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ASSESSMENT ON PRACTICES AND CHALLENGES OF POSTHARVEST HANDLING OF CUT-FLOWERS IN LINSSEN ROSES ETHIOPIA P.L.C

By:

TIRHAS GEBREAMLAK

JULY, 2021

ADDIS ABABA, ETHIOPIA

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APPROVAL

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ENDORSEMENT

This paper has been submitted for examination with my approval as an advisor.

Name _____

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DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of Assistant professor Asrat Bulbula. All sources of materials used for the manuscript have been duly acknowledged.

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Table of Content

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List of abbreviations and acronyms

1. **GDP** (Gross Domestic Product)
2. **EHPEA** (Ethiopian Horticulture Producers and Exporter Association)
3. **CDP** (country's domestic product)
4. **HA** (Hectares)
5. **SPSS** **(**statistical package for social science)
6. **P.L.C** (private limited company)
7. **PH** (power of hydrogen)
8. **BA/BSC** (bachelor of art/ bachelor of science)
9. **R&D** (Research and Development)
10. **NBE** **(**The National Bank of Ethiopia**)**
11. **EPA** **(**Export promotion Agency**)**

List of tables

Table **Page**

List of figures

Figures **Page**

Abstract

Floriculture is the newest of Ethiopia's export industries, having grown very rapidly over the past years to become the country's fourth largest export industry. The Ethiopian floriculture industry began in the 1980s when state-owned farms started exporting cut flowers to Europe. The objectives of this study were to: identify the major challenges of the company in terms of post-harvest managements in Linssen Roses Ethiopia P.L.C. The study was conducted using mixed research method. To this effect, survey questioners and interview were the method used to collect data which is supported with secondary sources. Responses of 133 survey participants were used in analysis in addition qualitative data was collected through interviews from four purposive selected informants. The result show that the major problems of floricultures in relation to post harvesting management were manual harvesting, sorting, storing and packing practice of the company. It is concluded that the major problems of floricultures postharvest managements are many but failing to work on employee capacity building regarding product handling on post-harvesting phase is the source of every problems in the company. Flower maturity, temperature, water supply, and Mechanical damage are mentioned with regards to major problems leading the company to losses products during post-harvesting phase. The result of this study show that working on employee capacity building regarding product handling on post harvesting phase is a key step in improving post-harvest losses of cut flowers.

Key Words:
Floriculture, Maturity, Harvesting, Grading, Bunching

CHAPTER ONE

1 INTRODUCTION

1.1 *Background of the Study*

Ethiopia is located in east Africa. It is a federal republic of nine (9) states with capital city Addis Ababa. It is a landlocked country of more than 1,125,000 square kilometers with an estimated 120 million inhabitants. Ethiopia is predominantly an agrarian economy, where the economy depends to a large extent on the agricultural sector which accounts for some 50% to the Gross Domestic Product (Minalu, 2008).

As Holzer (2001) has noted cut flowers are one of the major globally commercial mass production items. In the early 20th century, especially after the Second World War II, Cut flower production in the world gained acceptance. Due to this, fast growth and changes have occurred in the cut flower production, storage, classification and marketing. As a result of this change, new techniques and technologies are used in the cut flower industry from production to consumption (Abas, 2014). According to Rikken, (2011), at present flower industry is changing and has become a global industry.

In the past few decades, significant growth rates have been achieved and the leading flower exporting countries have been the Netherlands, Israel, Colombia, Ecuador and Kenya. The Dutch floriculture industry is generally known as the leading industry in the world. The country exported 639,000 tons 3,151 billion Euros with harvesting area of 5331 hectare. In case of Africa, there are many countries which export flower to the rest of the world. Among

these Kenya has been one of the largest cut flower exporters in Africa, and takes the 4th rank next to Holland, Colombia and Ecuador. There are about 3,400 hectares of flowers with 117,000 tons of flowers with the income of 500 million euro in Africa (EHPEA, 2014).

Ethiopian export commodities are dominated by some agricultural related products such as coffee, chat, oil seeds and pulses. Due to this, the country's economic performance corresponds to the fluctuation of income earned from these few exports. To this effect, Ethiopia is expected to diversify its export products. The cut-flower industry is, without doubt, Ethiopia's most important success story. It is probably the country's best example of identifying globally competitive natural resources for product diversification, generating employment and attracting foreign direct investment (Code of Practice for Sustainable Flower Production, 2011).

Ethiopia is the second largest cut flower exporter in Africa next to Kenya. There was no significant flower industry in the country until 2004. After Seven years, EHPEA), there are 100 flower growers on 1,700 hectares of which the lion's share is taken up by rose farms with exporting of 50000 tons of flowers and earns 146 million Euros. Floriculture has now become one of Ethiopia's main export sectors. According to Ethiopian Horticulture Producers and Manufacturers Association Ethiopia garnered USD 250 million from horticulture export in 2014. Innovation in the flower industry is largely driven by foreign investors.

