfy the demand of the people by providing quality lumber. The sawing process involves a number of variables that affect tool wear, cutting pressures, power consumption, surface quality, and other variables. These variables can be divided into three primary categories: the work piece, the feed, and the tool, which are listed in that order (Conference et al., 2019).

## **2.5 Sawing methods**

The majority of research, it has been found, has concentrated on band and circular sawing, the most common machining technique utilized in the primary and secondary wood transformation industries. While band saws are the most common type of tool used in wood machining, circular saws have a broader kerf. Hardwood lumber producers are constantly seeking methods to increase the value of their goods. One method of increasing the cost of timber is to saw the logs using a method that produces sawn lumber (Lolila et al., 2021). Quarter - saw lumber is far more valuable and in high demand for uses such as furniture and cabinet manufacturing than lumber saw in other ways.

## **2.6 Sawmill Lumber Manufacturing Process:**

Saw milling are facilities those process log value flow in to product ( Uganda , 2021). The industry's equipment and workforce were developed to process wood raw materials that were relatively defect-free, easily processed, and inexpensive to waste. However, the production and utilization of lower grade material has been prompted by price increases and dwindling high quality timber resources. The industry's traditional processing technology is not optimally suited to efficiently grade and process such materials. Consequently, the wood products manufacturing industry needs to explore innovative processes aggressively in order to maintain the quality of lumber and thrive in an increasingly complex and competitive environment (Capuano, 2023).



*Figure 2. 1: Sawmill Lumber Manufacturing Process*

## 2.7 Empirical Literature Review

The saw milling of *Cupressus lusitanica*, also known as Portuguese cypress, is an important industry in Gelan and Addis Ababa, and understanding the material and value flow analysis of this process is crucial for optimizing production and resource utilization. (Onyango et al., 2021). This empirical literature review aims to investigate the current state of research on the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa. Several studies have focused on the saw milling process of different tree species, but there is a lack of specific research on *Cupressus lusitanica* in the context of Gelan and Addis Ababa. However, some relevant literature can provide insights into the general principles and methodologies for material and value flow analysis in saw milling operations. One study by conducted a material flow analysis in a sawmill in Canada, focusing on the input-output balance and resource utilization efficiency. The study found that optimizing log breakdown patterns and processing techniques can significantly improve material yield and reduce waste (Chabanet et al., 2023). Investigated the value flow analysis in a sawmill in Sweden, analyzing the economic aspects of different processing methods and product distribution channels. The findings highlighted the importance of market demand forecasting and product differentiation for maximizing value creation. In addition to these general studies, it is essential to consider any specific research on *Cupressus lusitanica* saw milling or similar tree species that may provide insights into its unique characteristics and processing requirements. For example, a study by (Alhassan et al., 2019). examined the wood properties and processing challenges of *Cupressus lusitanica* in Portugal, which could be relevant to the saw milling operations in Gelan and Addis Ababa. Overall, while there is limited direct empirical literature on the material and value flow analysis of *Cupressus lusitanica* saw milling in Gelan and Addis Ababa, existing research on similar topics can offer valuable insights and methodologies for conducting such an investigation. (Tymendorf , 2020).Future studies should aim to fill this gap by conducting specific empirical research on the sawmilling process of *Cupressus lusitanica* in Gelan and Addis Ababa three sawmills to optimize production efficiency and resource utilization while maximizing value creation.

## 2.8 Research Gaps

The evaluation of existing methodologies for conducting Material Flow Analysis (MFA) and Value Flow Analysis (VFA) in saw milling operations is crucial for identifying best practices that can be applied to *Cupressus lusitanica* processing in Gelan and Addis Ababa sawmills. (Hopewell, 2011). By synthesizing knowledge from related studies, this theoretical literature review aims to provide a comprehensive understanding of material and value flows in *Cupressus lusitanica* saw milling operations in Gelan and Addis Ababa. Existing methodologies for MFA and VFA in saw milling operations typically involve the collection and analysis of data on inputs, outputs, and value-added processes within the production system. These methodologies help to identify inefficiencies, waste generation, and opportunities for improvement in the processing operations (Tesfaye, 2022).

In the context of *Cupressus lusitanica* processing in Gelan and Addis Ababa sawmills, it is important to consider factors such as

- Raw material sourcing,
- Processing techniques, and
- Market dynamics.

By applying MFA and VFA methodologies, sawmill operators can gain insights into their material and value flows, identify bottlenecks or inefficiencies in the production process, and make informed decisions to optimize resource utilization and maximize profitability.

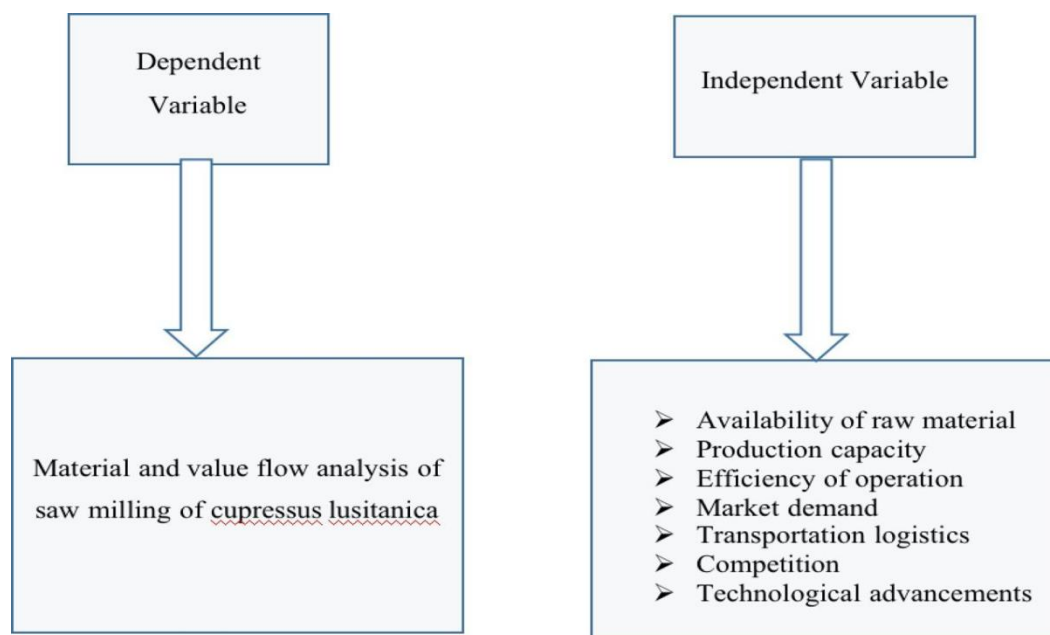
Based on the findings of this theoretical literature review, it is evident that there is a need for further research to improve sustainability and efficiency in timber processing industries. Future studies could focus on developing standardized methodologies for conducting MFA and VFA specifically tailored to *Cupressus lusitanica* processing in Gelan and Addis Ababa sawmills. Additionally, research efforts could explore innovative technologies or practices that can enhance resource efficiency, reduce waste generation, and increase value creation in the saw milling operations (Topanotti et al., 2021).

In conclusion, by leveraging existing knowledge from related studies on MFA and VFA in saw milling operations, Gelan and Addis Ababa sawmills can adopt best practices to enhance their operational performance and contribute towards sustainable development goals in the timber processing industry. This theoretical literature review sets the foundation for future research

endeavors aimed at improving sustainability and efficiency in *Cupressus lusitanica* processing operations.

## 2.9 Conceptual framework

**Figure 1** of the conceptual framework that follows illustrates the way the study variables should be related to one another. actors affecting the material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa City



*Figure 2.2 Conceptual framework*

# CHAPTER THREE

## Research Methods and procedures

### 3. Study Framework

#### 3.1 Description of the study area

The data were collected by interviewing sawmill manager, production, workers and employers area is located in Gelan and Addis Ababa, a region known for its saw milling industry.