The floriculture industry of Ethiopia is one of the fastest growing flower industries in the sub-Saharan Africa. Ethiopia grows different flowers like Roses, Carnations, Cardamoms and

Satice. The flower sector created employment for over 50,000 persons (permanent and temporary), and one of top five products that enable the country to earn foreign exchange.

The Ethiopian flower industry is an export-oriented industry. About 40 percent of the farms are fully foreign owned, 23 percent are joint ventures, and 36 percent are fully domestic owned (WB, 2010). The country has more comparative advantages than other African countries in the floriculture industry. These include the following: Proximity to the major global markets, Suitable agro-climatic conditions and ample natural resources, abundant, inexpensive, cultured/disciplined, competitive and easily trainable labor force, High level of security to investors/individuals and property, high level of support by the government with alluring incentive and the government has allocated a substantial amount of finance for investors.

However there are also some challenges that hinder the growth of these industries which includes the impact of global economic crisis, the impact of Climate change, the challenge related to Agro-bacterium, environment concerns on the horticultural sub-sector and others. Ethiopia's vast land, favorable climate, and water and land resources make it an incredible hub for investment. Located in the Horn of Africa, Ethiopia is at the crossroads between Africa, the Middle East and Europe. Ethiopia is close to its traditional markets for export products—the Middle East and Europe. This geographical proximity provides the major exporters in the world unparalleled access to the Ethiopian floricultural market.

Diverse agro-climatic conditions in the highlands and lowlands of Ethiopia make it a suitable place for the production of a wide range of flowering plants, making cut flower production a

fast-growing export business. Ethiopia has 12 river basins, 18 natural lakes (including the Rift Valley lakes) and a potential of 3.7 million hectares of irrigable land. About 80-90% of these resources are located in the west and south-west of the country, which is home to 40% of the population. Temperatures are conducive to floriculture and there are long hours of sunshine - usually more than 11 hours a day. Water for irrigation is available in ample quantity and the well-drained soil in Ethiopia is suitable for growing horticultural products. Ethiopia also has globally competitive advantages for quality produce, cost of freight, cost of production and proximity to markets. Labor costs are cheaper than many African countries already involved in floriculture export. Investments by floricultural companies have created employment opportunities.

The labor intensive process required for seeding, cultivating, packing and exporting makes the floriculture sector unique in absorbing a huge labor force, especially for women workers. New incentives have been offered to investors since Ethiopia's investment code was revised in May 2002. The floricultural sector in particular has strong backing from the Government. Incentives such as a five-year tax holiday, duty-free imports of machinery and easy access to bank loans and land have attracted investors.

As a result of these and other incentives, Ethiopia's flower business is booming and could potentially overtake coffee as the country's main export commodity. The market for Rose flowers is changing from time to time specially in the international market. It is so dynamic in nature. Besides, in the international market the demand for cut flowers is affected by several factors. In this study the researcher assess the market dynamics in relation to rose flower

export performance market and the reason for market dynamism will be assessed in the international market mainly in the Netherlands.

Ethiopia's economy is predominantly agrarian. It is, thus, natural to expect the bulk of the country's export to come from the agricultural sector. According to Ethiopian Customs Authority yearly report cited in Minalu (2008) the agricultural sector contributes 50% and 90% of the country's domestic product (CDP) and foreign exchange earning capacity from the export sector respectively. Compared to the fruits and vegetables components, the floriculture industry is growing at a fast rate in Ethiopia. In five years, it is expected to be one of Africa's leading flower producers.

About 20% of fresh flowers lose their quality while passing through the market (harvest, packaging, transportation, and sale) and a large deal of remaining flowers are sold at low quality conditions dissatisfying the consumer (Gebremedhin et al.,2013) due to physiological and pathological problems during the post-harvest handling. Under normal conditions, cut flowers last only for a few days maintaining their beauty and attractiveness. Thus, using appropriate preservatives could help to extend the vase life of the harvested produce for consumer satisfaction and exploitation of the business.

Roses are best known as ornamental plants grown for their flowers in the garden and sometimes indoors. They have been also used for commercial perfumery and commercial cut flower crops. Some are used as landscape plants, for hedging and for other utilitarian purposes such as game cover and slope stabilization. They also have minor medicinal uses. The history of flower business is fairly old in the developed countries. Since the last two decades, there

has been continuous expansion of global market for cut flowers. Rose demand is increasing due to elegance, beauty and long vase life (Dahal, 2013).

Horticulture and floriculture subsectors are relatively new to export and contain a huge potential to earn foreign currency through balanced export and diversification. The amount of flower products exported from Ethiopia is currently at a minimal with respect to the international market demand. However, the competitive edges gained by Ethiopian cut flowers, especially roses, in European markets have attracted several stakeholders. Floriculture is getting utmost consideration for exports presently in Ethiopia (Belwal and Meseret, 2007).

The horticulture commercial farms began in Ethiopia during Emperor Haile Selassie's era. Most of the farms were located in the rift valleys at places where abundant river and lake water was available (Sisay, 2004). Cut flower business was introduced by the Derge regime during 1980/1981 in collaboration with the German Society for Technical Co-operation.

Major policy reforms were introduced in 1992 by the Ethiopian People's Revolutionary Democratic Front-led government. Since, then the floriculture industry has sufficiently attracted participation of domestic and foreign private investors.

Despite Ethiopia's endowment of enormous natural resources and other competitive advantages, floriculture, so far, has been unable to make any significant dent in export earnings. The challenge lies in realizing the enormous potential and opportunity for exports. The study aims to present the factors behind Ethiopian cut flower success in the global cut flower market. By conducting an environmental appraisal of the floriculture industry in

Ethiopia, it further reveals some factors that concern future growth (Belwal and Meseret, 2007). The environment in Ethiopia, given the fact that it has different climate, quality of soil and seasonal variability has not been studied well to provide an evidence whether it is comfortable for the growth of different variety of flowers, this study is also intended to provide a clue.

1.2 *Statement of the Problem*

In Ethiopia output and export are highly concentrated on agricultural commodities. The sector structure of exports also reveals heavy reliance of the country on raw agricultural products for about 80% of its total export earnings. Manufactured exports that are crucial for a rapid structural transformation of production are negligible and the country is one of the least industrialized countries in the world (EPA, 2002)

Undiversified structure of the Export sector brings a problem of export instability, which can limit the import capacity of the country, since the country mainly depends on imported goods for industrialization process. This negatively affects the overall activity of the economy, which leads the country to negative trade balance (EHPEA, 2008).

Floriculture export activities must also be undertaken correctly. Nowadays, most organizations are incurring a huge sum of money, employee salary and wages. However the problem in most organizations is the development and export sector has various constraints that limit the contribution to the national export diversification.

Creating enabling environment and achieving competitiveness in the floriculture sub-sector require addressing of many constraints faced by the growers and exporters. These constraints are the limiting factors to attract domestic as well as foreign direct investments. These constraints are related to

- Inadequate infrastructures/ and local expertise
- government policies and strategies was good but needs improvements/ineffective government policies and strategy
- Lack of information on technology and technical experts
- Lack of knowledge about post-harvest technologies.

Flower export is highly time and process dependent. It requires improved infrastructure and logistical capabilities including air transport, post-harvest cold chain facilities, forwarding and handling services, packaging materials, information and communication technology (ICT), and quality control and certification services in Ethiopian (Mulu and Tetsushi, 2011). The government with support of donors has been involved in other capacity building activities such as training (degree programs and practical training centers on horticulture), quality control and certification services. However, some of the essential infrastructure and services like cold chain and phytosanitary services remain underdeveloped. The link between the industry and public research as well as development (R & D) is also weak. These weaknesses might hamper the future growth of the sector if they are not quickly addressed (Mulu and Tetsushi, 2011).

In line with the above background, this study has tried to investigate the major problems that the Linssen Roses Ethiopia is facing in terms of postharvest managements and examine factor that drives post-harvest losses in Linssen roses Ethiopia.

1.3 Research Questions

The following are research questions the study tried to address:

- What are the major problems that the company is facing in terms of postharvest managements?
- What is the factor that drives post-harvest losses in Linssen Roses Ethiopia Plc?

1.4 *Objective of the Study*

1.4.1 General Objective

The general objective of this study is to identify the major challenges of the company in terms of postharvest managements in Linssen Roses Ethiopia Plc. Ethiopia.

1.4.2 Specific Objectives

The study is specifically intended to meet the following objectives:

A. Identify the major problems of floricultures postharvest managements in Linssen roses Ethiopia Plc.
B. To examine factors that drives the company to lose products during post harvesting stage in Linssen Roses Ethiopia Plc.

1.5 Definition of Important Terms

Assessment: is the process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding and Knowledge (Huba and Freed 2000).

Challenge: to dispute especially as being unjust, invalid, or outmoded

Cut-Flower: a flower cut from the plant for use in decoration

Harvesting: is the process of gathering a ripe crop from the fields. Harvesting is the most labor-intensive activity of the growing season

Post-harvest Handling: is the stage of crop production immediately following harvest, including cooling, cleaning, sorting and packing

Practice: is the actual application or use of an idea, belief or method, as opposed to theories relating to it.

1.6 Significance of the Study

Ethiopia is one of the potential flowers producers in the world. Despite their benefits, Ethiopian flower was not largely found. This is due to the skill of the investors to harvest, and find the possible market place. However, Assessment on postharvest handling of cut-flowers of Ethiopian flowers for quality standards and factors affecting the post-harvest losses were not studied. The study is of benefit to the floriculture industry as well as the investors and policy makers intending to support establishing floriculture industries in countries such as Ethiopia.

Assessing the factors that affects the postharvest handling of cut-flowers will help the investors to produce to good quality flower, solve the problems with the production of flower,

helps the government to get necessary foreign currency and also for policy makers to set the standards.