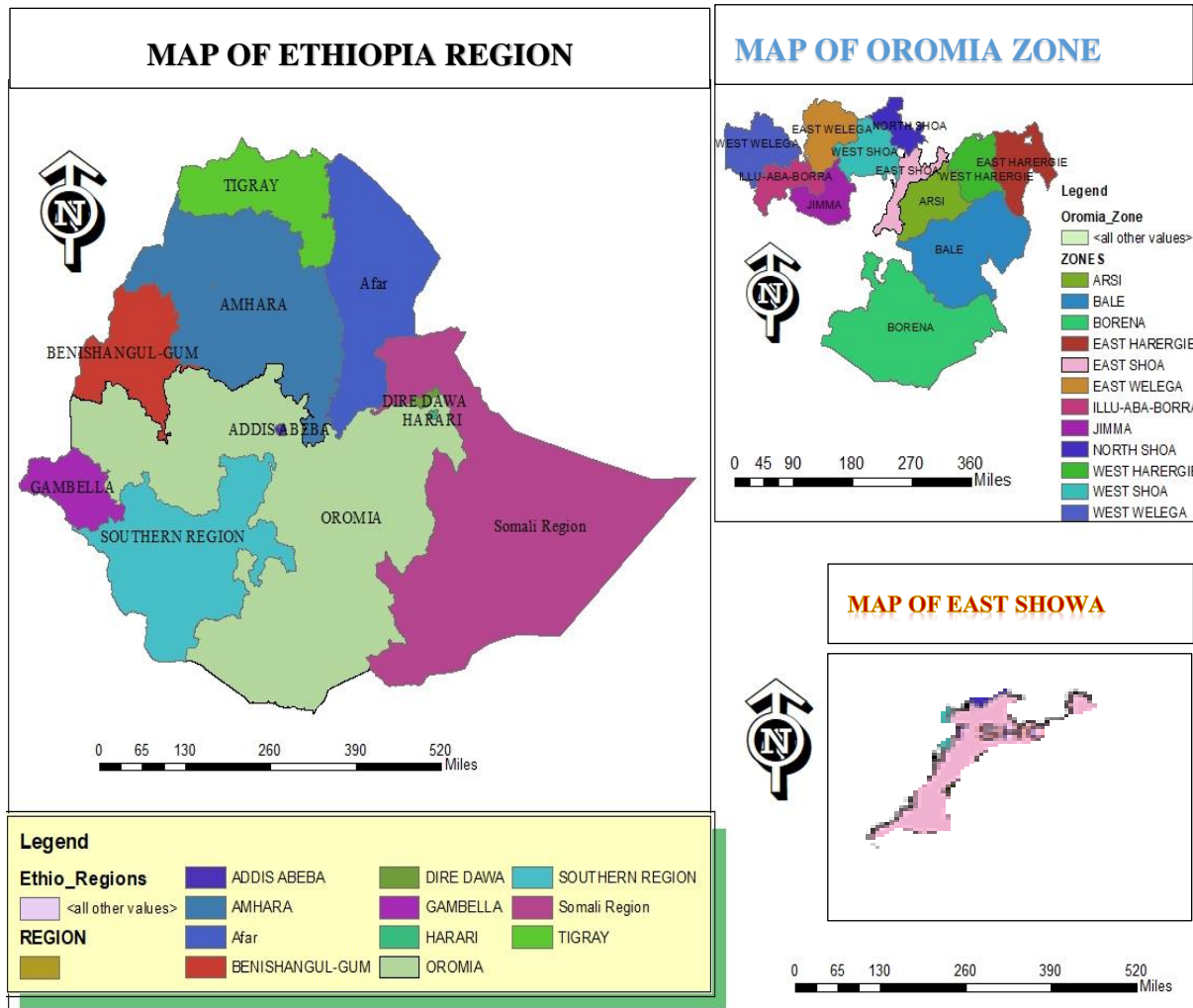


Figure 3. 1: Map of the study area (Source)

## 3.2 Research Methods and procedures

### 3.2.1 Survey and Sampling

The logs of *Cupressus lusitanica* that are widely used in the lumber production were accessed from the local market of Addis Ababa town with the length of 400 cm, and 200 cm log. The logs were producing for lumber that are used for this study was trimmed at the two-end portion about 4 m and 2 m length. in this study the saw milling respondent numbers is 90 on the three saw milling plc.

### 3.2.2 Sampling technique

In this study, multi-stage sampling technique was employed in order to achieve the objectives of the study.

*Table 3. 1: the study saw milling PLC*

	<b>Name of PLC</b>	<b>Frequency</b>	<b>Percent</b>
	Abiyata saw milling	30	33.3
	SNH saw milling	30	33.3
	Philiphose saw milling	30	33.3
	Total	90	90

*Table 3. 2: Interviewees and their position in the saw milling data*

<b>PLC participating in the study</b>	<b>Interviewees according to their position</b>
Level A	General manager
Level B	Production manager
Level C	Machine operator
Level D	Co-workers

### **3.3 Study variables**

In this study customer satisfaction is the dependent variable. Age, gender, income, ownership of the house, level of education, size of the wooden bed, price, durability, design and finishing of the wooden bed are the independent variables.

### **3.4 Variable definitions**

#### **3.4.1. Input Parameters**

- Log Quality and Species: The quality of incoming logs (diameter, length, defects) and the species determine their initial value and processing suitability.
- Log Volume: The volume of logs received dictates the potential output and overall efficiency of the sawmill.
- Log Delivery Schedule: Regular and predictable log delivery ensures smooth operation and minimizes downtime.

#### **3.4.2. Process Parameters**

- Sawmill Layout and Equipment: The configuration of the sawmill (sawing lines, sorting systems) and the type of equipment (sawmills, planers, kilns) significantly impact the speed, accuracy, and quality of processing.
- Sawing Techniques: The methods used to cut logs (rip sawing, crosscutting) determine lumber dimensions and yield.
- Drying Processes: Kiln drying and air-drying methods control moisture content and influence lumber stability and quality.
- Waste Management: Efficient waste management (sawdust, bark) minimizes environmental impact and potentially creates value from byproducts.

#### **3.4.3. Output Parameters**

- Lumber Quality and Dimensions: The grade, size, and quality of lumber produced directly impact market value.
- Lumber Yield: The percentage of usable lumber extracted from the logs influences profitability.
- Production Rate: The sawmill's overall output of finished lumber determines its productivity.

#### **3.4.4. Value Flow Optimization**

- **Material Flow Analysis:** Analyzing the movement of materials through the sawmill to identify bottlenecks and optimize efficiency.
- **Inventory Management:** Managing log and lumber inventory to minimize storage costs and ensure timely production.
- **Quality Control:** Implementing quality control measures at each stage to ensure consistent product quality and minimize waste.

#### **3.4.5. Financial Parameters**

- **Log Costs:** The price of logs is a major input cost that influences profitability.
- **Operational Costs:** Energy consumption, labor, maintenance, and other operational expenses impact profitability.
- **Lumber Sales:** The market value of lumber determines the profitability of the sawmill. By carefully managing these parameters, sawmills can achieve optimal materials value flow, maximizing efficiency, quality, and profitability in the production of lumber products.

#### **3.4.6 Quality**

Quality Control: Implementing quality control measures at each stage to ensure consistent product quality and minimize waste.

#### **3.4.7 Waste management**

Waste Management: Efficient waste management (sawdust, bark) minimizes environmental impact and potentially creates value from byproducts.

#### **3.4.8 Inventory**

Maintain accurate inventory records by tracking and managing stock across several locations, which lowers the possibility of stock discrepancies. From the reload yard to the mill and log yard.

#### **3.5 Data Collection:**

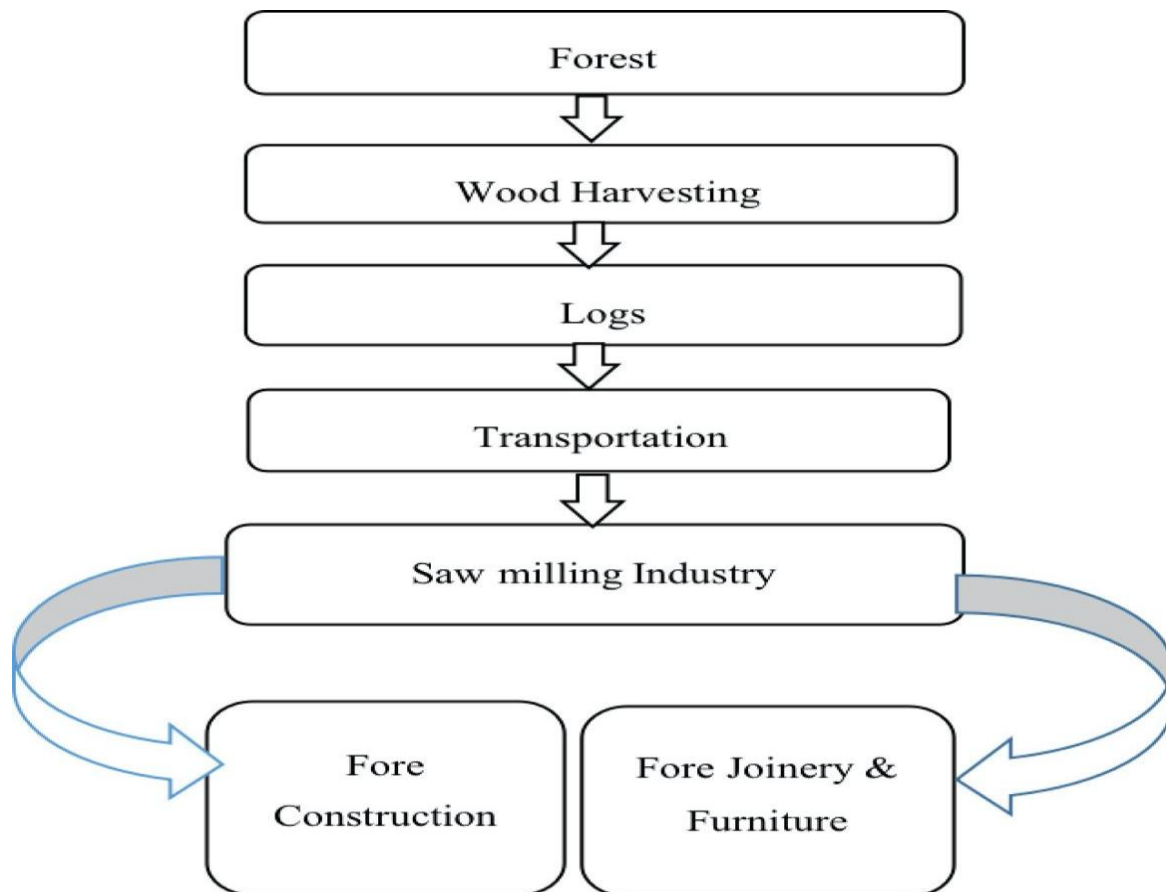
The data collected through direct observation of the saw milling processes at each selected mill. This is involve documenting each step involved in converting raw logs into finished lumber, including log intake, log breakdown, sorting, grading, drying, planning, and packaging (Capuano 2023).

### 3.6 Material Flow Analysis:

The collected data was used to create a material flow diagram that visually represents how materials move through each stage of the sawmill operations (Wang and Haller 2024).

### 3.7 Value Flow Analysis:

The value flow analysis Economic values associated with each stage of processing is be assessed to determine how much value is added at each step (Sui et al. 2020).



*Figure 3. 2: Value flow analysis*

### **3.8 Bottleneck Identification**

By analyzing the material and value flows, potential bottlenecks or inefficiencies will be identified that hinder optimal production processes or reduce economic returns.

### **3.9 Method of data collection**

The sampling method for investigating material and value flow analysis of saw milling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa It was involve a combination of random and purposive sampling techniques. First, a list of all the sawmills in Gelan and Addis Ababa that process *Cupressus lusitanica* it was be compiled. From this list, three sawmills were be on the purposively selected based on their size, production capacity, and reputation in the industry (Wang and Haller ., 2024). Once the three sawmills are identified, a random sampling technique ware used to select the specific days or periods for data collection. This was ensure that the data collected is representative of the overall operations of each sawmill. Within each selected sawmill, a purposive sampling method a respondent will be used to select specific processes and stages within the saw milling operation for data collection (Capuano ., 2023). This may include the selection of specific machines or equipment, as well as specific points in the material and value flow chain. data collection methods mas include direct observation, interviews with key personnel, and review of production records and financial documents. The data collected analyzed to understand the material and value flow within each sawmill, included inputs, outputs, waste generation, and value addition at each stage of the process. By using a combination of random and purposive sampling methods, this investigation aims to provide a comprehensive understanding of the material and value flow analysis of sawmilling of *Cupressus lusitanica* in three selected sawmills in Gelan and Addis Ababa.

### **3.10 Data Analysis**

Descriptive statistics like means, frequencies, percentages, and standard deviation will be used to record, summarize, and interpret the data that has been collected. To examine the differences between statistically significant data groups, Microsoft Word and Excel will be utilized, along with ANOVA for documentation purposes. Determining the standards for the various visual quality grading categories it is also be made easier with an investigation into how sawing techniques affect the grading of lumber made from *Cupressus lusitanica*. Analyze the data at 0.05 level first.

### **3.11 Machineries saw milling process**

This study was going to investigate the effects of sawing methods on the grading of lumber produced from *Cupressus lusitanica* by using band-sawmill, which are prevalent in Ethiopia. ( Rawat, et al., 2023). The machines are housed at Abate Sawmill Enterprise, SNB Sawmill Enterprise Philip hose Sawmill Enterprise in Gelan and Addis Ababa.

#### **3.11.1 Jointer Machine:**

A jointer used to make one face of a board, and one adjacent edge, perfectly flat and square to each other. Jointers are also great for flattening out cupped boards, removing twist, preparing board edges and to produce a flat surface along a board's length (Boswell ., 2023).

#### **3.11.2 Band-sawmill:**

The machine assembly is installed on a permanent site. The band saw cuts fast and accurately, provided the blade is correctly sharpened, tensioned, and strained between two large (upper and lower) wheels. The lower, heavier wheel is powered and pulls the blade down through the log as it is fed into the saw (Boswell., 2023).

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### **4.1 The material flow within the selected sawmills during the saw milling process of *Cupressus lusitanica***

Ethiopia is one of the countries that produces the most *Cupressus lusitanica* lumber, with a variety of logging operations (Sui et al., 2020). One issue that has to be taken into account is transportation and broker. The price of the hydration the sawing technology in use determines the varying quantities and quality of these items (Das et al., 2021). Cutting optimization is currently a major focus of production planning techniques. However, it is clear that operating expenses may be reduced by using a more integrated strategy that takes inventory management and a thorough resource scheduling of bottlenecks into account. Furthermore, a methodical connection is established between production planning choices and client orders. When market trends shift and a new manufacturing mix is needed, this was advantageous (Wang and Haller., 2024). This new mix represents the demand for and profit potential from by-products in addition to being a mixture of the primary items. Addis Ababa and Gelan the saw milling machine Band saw machine and Jointer Machine, Utilizing cutting-edge machinery and saw milling plc procedures, the material flow evaluation underpins the planning methodologies. technology and production volume is presented in this study. Mill efficiency will rise even more with the use of this new planning tool. (Chabanet et al., 2023). For mills with high personnel expenses, this is an essential necessity to maintain their competitiveness and guarantee the functioning of a specific manufacturing location (Trzcinski and Tymendorf . 2020) *Cupressus lusitanica* the feedback crucial to every sawmill operation the Investigating material and value flow analysis of sawmilling of *Cupressus lusitanica* in three sawmills of Gelan and Addis Ababa selected saw mill in Gelan city Abiyata .SNH sawmill PLC and philiphose saw milling PLC in Addis Ababa All necessary data were collected and recording on data collection sheets prepared for the purpose of the study the quantity skills and adequacy of the saw mill personnel at each site operation were observed .

##### **4.1.1 characteristics**

This study is Investigating Material and Value Flow Analysis of Sawmilling Of C. Lusitanica In Three Sawmills Of Gelan And Adise Abeba. A total of 90 employed respondents were included for this study. The respondents were composed of 76% and 24 % men and femal , respectively.

More than one-third (53 %) of the respondents are under the age range of 18 to 35 years. The mean age of the study participants was 47 % above 36 age years old. Gelan sub city 67% and Addise Abeba city kirkose wareda 33% participants in live . The majority (46%) of the respondents education levele 12 blow , degree 16% and diploma 38% . More than half (58 %) of the respondents not profotional the educational level around one-third of participants (38%) had achieved college The general characteristics of the study participants are listed in **Table 4.1**

*Table 4. 1: On the Preferences of the respondent's full data*

No	Gender	Frequency	Percent
1	Male	68	76
2	Female	22	24
3	Total	90	10
No	Age		
1	18-35	48	53
2	36-44	42	47
3	Total	90	100
No	Adders		
1	Sub city	60	67
2	Werda	30	33
No	Educational level		
1	Diploma	35	38
2	Degree	14	16
3	12 Below	41	46
4	Total	90	100
No	Professions		
1	Furniture	38	42
2	Other	52	58
3	Total	90	100
No	Position		
1	Production manger	36	13
2	Co-worker	54	87
3	Total	90	100

## 4.2 Waste material managed and disposed of during the saw milling process

Among the waste products produced during the sawmilling process are bark, wood chips, and sawdust. These materials can be handled and disposed of in a number of ways, including landfill disposal, energy production, composting, and recycling (Blinová et al., 2017) In sawmilling, waste material management refers to the effective processing and utilization of byproducts produced during the milling process, such as bark, wood chips, and sawdust. To reduce environmental effect and maximize resource use, waste can be recycled for energy production, turned into wood pellets or composite materials, or used for landscaping and animal bedding (Kasirajan et al., 2017). the importance of input, process, output, value flow optimization, finances, quality, waste management, and inventory of waste materials managed and disposed of during the saw milling process is shown by the respondents' status in the (Topanotti et al., 2021) The average overall importance of prospective advantages throughout the saw milling process was determined based on the findings.(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree)(11.12), Input (17%), process (22%) ,Output (16%), Value flow optimization (2%), , Quality (20.%) ,Waste management (34%) and Inventory(28%) on 5-point scale from 1 (strong agree) to 5 (strong disagree), input (50 %) agree , output (51%) agree , and quality (27 %) agree were considered as very important factors waste management. (Stafford and De Lange. 2018).The result revealed that majority of respondents strong disagree on waste management in the sawmill industry. This result shows that there is no waste management practice in all sawmill shop (**Table 4.2**). But according to this result there were high percentage of value flow optimization in all sawmill industry (**Table 4.2**). The average percentage of total respondents shows in the (**Table 4.2**) shows that there are high percentage (41%)of agree response in all patterns on waste material management and disposal material during saw milling process (Vojáčková, Tippner, and Nop. 2020).The results also revealed that there is an agree response on the quality of material input and output in sawmill industry in Gelan and Addis Ababa (**Figure 4.1**). On the other hand, not important factors at all. Nearly two-third product the problem of waste management respondent say to big challenge the (Stafford and De Lange . 2018).The material flow within the selected sawmills during the saw milling process of *Cupressus lusitanica* more information to the study participants are listed in **Table 4.2**. regarding to input materials in all sawmill industry the result shows that there were high percentage of agree response on *Cupressus lusitanica* timber in all industry (**Figure 4.1**). According to this result most sawmill industry uses the *Cupressus lusitanica* timber for the production. When it

comes to the respondents' preferred *Cupressus lusitanica* lumber product, the majority of them (56 %) select locally produced goods (Palátová , 2019). Approximately 3 quartiles (48%) of the participants possess locally sourced hardwood timber items. The majority of respondents (62.4%) said they got their hardwood bed products from a little shop close to where they lived (**Figure 4.1**).