1.7 Scope of the Study

The study focuses in assessing the post-harvest handling of cut flower in the case of Linssen Roses Ethiopia P.L.C located in Oromia region, West shewa Zone, Ejere Woreda, specific area called Kimoye.

1.8 Limitation of the Study

The major limitation of this study was no literatures on this specific topic available in our country as well as in Africa context to be used for reference as well as comparison of the result of research and they are also resource constraints, in terms of time and the availability of relevant data was also influence the study.

1.9 Organization of the Study

This study is structured into five chapters. The first chapter, which is the introductory part, deals with the background of the study, statement of the problem, research questions, objectives, significance of the study, scope of the study and definition of the key terms used in the study. Chapter two presents the review of related literatures about the subject matter. Chapter Three .explained the research methodology that was used in carrying out the study, research methodology present brief explanation on how the study was conducted basically includes, the study design and approaches, sample size and sampling techniques, data collection methods and data analysis. Chapter four is dedicated to discuss the results and the

findings obtained from the study. Finally, the summary of major findings, conclusions and recommendations are explained in chapter five.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 History of Flower Culture

People all over the world realize that flowers influence human feelings more than words or other gifts. Globalization, cultural exchanges, and celebrations enhancing fraternity such as New Year, Valentine's Day, Memorial Day, Mothers' Day, Fathers' Day, Christmas, and weddings have induced people globally to use flowers as a means of sharing their feelings. Above all, these celebrations have acquired one-to-one pairing with flowers in some cases, e.g. roses to Valentine's Day and carnations to Mother's Day. Increased use of flowers and ornamental plants makes marketing of flowers a lucrative business.

The majority of cut flowers are produced in countries with dedicated infrastructure having facilities for airlifting to major distribution centers. According to the AIPH International Statistics Flowers and plants 2004 (2005), the Asia/Pacific region leads in flower production with a total production area of 244,263 hectares (HA) followed by Catalysts and barriers to cut flower export 217 Europe (54,815);Central/South America (45,980); North America (26,135); Africa (5,697); and the Middle East (3,845). The AIPH report estimates a global area of 360,000 hectares dedicated to world flower and plant production involving USD 60 billion in value terms and 100,000 companies. In 2001, the UN International Trade Centre estimated the global area of 200,000 hectares dedicated to cut flowers commanding value of USD 27 billion. In terms of total area of production, Asia and the Pacific cover nearly 60 percent of the total world area [1]. The key markets for flower are Western Europe, North

America and Japan [2]. The EU is the world's leading importer of flowers. The other largest importers are Germany, the USA, the UK, France, The Netherlands and Switzerland – accounting for nearly 80 percent of global imports.

The Netherlands is the world's largest producer of cut flowers and foliage valued at USD 3.6 billion, followed by Germany and Italy (www.syngenta.com/en/products). In addition, The Netherlands plays a major role in setting the global standard for daily prices through its computerized clock auction system and acts as the logistical distribution hub for Europe. South American countries Colombia and Ecuador as well as Israel, are the major producers of carnations and roses. An increasing investment has also been witnessed in Kenya and other African countries (Hamrick, 2004).

2.2 *Factors Affecting Postharvest Quality*

Maintaining quality in export cut flowers depends on an understanding the factors that lead to deterioration. Understanding these factors allows the grower and shipper to develop and implement optimum postharvest handling technologies (Halevy, A.H. and S. Mayak. (1982).

2.2.1 Flower Maturity

Minimum harvest maturity for a cut-flower crop is the stage at which harvested buds can be opened fully and have satisfactory display life after distribution. Many flowers are best cut in the bud stage and opened after storage, transport or distribution. This technique has many advantages, including reduced growing time for single-harvest crops, increased product packing density, simplified temperature management, reduced susceptibility to mechanical

damage and reduced desiccation. Many flowers are presently harvested when the buds are starting to open (rose, gladiolus), although others are normally fully open or nearly so (chrysanthemum, carnation). Flowers for local markets are generally harvested much more open than those intended for storage and/or long-distance transport (Hardenburg, R.E., Watada, A.E., Wang, C.Y., 1986).

2.2.2 Temperature

The temperature of the growing location affects postharvest life of cut flowers. The effect of growing temperature on cut flower longevity is mainly related to carbohydrate synthesis and metabolism, water relations, cell membrane properties, and ethylene production and sensitivity. Reduction in postharvest vase life of cut flowers due to high growing temperature has been reported and flowers produced at low temperature have been assumed to have longer postharvest vase life (Rij, R.E, Thompson, J.F., and Farnham, D.S., 1979).