Table 4. 2: Waste material managed and disposed of during the saw milling process

Parameter	Strong disagree		Disagree		Neutral		Agree		Strong agree	
	Fre	%	Fre	%	Fre	%	Fre	%	Fre	%
Input	15	17	26	29	2	2	45	50	2	2.2
Process	20	22	3	3	20	22	46	51	1	1.1
Output	14	16	18	20	22	24	36	40	0	0
Value flow optimization	2	2	22	24	5	5.6	61	68	0	0
Financial	0	0	41	46	12	13	37	41	0	0
Quality	18	20	17	19	31	34	24	27	0	0
Waste management	31	34	22	24	15	17	22	24	0	0
Inventory	25	28	32	36	11	12	22	24	0	0
<b>Average percentage total</b>		17		25%		16%		41%		1%

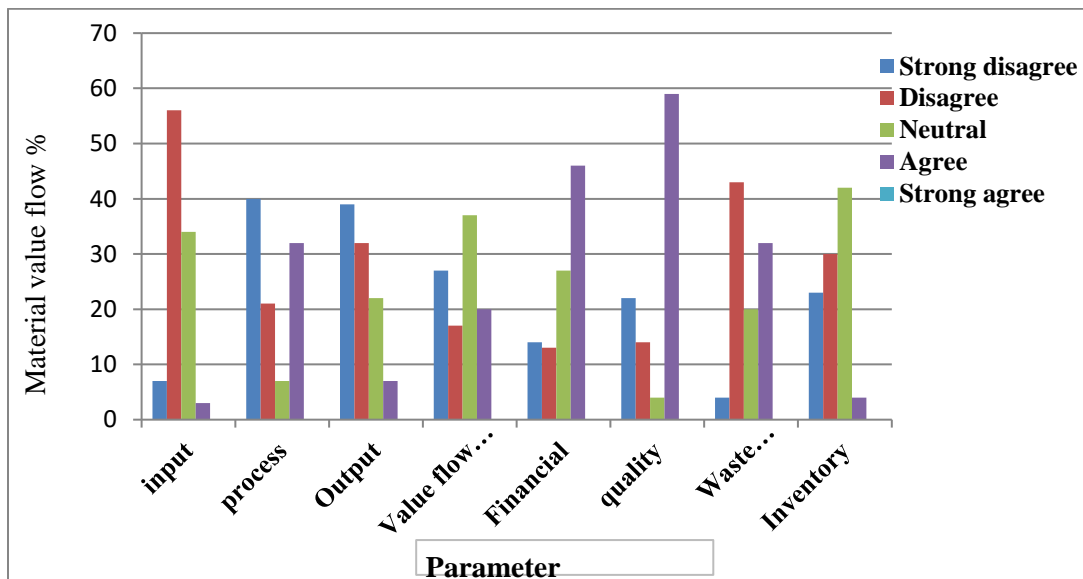


Figure 4. 1: Waste material managed and disposed of during the saw milling process



*Figure 4. 2: Abiyata saw milling processing sample product*



*Figure 4. 3: SNH Improvement in the material flow within the sawmills*

### **4.3 The value flow from raw materials (logs) to finished products (lumber) in terms of economic value added at each stage.**

Value Flow Analysis (VFA) can be applied to measure the value produced by a system and enhance procedures. It is a lean manufacturing tool that aids in locating wasteful and value-adding processes inside a process. (Kitek Kuzman .2024). VFA seeks to maximize the value stream through productivity gains, quality enhancements, lead time reductions, and waste elimination. (Palátová. 2019) Value Stream Mapping (VFA) is a process optimization tool that entails mapping the value stream, analyzing the flow of value, finding waste, and creating a plan to optimize the value stream and remove waste (Sui et al., 2020). By providing high-quality goods or services on time, the VFA method aids businesses in cutting expenses, boosting productivity, and improving customer happiness. However, VFA can also be applied as a method to choose KPIs (Key Performance Indicators) that quantify the value produced by a system at each phase (input, process, output, and outcome). The value flow from raw materials (logs) to finished products (lumber) in terms of economic value added at each stage The main cause of Ethiopia's sawmills' low capacity utilization is their antiquated machinery, which produced a huge amount of waste and a low recovery rate (Sui et al, 2020). The output (lumber) of a log during the sawing operation is known as the lumber. *Cupressus lusitanica* is widely used in Ethiopia The value flow from raw materials (logs) to finished products (lumber) in terms of economic value added at each stage for lumber, construction, furniture making, poles, and posts. To estimate the lumber product, sampled logs were processed in accordance with the sawmill's standard lumber size and regular production rate. The purpose of this study was to look at the value flow of *Cupressus lusitanica* and its constituents (Nebiyu. 2023). The size of the lumber recovery rate was reduced by several reasons. Wider saw kerf cutting was shown to result in more sawdust being produced, which in turn slowed the rate at which lumber recovered. The sawmill yard was used to air-season the lumber (Wongnaa et al, 2022). By maximizing the amount of lumber recovered from the logs, sawmill profitability can rise, climate change effects can be mitigated, natural resource sustainability can be ensured, energy efficiency can be improved, and wood waste can be managed (e.g., through recycling and prevention) for the development of green economies and the transformation of industries. Due to the high demand for this species in Ethiopia's wood industry, more *Cupressus lusitanica* plantations and yields are needed to support sustainable forestry, preserve priceless forest

resources, and preserve the nation's biodiversity.(Sui et al., 2020) From raw materials (logs) to completed goods (lumber), there are multiple phases of economic value addition in the value flow:

1. Acquisition of Raw Materials: Logs are collected and processed, adding initial value by transportation and extraction.
2. Primary Processing: By sawing and using other primary processing techniques, logs are turned into rough lumber, which raises their value.
3. Secondary Processing: By shaping, cutting, and finishing rough lumber, additional value is added to completed goods like boards, planks, or beams.
4. Distribution and Marketing: To effectively reach customers, value is added through distribution methods, branding, packaging, and marketing initiatives.
5. Retail Sale: The last phase is charging consumers or companies a price for the completed lumber goods that represents the whole worth of all earlier phases.From raw materials to completed goods, every step of the supply chain adds to the total economic value generated (Mathur, 2021).

The status of the responders, illustrates the significance of input, process, output, value flow optimization, finances, quality, waste management, and inventory of waste materials managed and disposed of during the sawmilling process.(Sui et al., 2020). The Analyzed data revealed that the perceived importance of various factors within the sawmilling process. Respondents strongly agreed that input (50%), output (51%), and quality (27%) are crucial for waste management. The overall significance of potential benefits throughout the sawmilling process was calculated, with input (17%), process (22%), output (16%), value flow optimization (2%), quality (20%), waste management (34%), and inventory (28%) deemed important. These findings demonstrate a widespread understanding of the economic value of material flow within the sawmill industry (**Figure 4.4**). The surveyed data revealed that insights into the purchasing habits and preferences of consumers regarding *Cupressus lusitanica* wood products ( Tekleyohannes, 2021). A majority (51.9%) of respondents had purchased *Cupressus lusitanica* lumber products in the past, while the remaining participants had purchased them more recently in terms of their economic value. Similar result shows that a significant majority (56.3%) of respondents preferred locally made *Cupressus lusitanica* products, and approximately three-quarters (48%) of the participants owned wood timber products purchased locally (Sui et al., 2020). The majority (64%) of respondents purchased their wood log goods from small stores near their homes (**Figure 4.4**). The most common motivation for purchasing *Cupressus lusitanica* wood was its affordability (41.5%). Other factors

influencing purchase decisions included species richness (14.7%), lower prices (13.3%), and higher quality. These findings suggest that *Cupressus lusitanica* wood products are popular in the local market, with a strong preference for locally sourced goods. The affordability of this species appears to be a major driving factor for consumers (Stafford and De Lange. 2018).

Table 4. 3: Frequency for value flow of raw materials in terms of economic value

Parameter	Strong disagree		Disagree		Neutral		Agree		Strong agree	
	Fre	%	Fre	%	Fre	%	Fre	%	Fre	%
Input	6	7	50	56	31	34	3	3	0	0
Process	36	40	19	21	6	7	29	32	0	0
Output	35	39	29	32	20	22	6	7	0	0
Value flow optimization	24	27	15	17	33	37	18	20	0	0
Financial	13	14	12	13	24	27	41	46	0	0
quality	20	22	13	14	4	4	53	59	0	0
Waste management	4	4	39	43	18	20	29	32	0	0
Inventory	21	23	27	30	38	42	4	4	0	0

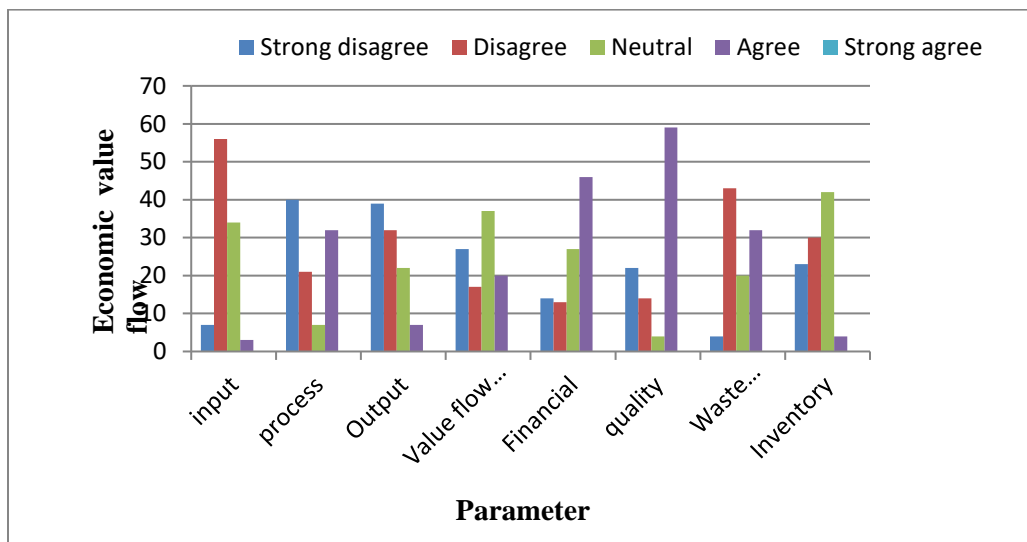


Figure 4. 4: Frequency for value flow of raw materials in terms of economic value

#### **4.4 The primary materials used in the saw milling process of *Cupressus Lusitanica* in the three sawmills of Gelan and Adise Abeba**

The obtained data revealed that the primary materials used in the saw milling process of *Cupressus Lusitanica* in the three sawmills of Gelan and Adise Abeba it was be recorded, compiled, and interpreted using descriptive statistics such as means, frequencies, percentages, and standard deviation ,(Irey, 2023).Due to its rapid growth and ability to adapt to a wide range of geographical conditions, *Cupressus lusitanica* (Miller) has been widely selected in Ethiopia in several sawmill industry.(Boswell , 2023) In contrast, indigenous species grow more slowly and yield lower returns on investment. An examination of the effects of sawing procedures on the grading of *Cupressus lusitanica* lumber werel also facilitate the determination of criteria for the various timber quality selecting categories ,(Wang and Haller ,2024).

In the industry, "sawmill" might refer to one of two distinct ideas. The first is a place where lumber is milled. The entire plot of land that houses the sawmill, including the milling equipment, the log sort yard, and the area used for sorting and storing wooden planks, is known as the sawmill. A sawmill's administration and maintenance areas are located on the premises. (Mulkey and Dow. 2021)

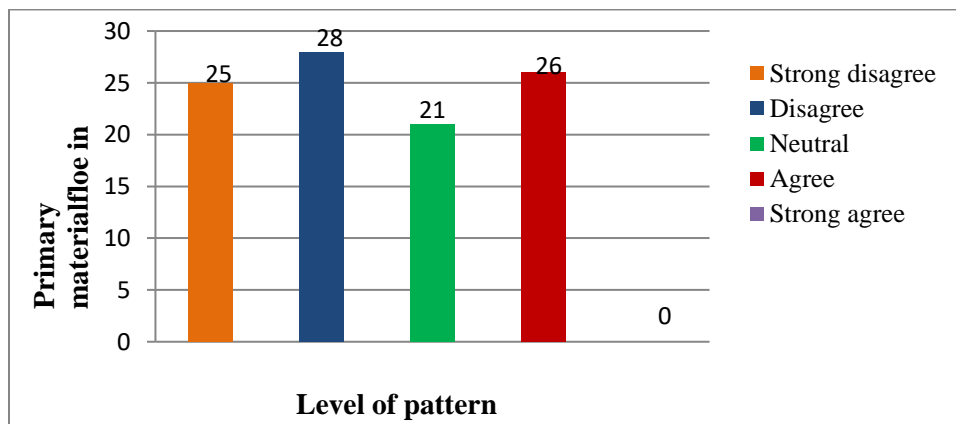
A sawmill can also refer to a particular type of cutting or sawing equipment. For use in production, these devices transform round logs into rectangular timbers. The core sawing machine is referred to as a head rig in the sawmill industry, however in order for it to work properly, it requires a substantial support structure. Possibly the best way to characterize a sawmill is as the complete apparatus that transforms logs in to Sawmills are by nature busy places, whether you use the term to describe the particular sawing machine or the complete timber milling operation. The majority of sawmills in use today are massive, highly productive commercial operations. To maintain efficient timber output, several of these sites arrange rotating shifts for hundreds of workers.(Das et al., 2021).

The primary material used in the saw milling process of *Cupressus lusitanica*, also known as Mexican cypress or Portuguese cypress, is the wood from the tree itself. This wood is valued for its durability, straight grain, and resistance to decay. It is commonly used in construction, furniture making, and other woodworking applications (Borz et al., 2021). The results in the **table 4.4** and **figure 4.5** revealed that there were the majority of respondents disagree (28%) on the primary raw material in the sawmill industry. some responses are agree (26%) on the quality of primary raw

materials such as timber in sawmill industry (**Figure 4.5**). The 25% of respondents strong disagree and 21% of respondents are neutral on their response on primary raw material in sawmill process (**Table 4.4**). Based on the surveyed data the average responses of respondents was calculated throughout the saw milling process regarding accessing of primary materials (Borz et al., 2021). Therefore, this findings direct there no attention on criteria on the selection of primary raw materials for sawmill process (Sui et al., 2020).That means the degree of awareness on material flow with its value is low as the results indicated.

*Table 4. 4: Frequency for primary materials in the sawmilling process*

Parameter	Strong disagree		Disagree		Neutral		Agree		Strong agree	
	Fre	%	Fre	%	Fre	%	Fre	%	Fre	%
Input	15	17	36	40	17	19	22	24	0	0
Process	12	13	42	47	24	27	12	13	0	0
Output	37	41	17	19	9	10	25	28	2	2
Value flow optimization	28	31	26	29	28	31	8	9	0	0
Financial	18	20	14	16	30	33	28	31	0	0
Quality	13	14	20	22	16	18	41	46	0	0
Waste management	16	18	23	26	6	7	45	50	0	0
Inventory	39	43	19	21	23	26	9	10	0	0
<b>Average total</b>		25		28		21		26		



*Figure 4. 5: Average percentage of respondent on primary material flow in sawmill process*

## CHAPTER FIVE

### 5. CONCLUSION AND RECOMMENDATIONS

#### 5.1. Conclusion

In this research, the general analysis of the three log sawmill manufacturing processes from supply to the manufactured product is made through physical observation and questions. The findings of the present study suggests the beginning of the production of *Cupressus lusitanica* we will be supplied to them through a middleman and they have informed us that they have a problem with the supply. He said that one of the problems of our work is not being able to travel as desired due to seasonal changes in transport. In terms of production materials, the inability to process the flow of workers as required, this problem is the lack of sufficient skilled manpower to use modern machines. There is a problem of not having enough spare parts for the machines, although there are some of them, we are not allowed to buy them at high repair prices, and all three saw milling plc One of our problems is that the materials we produce are limited, for example, timber and morale. The first production flow in the C- splitter is that the log is cut, it is rolled by human power to the commercial side, and then it is loaded by human power to the truck and arrives with our broker and freight forwarder. Therefore, the work flow indicates that there are problems from the supply to the material. Therefore, to solve these problems, all parties should talk closely and provide a solution to the problem.

#### 5.2 Recommendations:

Based on identified inefficiencies or bottlenecks, recommendations were made to optimize material consumption and increase overall value production within the sawmill operations. The study's findings lead to the recommendations listed below. The sawmill industry requires a consistent flow of high-quality, thick-cut sawmills. *Cupressus Lusitanica* is now priced as it is because we are unable to order as much as we would want due to middlemen in the supply chain. The study's findings lead to the recommendations listed below.

1. The sawmill industry requires a consistent flow of high-quality, thick-cut sawmills.
2. The price of *Cupressus Lusitanica* is now high since we are unable to order as much as we would like due to middlemen in the supply chain.

3. It is a good idea to employ new trucking technologies going forward since they can facilitate human labor during loading and unloading in the event that the transportation problem is resolved.
4. We've seen that all three industries are using antiquated equipment, so new equipment needs to be installed in their place.
5. The capacity is the largest obstacle to doing this.