In contrast, higher growing temperature (32/27oC; day/ night) have been found to increase postharvest vase life of rose flowers (Monteiro et al. 2001). Temperature and light intensity directly influence the photosynthetic level in flower tissues. Sugar level has been known to be closely correlated with postharvest life of cut flowers. The lower carbohydrate content in petals due to the low temperature and light intensity will result in shorter vase life (Halevy and Mayak, 1979).Variation in the longevity of cut flowers due to the seasonal effects have also been reported as sugar content of petals increases in autumn and decreases slightly towards summer, while chlorophyll intensity increases gradually towards spring and decreases in summer (Celikel and Karacaly, 1995).

2.2.3 Water Supply

Cut flowers, especially those with leafy stems, have a large surface area, so they lose water and wilt very rapidly. They should be stored at relative humidity above 95% to minimize water loss, particularly during long-term storage. Water loss is dramatically reduced at low temperatures, another reason for prompt and efficient cooling of cut flowers. Even after flowers have lost considerable water (for example during air transportation or long-term storage) they can be fully rehydrated using proper techniques. Cut flowers will absorb solutions without difficulty providing there is no obstruction to water flow in the stems. Air embolism, bacterial plugging, and poor water quality are factors that can reduce solution uptake (M.S. Reid, 2009).

2.2.4 Mechanical Damage

Bruising and breakage of cut flowers should be avoided. Flowers with torn petals, broken stems or other obvious injuries are undesirable for aesthetic reasons. Disease organisms can more easily infect plants through injured areas. In fact, many disease organisms can only enter a plant through an injury point. Additionally, respiration and ethylene evolution is generally higher in injured plants, further reducing storage and vase life (M.S. Reid, 2009).

2.2.5 Disease

Flowers are very susceptible to disease, not only because their petals are fragile, but also because the secretions of their nectaries often provide an excellent nutrient supply for even mild pathogens. To make matters worse, transfer from cold storage to warmer handling areas can result in condensation of water on the harvested flowers (M.S. Reid, 2009). The most

commonly encountered disease organism, gray mold (Botrytis cinerea), can germinate wherever free moisture is present. In the humid environment of the flower head, it can even grow (albeit more slowly) at temperatures near freezing. Proper management of greenhouse hygiene, temperature control, and the minimizing of condensation on the harvested flowers all reduce losses caused by this disease (M.S. Reid, 2009).

Some fungicides, such as Ronalin, Rovral (Iprodione), and the copper-based Phyton-27 have been approved for use on cut flowers and are very effective against graymold. Newer fungicides, including 'Palladium', a mixture of fludioxinal and cyprodium, have proven to be very effective as postharvest dips for preventing Botrytis infection and may be registered for this use in the near future (M.S. Reid, 2009).

2.3 Ethiopian Floriculture Industry

Cut-flowers and vegetables are fast growing export businesses in Ethiopia. In 2000/2001Ethiopia earned about USD 660,038 from exporting cut flowers which grew to USD12.7 million in 2004/2005 (Ethiopia, 2005). Ethiopia exported 16 million cut flowers to the world market in 2003 and 32 million cut flowers in 2004 [4]. Annual flower exports from Ethiopia from the existing units are expected to reach $100 million by 2007(Belwal, R. and Chala, M., 2008).

More than 100 investors from The Netherlands, Germany, India and Israel have acquired 450 hectares of land to set up farms during 2006. Table I provides summarized account of such investors by country of origin. The majority of the investors belong to Israel and The Netherlands. Out of these investments 61 are purely

domestic, 112 purely foreign based and 36 as joint ventures between Ethiopian entrepreneurs and foreigners (Table II). While most of such investments (142) came in the form of private limited companies (PLC), 68 emerged as sole proprietorship and three as shared ventures (Table III). The newer investments are expected to generate another$300 million a year by 2007. This clearly reveals the increasing volume of floriculture exports and prospects for the future.

Table 2.1: Floriculture investment in Ethiopia by country of origin (1992-2007)

Country	Frequency	Percent
Ethiopia	64	30
Israel	40	18.8
Netherlands	24	11.3
USA	15	7.0
India	14	6,6
Britain	9	4.2
France	3	1.4
Italy	4	1.9
Saudi Arabia	3	1.4
Sudan	3	1.4
Others	12	5.6
Total	213	100

Source: *Source: EIC (2008)*

Table 2.2: Nature of investment in Floriculture in Ethiopia (1992- March2007)

Investment type	Frequency	Percent
Domestic	61	28.6
Ethiopia born foreign	4	1.9
Foreign with domestic	36	16.9
Purely foreign	112	52.6
Total	213	

Source: EIC (2008)

2.4 Postharvest Management Techniques

According to Taylor (2011) once harvested, there are interlinked tasks are done to prepare the flowers for market. These are collectively called post handling. These handling steps

include Grading, Leaf Removal, Bunching, Re cutting, Hydration, Special Treatments, Packing, Pre cooling, Cold Storage and Delivery to Market. Similar to the above, Binyam Zewdie (2007) has also list about post-harvest management of cut flowers like: Sort the flowers according to the following: cultivate, stage of maturity, extent of damage due to diseases, mechanical damage, abnormal flower parts and defects of color, grade according to stem length or size, bunch flowers according to cost, amount, exposure to injury, and exhibit quality of individual flower heads, tie bunches below the head of flower, and about two inches from the cut flower stem ends. Tying must not be too loose and too tight rubber bands are best, because they can hold bunches securely. Do not close the top of the sleeve, arrange in layers according to type and use a technical of tracking and tracing system to find the post-harvest problem.