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## **APPENDIX I: *Cupressus Lusitanica*, Sawmill, Recovery, Value Flow, Lumber, Production flow questionnaire**

### **Annexes**

#### **Annex I: Information sheet and consent form (English version)**

##### **Information sheet**

*Esayas Tilahun is my name. I am a second-year student at the FDRT Technical Vocational and Training Institute in Addis Ababa studying wood since technology. As part of my master's degree requirements, I am conducting research on Investigating Material and Value Flow Analysis of Saw milling of *Cupressus Lusitanica* In Three Sawmills of Gelan and Addis Ababa You won't be paid for taking part in this survey, but the findings will contribute to raising the Material and Value Flow Analysis of Saw milling of *Cupressus Lusitanica*. Your responses will be kept private throughout all operations by using the coding method. You have the freedom to join or leave at any moment, and you won't lose anything by declining to take part.*

##### **Consent form**

The data collector has provided me with information on the study. I was aware of the purpose of this investigation. By signing this form, I confirm that I am willing to take part in the study.

Participant 's signature \_\_\_\_\_ Date \_\_\_\_\_

Investigators signature \_\_\_\_\_ Date \_\_\_\_\_ Questionnaire code \_\_\_\_\_

Thank you again!

If you need to have further information you can contact me using the following address:-

Investigator :-**Esayas Tilahun** , Mobile: **0913796848**

**Annex II Information sheet and consent form (English) version**



**የኢ.ፌ.ዲ.ሪ የቴክኒክና ሙያ  
ስልጠና አገልግሎት  
FDRE TECHNICAL & VOCATIONAL  
TRAINING INSTITUTE**

**FACULTY OF CIVIL TECHNOLOGY DIVISION**

**DEPARTEMENT OF WOOD SCIENCE TECHNOLOGY**

**THESIS PROPOSAL**

**ON**

**Investigating Material And Value Flow Analysis Of Sawmilling Of Cupressus lusitanica In Three Sawmills  
Of Gelan And Adise Abeba.**

**Proposal For Partial Fulfillment Of The Requirements For The Master Of Science In Wood Science  
Technology**

**By**

**Esayas Tilahun Gosaye**

**Email :-esayastilahun966@gmail.com**

**Phon number +251913796848**

**RESEARCH QUESTIONNAIRE**

Dear respondents, the following questions are prepared in order to get the necessary information about launching **The Master Of Science /MSC/ In Wood Science Technology** feed back Investigating Material And Value Flow Analysis Of Sawmilling Of Cupressus lusitanica In Three Sawmills Of Gelan And Adise Abeba. give us accurate responses for the question write below

1. Name of worker: \_\_\_\_\_
2. Gender 1.male 2.female
3. Age 1. 18-35 2. 36-45 3. 46 above
4. Address: 1 sub city 2. woreda
5. Educational level of the respondent 1. diploma 2. degree 3 .12 blow
6. Professional 1.Furniture making 2. other

7. Position 1. production manger 2. co- worker

**Part 1:** To analyze the material flow within the selected sawmills during the saw milling process of *Cupressus lusitanica*. Rate your agreement with the following statements about potential benefits (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree).

<b>P</b>	<b>Benefits of Integrating DES with BIM</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
West management	How is waste material managed and disposed of during the saw milling process of <i>Cupressus lusitanica</i> ?					
	Are there any specific challenges or bottlenecks in the material flow within the sawmills during the saw milling process of <i>Cupressus lusitanica</i> ?					
	How is the material flow optimized to ensure efficiency and productivity in the saw milling process of <i>Cupressus lusitanica</i> ?					
Process	What measures are in place to track and monitor the material flow within the sawmills during the saw milling process of <i>Cupressus lusitanica</i> ?					
	How does the material flow within the sawmills impact overall production and output of lumber from <i>Cupressus lusitanica</i> ?					
In put	Are there any opportunities for improvement in the material flow within the sawmills during the saw milling process of <i>Cupressus lusitanica</i> ?					
	How does the material flow within the sawmills align with sustainable forestry practices and resource conservation principles?					

**Part 2:** To evaluate the value flow from raw materials (logs) to finished products (lumber) in terms of economic value added at each stage.. Rate your agreement with the following statements about potential benefits (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree).

<b>P</b>	<b>Benefits of Integrating DES with BIM</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Financial	What factors influence the economic value added during the transformation of logs into lumber in the sawmills?					

	Are there any value-adding activities or processes implemented to enhance the economic value of lumber from Cupressus lusitanica?					
Value flow	How do market prices and demand for lumber affect the value flow from raw materials to finished products in the sawmills?					
	What role do quality control measures play in maintaining and enhancing the economic value of lumber from Cupressus lusitanica?					
	How are production costs and overhead expenses factored into the economic value added analysis at each stage of the saw milling process?					
Out put	Are there any strategies or initiatives in place to optimize value flow and maximize profitability in the sawmills?					
	How does the economic value added analysis contribute to decision-making and strategic planning in the saw milling operations?					
	What are the key performance indicators used to assess the economic efficiency and competitiveness of the sawmills in terms of value flow?					

**Part 3: To identify the primary materials used in the saw milling process of Cupressus lusitanica in the three sawmills of Gelan and Adise Abeba.** Rate your agreement with the following statements about potential benefits (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree)

P	Benefits of Integrating DES with BIM	1	2	3	4	5
Quality	What measures are taken to ensure consistent quality and supply of primary materials for the saw milling process of Cupressus lusitanica?					
	What role do secondary materials or additives play in enhancing the quality or efficiency of the saw milling process for Cupressus lusitanica?					
	How is inventory management and stock control handled for primary materials used in the saw milling operations?					
Inventory	Are there any sustainability considerations or environmental impacts associated with sourcing and using primary materials in the saw mills?					
	How do fluctuations in raw material availability or pricing impact production and operations in the saw mills?					

	Are there any specific criteria or standards for selecting and handling raw materials in the saw milling operations?					
A7	Are there any opportunities for innovation or optimization in sourcing and utilizing primary materials for saw milling operations?					
A8	How do primary materials contribute to overall cost structure, efficiency, and product quality in the saw mills?					

Part 5.(process)

5.1 What are the main stages involved in the saw milling process of Cupressus lusitanica at the selected sawmills?

- A. rough surface      B Edging      C, trimming      D,all

5.2 What types of equipment are used for the saw milling process of Cupressus lusitanica in the selected sawmills?

- A. band saw machine B .Circular saw machine C. Joints machine D . A and B E. All

Part 6.(finance )

6.1 What is the economic value added at each stage of the saw milling process of Cupressus lusitanica in the selected sawmills?

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Part 7(.in put and out put )

7.1 What are the primary materials required for the saw milling process of Cupressus lusitanica in the selected sawmills?

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7.2 How are raw materials sourced and transported to the sawmills for processing?

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**Thank you very much for your participation**

# Annex III Information sheet and consent form (Amharic) version

ፋኩልቲ የ የሲቪል ቴክኖሎጂ ክፍል

የአንጨት ሳይንስ ቴክኖሎጂ ዲፓርትመንት

TheSIS ፕሮፖዛል

በርታል

በጌላን እና አድሴ ሶስት የሶውሚል ፋብሪካዎች ውስጥ የሲ. ሉሲታኒካ የቁሳቁስ እና የእሴት ፍሰት ትንተና አበባ .

ቴክኖሎጂ ውስጥ የሳይንስ መምህር የሆኑትን መሰፈርቶች በከፊል ለማሟላት የቀረበ ሀሳብ

በ

ኢሳያስ ጥላሁን ጎሳዬ

ኢሜል :- esayastilahun966@gmail.com

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የጥናት ጥያቄ

የሳይንስ ማስተር ኦፍ ሳይንስ/ኤም.ኤስ.ሲ/ በአንጨት ሳይንስ ቴክኖሎጂ ግብረ መልስ የC. Lusitanica Sawmilling Of Gelan And Value Flow Analysis Of Sewmilling Of Gelan And Adise ውስጥ ስለመጀመር አስፈላጊውን መረጃ ለማግኘት የሚከተሉት ጥያቄዎች ተዘጋጅተዋል። አበባ . ለጥያቄው ትክክለኛ ምላሽ ይስጡን

1. የሰራተኛው ስም:- \_\_\_\_\_
2. ያታ 1.ወንድ 2.ሴት
3. እድሜ 1. 18-35 2 . 36-45 3 . 46 በላይ
4. አድራሻ : 1 ከ/ከተማ 2. ወረዳ
5. የተጠሪ የትምህርት ደረጃ 1 . ዲፕሎማ 2. ዲግሪ 3 .12 ምት
6. ፕሮፌሽናል 1. የቤት እቃዎች መሰራት 2 . ሌላ
7. የሥራ መደብ 1.የማምረቻ ማንገር 2. የሰራ ባልደረባ

ክፍል 1 : በሲ ሉሲታኒካ የአንጨት መፍጨት ሂደት ውስጥ በተመረጡት የአንጨት ፋብሪካዎች ውስጥ ያለውን የቁሳቁስ ፍሰት ለመተንተን . ሊሆኑ ስለሚችሉ ጥቅሞች ከሚከተሉት መግለጫዎች ጋር ስምምነትዎን ደረጃ ይስጡ ( 1 = በጣም አልሰማማም ፣ 2 = አልሰማማም ፣ 3 = ገለልተኛ ፣ 4 = እሰማማለሁ እና 5 = በጣም እሰማማለሁ)።

ፕ	DES ከ BIM ጋር የማዋሃድ ጥቅሞች	1	2	3	4	5
የምዕራብ አስተዳደር	ሉሲታኒካ የመጋዘ መፍጨት ሂደት ውስጥ የቆሻሻ መጣያ ቁሳቁሶችን እንዴት ማስተዳደር እና ማስወገድ ይቻላል ?					
	ሉሲታኒካ የመጋዘ መፍጨት ሂደት ውስጥ በእንጨት መሰንጠቂያው ውስጥ ባለው የቁሳቁስ ፍሰት ውስጥ ልዩ ተግዳሮቶች ወይም ማነቆዎች አሉ ?					
	ሉሲታኒካ የእንጨት መፍጨት ሂደት ውስጥ ቅልጥፍናን እና ምርታማነትን ለማረጋገጥ የቁሳቁስ ፍሰቱ እንዴት ተመቻችቷል ?					
ሂደት	በሲ ሉሲታኒካ መጋዘ መፍጨት ሂደት ውስጥ በእንጨቱ ውስጥ ያለውን የቁሳቁስ ፍሰት ለመከታተል እና ለመቆጣጠር ምን እርምጃዎች ተዘጋጅተዋል ?					
	በእንጨት መሰንጠቂያው ውስጥ የሚፈሰው ቁሳቁስ አጠቃላይ ምርትን እና ከሲ ሉሲታኒካ የሚገኘውን የእንጨት ምርት ላይ ተጽዕኖ የሚያሳድረው እንዴት ነው ?					
በማስቀመጥ	በሲ ሉሲታኒካ መጋዘ መፍጨት ሂደት ውስጥ በእንጨት መሰንጠቂያዎች ውስጥ ያለውን የቁሳቁስ ፍሰት ለማሻሻል እድሎች አሉ ?					
	በእንጨት መሰንጠቂያው ውስጥ ያለው ቁሳቁስ ከዘላቂ የደን አሠራር እና ከሀብት ጥበቃ መርሆዎች ጋር እንዴት ይጣጣማል?					

**ክፍል 2:** በእያንዳንዱ ደረጃ ላይ በተጨማሪው ኢኮኖሚያዊ እሴት ከጥሬ ዕቃዎች (ሎግ) ወደ የተጠናቀቁ ምርቶች (እንጨት) የእሴት ፍሰት ለመገምገም . . ሊሆኑ ስለሚችሉ ጥቅሞች ከሚከተሉት መግለጫዎች ጋር ስምምነትዎን ደረጃ ይስጡ ( 1 = በጣም አልሰማማም ፣ 2 = አልሰማማም ፣ 3 = ገለልተኛ ፣ 4 = እስማማለሁ እና 5 = በጣም እስማማለሁ)።

ፕ	DES ከ BIM ጋር የማዋሃድ ጥቅሞች	1	2	3	4	5
የገንዘብ	በእንጨት መሰንጠቂያዎች ውስጥ እንጨቶችን ወደ እንጨት በሚቀይሩበት ጊዜ በተጨማሪው ኢኮኖሚያዊ እሴት ላይ ምን ተጽዕኖ ያሳድራሉ ?					
	ሉሲታኒካ የእንጨትን ኢኮኖሚያዊ ጠቀሜታ ለማሳደግ የተተገበሩ እሴት የሚጨምሩ ተግባራት ወይም ሂደቶች አሉ ?					
የእሴት ፍሰት	የገበያ ዋጋ እና የእንጨት ፍላጎት ከጥሬ ዕቃ ወደ የተጠናቀቁ ምርቶች በእንጨት መሰንጠቂያዎች ላይ ያለውን የእሴት ፍሰት እንዴት ይጎዳል?					
	ሉሲታኒካ የእንጨት ኢኮኖሚያዊ ጠቀሜታ ለመጠበቅ እና ለማሻሻል ምን ሚና አላቸው ?					

	የማምረቻ ወጪዎች እና የትርፍ ወጪዎች በእያንዳንዱ የመጋዘ ወፍጮ ሂደት ውስጥ በኢኮኖሚ እሴት የተጨመሩ ትንታኔዎች ውስጥ እንዴት ይካተታሉ?						
ወጥቷል	በእንጨት መሰንጠቂያዎች ውስጥ የእሴት ፍሰትን ለማመቻቸት እና ትርፋማነትን ለማሳደግ ስልቶች ወይም ተነሳሽነቶች አሉ ?						
	በመጋዘ ወፍጮ ስራዎች ላይ የኢኮኖሚ እሴት የተጨመረው ትንታኔ ለውሳኔ አሰጣጥ እና ስልታዊ እቅድ እንዴት አስተዋጽኦ ያደርጋል?						
	የእንጨት መሰንጠቂያዎችን ኢኮኖሚያዊ ብቃት እና ተወዳዳሪነት ከዋጋ ፍሰት አንጻር ለመገምገም የሚያገለግሉ ቁልፍ የአፈፃፀም አመልካቾች ምንድ ናቸው ?						

**ክፍል 3 : በሲ ሉሲታኒካ በመጋዘ መፍጨት ሂደት ውስጥ በገላን እና በአዲሴ ሶስት የእንጨት ፋብሪካዎች ውስጥ ጥቅም ላይ የሚውሉ ቀዳሚ ቁሳቁሶችን መለየት። አበባ . ሊገኙ ስለሚችሉ ጥቅሞች በሚከተለው መግለጫዎች የእርስዎን ስምምነት ደረጃ ይስጡ (1 = በጣም አልሰማም, 2 = አልሰማም, 3 = ገለልተኛ, 4 = እስማማለሁ እና 5 = በጣም እስማማለሁ)**

ፕ	DES ከ BIM ጋር የማዋሃድ ጥቅሞች	1	2	3	4	5
ጥራት	ለሲ ሉሲታኒካ መጋዘ መፍጨት ሂደት የአንደኛ ደረጃ ቁሳቁሶችን ጥራት እና አቅርቦትን ለማረጋገጥ ምን እርምጃዎች ተወስደዋል ?					
	ሉሲታኒካ የመጋዘ መፍጨት ሂደትን ጥራት ወይም ቅልጥፍን ለማሳደግ ሁለተኛ ደረጃ ቁሳቁሶች ወይም ተጨማሪዎች ምን ሚና ይጫወታሉ ?					
	በመጋዘ ወፍጮ ሥራዎች ውስጥ ጥቅም ላይ ለዋሉ የመጀመሪያ ደረጃ ዕቃዎች የእቃዎች አያያዝ እና የአክሲዮን ቁጥጥር እንዴት ይያዛሉ?					
ቆጠራ	ወፍጮዎች ውስጥ የመጀመሪያ ደረጃ ቁሳቁሶችን ከመቅዳት እና ከመጠቀም ጋር የተዛመዱ ዘላቂነት ጉዳዮች ወይም የአካባቢ ተፅእኖዎች አሉ ?					
	ፋብሪካዎች ውስጥ ምርት እና ሥራ ላይ ምን ተጽዕኖ ያሳድራል ?					
	በመጋዘ መፍጨት ሥራዎች ውስጥ ጥሬ ዕቃዎችን ለመምረጥ እና ለመያዝ የተለዩ መስፈርት ወይም ደረጃዎች አሉ?					
አ 7	ለመጋዘ ወፍጮ ሥራዎች የመጀመሪያ ደረጃ ቁሳቁሶችን በማፈለግ ወይም በማመቻቸት ለፈጠራ ወይም ለማመቻቸት እድሎች አሉ?					
A8	በመጋዘ ወፍጮዎች ውስጥ አንደኛ ደረጃ ቁሳቁሶች ለጠቅላላው የዋጋ መዋቅር ፣ ቅልጥፍና እና የምርት ጥራት እንዴት አስተዋጽኦ ያደርጋሉ ?					

ክፍል 5 ( ሂደት)

በተመረጡት የእንጨት ፋብሪካዎች ላይ በሲ ሉሲታኒካ የመጋዘ መፍጨት ሂደት ውስጥ የሚካተቱት ዋና ዋና ደረጃዎች ምንድናቸው ?

ሀ. ቫካራ ላዩን ቢ ኤዲጂንግ ሲ፣ መቀረጫ D ፣ ሁሉም

በተመረጡት የእንጨት ፋብሪካዎች ውስጥ ለሲ ሉሲታኒካ የመጋዘ መፍጨት ሂደት ምን ዓይነት መሳሪያዎች ጥቅም ላይ ይውላሉ ?

A. band saw machine B .የክብ ቅርጽ ማሽን C. Joints machine D . A እና B E. ሁሉም

ክፍል 6 ( ፋይናንስ)

በተመረጡት የእንጨት ፋብሪካዎች ውስጥ የሲ ሉሲታኒካ የመጋዘ መፍጨት ሂደት በእያንዳንዱ ደረጃ ላይ የተጨመረው ኢኮኖሚያዊ እሴት ምን ያህል ነው ?

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7 ( በወጣ እና በወጣ )

በተመረጡት የእንጨት ወፍጮዎች ውስጥ ለሲ ሉሲታኒካ መጋዘ መፍጨት ሂደት የሚያስፈልጉት ቀዳሚ ቁሳቁሶች ምንድን ናቸው ?

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7.2 ጥሬ ዕቃዎችን ለማቀናበር ወደ እንጨት ፋብሪካዎች የሚወሰዱት እና የሚጓጓዙት እንዴት ነው?