Systems for harvesting and marketing cut flowers vary according to individual crops, growers, production areas, and marketing systems. All involve a series of steps - harvesting, grading, bunching, sleeving, packing, pre-cooling and transportation - not necessarily in that order. Management systems should be selected so as to maximize postharvest life of the flowers, a goal which usually requires prompt pre-cooling and proper temperature management throughout the harvesting chain. Increasingly, producers are trying to reduce the number of separate steps in the marketing chain (Belwal, R. and Chala, M., 2008)

2.4.1 Harvesting

Harvesting is normally done by hand using shears or a sharp knife. Simple mechanical aids are used to harvest some crops, for example the hook-shaped "comma" which permits

chrysanthemum harvest without stooping, and rose shears which grip the flower stem after it has been cut, allowing it to be withdrawn single-handedly from the bench. At no time should harvested flowers be placed on the ground because of the danger of contaminating the flowers with disease organisms. Ideally, harvesting, grading and packing should all be done dry that is to say without the use of chemical solutions or water. If this is not possible, however, clean buckets containing clean water and a biocide should be used.

2.4.2 Grading

The designation of grade standards for cut flowers is one of the most controversial areas in their care and handling. Objective standards such as stem length, which is still the major quality standard for many flowers, may bear little relationship to flower quality, vase life or usefulness. Weight of the bunch for a given length is a method that has been shown to strongly reflect flower quality. Straightness of stems, stem strength, flower size, vase life, and freedom from defects, maturity, uniformity, and foliage quality are among the factors which should also be used in cut flower grading. Mechanical grading systems should be carefully designed to ensure efficiency and to avoid damaging the flowers (Maertens, M. and Swinnen, J.F.M., 2006)

2.4.3 Bunching

Flowers are normally bunched, except for anthuriums, orchids and some other specialty flowers. The number of flowers in the bunch varies according to growing area, market and flower species. Groups of 10, 12, and 25 are common for single-stemmed flowers. Spray-type flowers are bunched by the number of open flowers, by weight or by bunch size. Bunches are

held together by string, paper-covered wire or elastic bands and are frequently sleeved soon after harvest to separate them, protect the flower heads, prevent tangling and identify the grower or shipper. Materials used for sleeving include paper (waxed or unwaxed), corrugated card (smooth side towards the flowers) and polyethylene (perforated, unperforated and blister). Sleeves can be performed (although variable bunch size can be a problem), or they can be formed around each bunch using tape, heat sealing (polyethylene), or staples (Maertens, M. and Swinnen, J.F.M., 2006).

Damage through multiple handlings can be reduced if grading, sizing, and even bunching are carried out in the field or greenhouse. Flowers should be graded and bunched before being treated with chemicals or being placed in storage. When the flowers are badly wilted, or when labor is not available for grading and bunching, flowers should be rehydrated and cooled until these operations can be carried out.

2.4.4 Packing

There are many shapes of packing containers for cut flowers, but most are long and flat and a full telescoping design (top completely overlaps the bottom). This design restricts the depth of the flowers in the box, which may in turn reduce physical damage of the flowers. In addition, flower heads can be placed at both ends of the container for better use of space. With this kind of flower placement, whole layers of newspaper have often been used to prevent the layers of flowers from injuring each other. The use of small pieces of newspaper to protect only the flower heads, however, is a better practice, since it allows for more efficient cooling of

flowers after packing. It is critically important that containers be packed in such a way that transport damage is minimized (Maertens, M. and Swinnen, J.F.M., 2006).

Some growers anchor the product by using enough flowers and foliage in the box so that the package, after banding, holds itself firmly. To avoid longitudinal slip, packers in many flower-producing countries use one or more "cleats". These are normally foam- or newspaper-covered wood pieces that are placed over the product, pushed down, and stapled into each side of the box. Padded metal straps, high density polyethylene blocks, and cardboard tubes can also be used as cleats. The heads of the flowers should be placed 5 – 10 cm from the end of the box to allow effective pre-cooling and to eliminate the danger of petal bruising should the contents of the box shift. Another system commonly employed to secure flowers is an elastic strap, anchored in the base of the box that is stretched over the stems of the flowers after packing. Some flowers lend themselves to packing in a manner where the stem bases of some bunch are placed against the ends of the box. The rest of the flowers are packed normally (5-8 cm from the end of the box), and the conical shape of typical bunches means that all the flowers are well secured (Ethiopian Horticulture Producers and Exporters Association, EHPEA, 2011).

2.4.5 Cooling

By far the most important part of maintaining the quality of harvested flowers is ensuring that they are cooled as soon as possible after harvest and that optimum temperatures are maintained during distribution. Most flowers should be held at 0-2^{o}C. Chilling-sensitive flowers (anthurium, bird-of-paradise, ginger, tropical orchids, and heliconias) should be held

at temperatures above 10^{o}C.Individually, flowers cool (and warm) rather rapidly (half-cooling times of a few minutes). So, while individual flowers can be cooled quickly, it is also true that individual flowers brought out of cool storage into a warmer packing area will warm quickly and develop condensation prior to packing (Nowak, J., and R.M. Rudnicki, 1990).

The simplest method of ensuring that packed flowers are adequately cooled and dry is, therefore, to pack them in the cool room. Although this method is not always popular with packers, will probably increase labor cost and may slow down packing somewhat, it ensures a cooled, dry product (Nowak, J., and R.M. Rudnicki., 1990).

2.5 Quality Control

Due to the quality pressures from the West and to the demanding and ever changing safety and environmental standards needed, the industry should presents a unique opportunity to be a leader in social change in these exporting countries. According to Dickey, (2011), the quality of cut flowers are determined by like cutting stems under water, absorption of water by cut flowers stems, use of chemicals and use of cold storage.

There are few official grade standards for cut flowers. Some marketing channels, for example the British mass market chains and the Dutch auctions, have internal quality control systems that provide a check on quality of flowers(Dolan, C. and Humphrey, J.,2000) . The most important quality parameter is "freshness" or vase life. This parameter is difficult to assess visually, but because of its importance, producers and receivers should set up a "quality control" program that would involve evaluation of the vase life of representative flowers **o**n a

continuing basis. Such a program might involve one employee for no more than 20 minutes per day, and would repay dividends in terms of information about the products handled and the effects of any pretreatments applied (M.S. Reid, 2009)

2.6 Profile of the Study Company

Linssen Roses first started out in Hout-Blerick, in the municipality of Venlo. These days, however, the roses are exclusively cultivated in Ethiopia and it was established in 2004 on 40 hectares of land and has grown to 82 hectare. And at a very specific location, Ejere Wereda about 60Km west from the capital of Addis Ababa. The rose farm is situated 2,100 meters above sea level, where it is relatively cool, yet mostly sunny. These circumstances combine to create the perfect place to cultivate roses of extraordinary quality and every day, 1200 employees of Linssen Roses Ethiopia P.L, C work together with great dedication to provide our customers the best quality roses. Linssen roses Ethiopia aspire for roses with the biggest rose bud and the most beautiful color range.

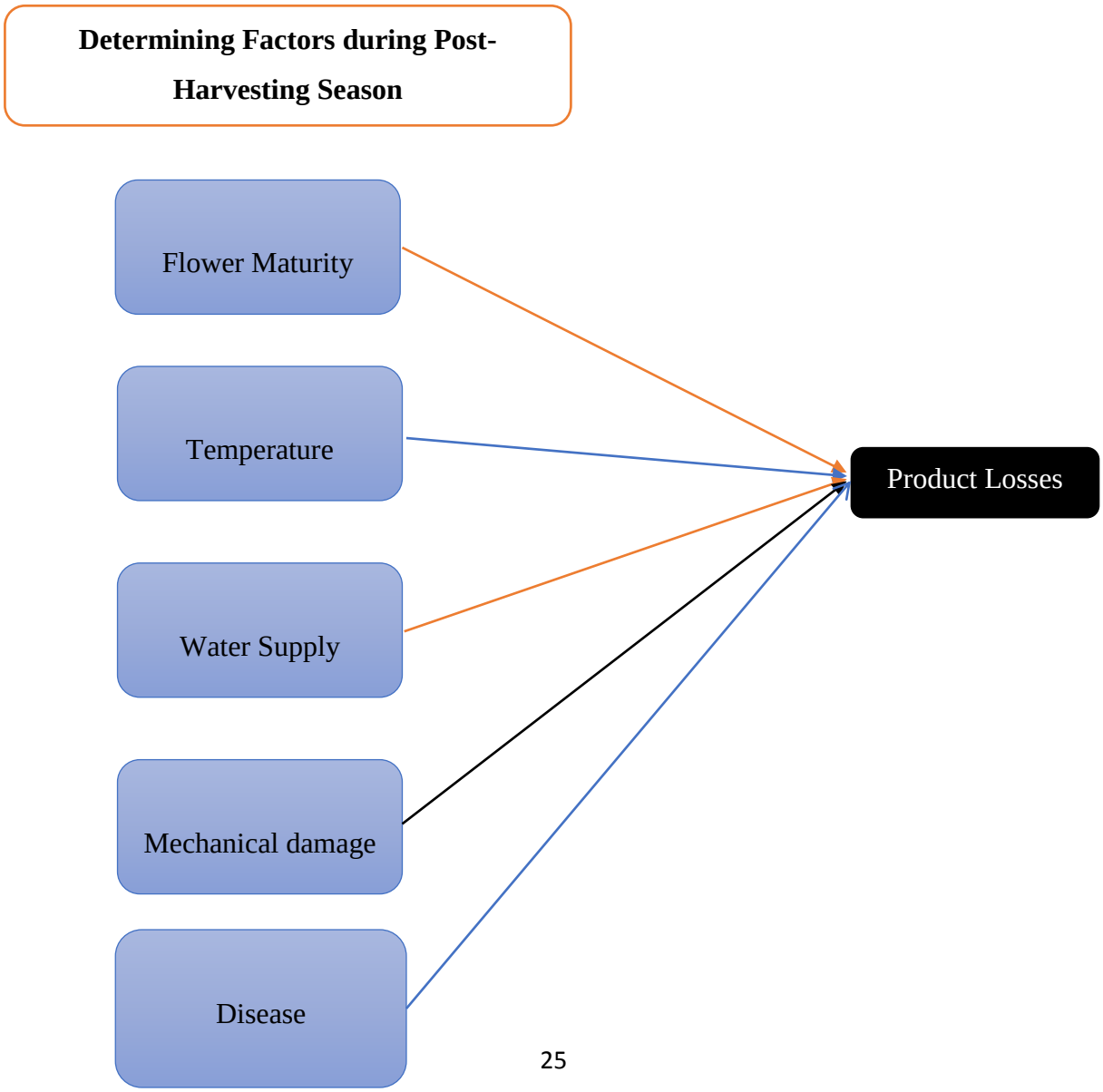
Linssen Roses Ethiopia(LRE) conduct its business ethically and in compliance with health, safety and environmental protection standards through a continuing commitment to produce the environment in mind and promote environmental sustainability and contribute to social and economic development while improving the quality of life of our workforce and their families as well as of the local community and society