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ለተሳትፎዎ በጣም እናመሰግናለን

## **Annex IV Information sheet and consent form (Oromia) version**

**FACULTY OF KUTAA TEEKNOOLOOJII SIIVILII**

**KUTAALEE TEEKNOOLOOJII SAAYINSII MUKAA**

**YAADA BARREEFFAMAA**

**IRRA**

**Xiinxala Dhangala'aa Meeshaa Fi Gatii Sawmilling C. Lusitanica Sawmills Sadii Gelan Fi Adise Keessatti  
Qoruu Abeba .**

**Yaada Ulaagaalee Master Of Science Teeknooloojii Saayinsii Mukaa Gartokkoon Guutuu**

**N**

**Esaayyaas Tilahun Gosayee**

**Imeelii :- esayastilahun966@gmail.com irratti ergaa**

**bilbilaa +251913796848**

**GAAFFII QORANNOO**

**The Master Of Science /MSC/ In Wood Science Technology** feed back Investigating Material And Value Flow Analysis Of Sawmilling Of C. Lusitanica In Three Sawmills Of Gelan And Adise jedhu irratti odeeffannoo barbaachisaa ta'e argachuuf qophaa'aniiru Abeba . gaaffii armaan gaditti barreeffameef deebii sirrii nuuf kenni

1. Maqaa hojjetaa: \_\_\_\_\_ .
2. Saala 1. dhiira 2. dubartii
3. Umurii 1. 18-35 2 . 36-45 3 . 46 armaan olitti ibsameera
4. Teessoo: 1 sub city 2. woreda
5. Sadarkaa barnootaa deebii kennituu 1 . dippiloomaa 2. digrii 3 .12 rukuttaa
6. Ogeessa 1. Meeshaalee manaa hojjechuu 2 . kan biraa
7. Gitoota hojii 1. mana oomishaa 2. hojjetaa waliin hojjetu

**Kutaa Iffaa : Adeemsa saw milling C. lusitanica keessatti dhangala'aa meeshaa warshaalee mukaa filataman keessaa xiinxaluu .** Waliigaltee kee ibsa armaan gadiitiin waa'ee faayidaa argachuu danda'u madaali ( 1 = Cimsee walii hin galu, 2 = Walii hin galu, 3 = Giddu galeessa, 4 = Walii galuu fi 5 = Cimsee walii gala).

P	Faayidaa DES BIM waliin walitti makuu	1	2	3	4	5
		.	.	.	.	.
		1	2	3	4	5
		.	.	.	.	.
Hoggansa warra dhihaa	lusitanica keessatti meeshaaleen balfi akkamitti bulfamuu fi gatama ?					
	Adeemsa saw milling C. lusitanica keessatti yaa'a meeshaa warshaalee mukaa keessa jiru keessatti qormaanni addaa ykn qaruuraa ni jiraa ?					
	lusitanica keessatti gahumsaa fi oomishtummaa mirkaneessuuf dhangala'aan meeshaa akkamitti optimized ta'a ?					
Adeemsa	Adeemsa saw milling C. lusitanica keessatti dhangala'aa meeshaa warshaalee mukaa keessa jiru hordofuu fi hordofuuf tarkaanfiiwwan maaltu fudhatameera ?					
	Dhangala'aan meeshaa warshaalee mukaa keessaa oomisha waliigalaa fi oomisha mukaa C. lusitanica irraa argamu irratti dhiibbaa akkamii qaba ?					
In put	Adeemsa saw milling C. lusitanica keessatti dhangala'aa meeshaa warshaalee mukaa keessaa fooyyessuuf carraan jiraa ?					
	Dhangala'aan meeshaalee warshaalee mukaa keessa jiran gochaalee bosona itti fufiinsa qabuu fi qajeeltoowwan kunuunsa qabeenya waliin akkamitti walsima?					

**Kutaa 2: Dhangala'aa gatii meeshaalee jallisii (logs) irraa gara oomishaalee xumuraman (muka) sadarkaa tokkoon tokkoon isaaniitti gatii dabalataa dinagdeetiin madaaluu . . Waliigaltee kee ibsa armaan gadiitiin waa'ee faayidaa argachuu danda'u madaali ( 1 = Cimsee walii hin galu, 2 = Walii hin galu, 3 = Giddu galeessa, 4 = Walii galuu fi 5 = Cimsee walii gala).**

P	Faayidaa DES BIM waliin walitti makuu	1	2	3	4	5
		.	.	.	.	.
		1	2	3	4	5
		.	.	.	.	.

Kan maallaqaa	Yeroo jijjiiramni mukaa gara mukaatti warshaalee mukaa keessatti gatii dabalataa dinagdee irratti dhiibbaa kan geessisu wantootni maali ?					
	Gatii dinagdee mukaa C. lusitanica irraa argamu guddisuuf hojiiwwan ykn adeemsi gatii dabaluu hojiirra oole jiraa ?					
Dhangala'aa gatii	Gatiin gabaa fi fedhiin mukaa dhangala'aa gatii meeshaalee jallisii irraa gara oomisha xumurame warshaalee mukaa keessatti dhiibbaa akkamii qaba?					
	Tarkaanfiiwwan to'annoo qulqullinaa gatii dinagdee mukaa C. lusitanica irraa argamu eeguu fi guddisuu keessatti gahee akkamii qabu ?					
	Baasii oomishaa fi baasii ol'aanaa sadarkaa tokkoon tokkoon adeemsa saw milling irratti xiinxala gatii dabalataa dinagdee keessatti akkamitti factored ta'a?					
Bu'aa	warshaalee mukaa keessatti argachuuf tooftaaleen ykn jalqabiiwwan hojiirra jiran jiruu ?					
	Xiinxalli gatii dabalataa dinagdee hojiiwwan saw milling keessatti murtee kennuu fi karoora tarsimoo akkamitti gumaacha?					
	warshaalee mukaa gama dhangala'aa gatiitiin madaaluuf agarsiistonna raawwii hojii ijoo maal fa'a ?					

**Kutaa 3ffaa: Meeshaalee jalqabaa adeemsa daakuun cirrachaa C. lusitanica warshaalee mukaa sadan Gelan fi Adise keessatti fayyadaman adda baasuu. Abeba .** Waliigaltee kee ibsa armaan gadiitiin waa'ee faayidaa argachuu danda'u madaali (1 = Cimsee walii hin galu, 2 = Walii hin galu, 3 = Giddugaleessa, 4 = Walii galuu fi 5 = Cimsee walii gala) .

P	Faayidaa DES BIM waliin walitti makuu	1	2	3	4	5.
		.	.	.	.	5.
		1	2	3	4	
		.	.	.	.	
Qulqullina	lusitanica tiif qulqullinaa fi dhiyeessii meeshaalee jalqabaa walfakkaatu mirkaneessuuf tarkaanfiiwwan akkamii fudhatamu ?					

	lusitanica guddisuu keessatti gahee akkamii qabu ?					
	Meeshaalee jalqabaa hojiiwwan saw milling keessatti fayyadamaniif bulchiinsi inventarii fi to'annoo istookii akkamitti qabama?					
Eeruu	warshaalee saw keessatti fayyadamuu wajjin walqabatee yaadonni itti fufiinsa qaban ykn dhiibbaan naannoo ni jiraa ?					
	Jijjiiramni argama meeshaalee jallisii ykn gatii oomishaa fi hojii warshaalee saw irratti dhiibbaa akkamii qaba ?					
	Hojiiwwan saw milling keessatti meeshaalee jallisii filachuu fi qabachuuf ulaagaaleen ykn ulaagaaleen addaa ni jiruu?					
A 7.1	Madda meeshaalee jalqabaa hojii saw milling madda fi itti fayyadamuu keessatti carraan kalaqa ykn optimization jiraa?					
A8	Meeshaaleen jalqabaa caasaa baasii waliigalaa, gahumsa, fi qulqullina oomishaa warshaalee saw keessatti akkamitti gumaachu ?					

Kutaa 5. ( adeemsa) .

lusitanica warshaalee mukaa filataman irratti sadarkaaleen gurguddoon hirmaatan maali ?

A. fuula qalla'aa B Qarqara C, ciruu D , hunda

Adeemsa saw milling C. lusitanica warshaalee mukaa filataman keessatti meeshaaleen gosa akkamii fayyadamu ?

A. Maashinii baandii saw B. Maashinii saw geengoo C. Maashinii walqabsiisaa D. A fi B E.  
Hundaa

Kutaa 6. ( faayinaansii) .

6.1 Sadarkaa tokkoon tokkoon adeemsa saw milling C. lusitanica warshaalee mukaa filataman keessatti gatii dinagdee dabalataa maali?

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Kutaa 7ffaa ( in put and out put ) .

7.1 Meeshaaleen jalqabaa adeemsa daakuun cirrachaa *C. lusitanica* warshaalee mukaa filataman keessatti barbaachisan maali?

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7.2 Meeshaaleen jallisii akkamitti madda isaanii fi gara warshaalee mukaatti geejjibsiifamanii akka hojjetaman?

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Hirmaannaa keessaniif hedduu galatoomaa