Linssen Roses cultivates almost 30 varieties of high-quality roses in a range of colures year-round production of quality fresh cut roses to customers through observing the highest level of Good Agricultural Practices, social and environmental responsibility and The lifespan of

the plants depends on the growth – Linssen roses Ethiopia harvest 365 days a year, up to 4 times per day and company under production are 65 hectares and export on a daily basis – Linssen Roses Ethiopia sell roses throughout the whole world but most flowers go to Germany and produces over 90 million stems per year.

2.7 Conceptual Frame Work

Figure 2.1: Conceptual Framework



CHAPTER THREE

3 RESEARCH DESIGN AND METHODOLOGY

The study was conducted with the objective to identify the major challenges and examination of the company in terms of postharvest managements in Linssen Roses Ethiopia P.L.C. To this effect, the study has employed both quantitative and qualitative approach to collect and analyze the data needed to address various issues central to the study.

In this chapter, the researcher discuss the detail research approaches and methods such as research design, sampling techniques, methods and instruments of data collection, method of data analysis tools and ethical considerations.

3.1 Research Design

This research used mixed approach research design. Thus, it is more than simply collecting and analyzing both kinds of data; it also requires the use of both approaches one behind the other so that the overall strength of a study is greater than either qualitative or quantitative research (Creswell & Plano Clark, 2007).

Mainly, cross-sectional study design was employed so as to obtain factual data from randomly selected Linssen Roses Ethiopia P.L.C. Ethiopia employees and purposively selected informants, about the present situation regarding the issue understudy.

3.2 Population and Sampling Design

In the case at hand, the population constitutes one side area aggregation employees of the farm (520 as at January 12 2021). Target Population refers to the set of all elements belonging to a certain defined group to be studied or to which research results are going to be generalized to. The target population in the case at hand comprises 200 employees of the Linssen Roses Ethiopia that are working in greenhouse and pack house.

Since the study employed qualitative data, participants for interview were purposively selected. Hence, two key informants from managerial position and two informants were also selected for in depth based on the year of experience working on post harvesting activities.

A stratified sampling is chosen as the target population comprises of two strata, using employees gender, from which a sample is to be drawn doesn't constitute a homogeneous group, then stratified sampling technique is applied so as to obtain a representative sample (Kohtari, 2004). In this technique, the population is stratified into a number of non-overlapping sub populations or strata and sample items are selected from each stratum. Proportional stratified sampling specifically is the one in which the number of sampling units drawn from each stratum is in proportion to the relative population size of that stratum. This sampling technique is advantageous since it assures representation of all groups in sample population needed. The desired sample size is 133. This is calculated using the following sample size determination formula suggested by http://www.webcitation.org.

$n = N/ (1 + N (e) 2)$

Where N = Target population

n = sample size

e = level of precision=0.05

Given confidence level of 95% and precision rate of ±5 percent

n = 200 / (1+200(0.05)2) = 133

The number of target population of male employee is 22 and the second target population is female employee working at post harvesting department is 178. The above sample size 133 is proportionately distributed into these two strata to guarantee appropriate and equal representation. Strata one consists male employee working at post harvesting and female employee working at post harvesting department.

The applicable formula to identify the respective sample size for each strata is:-

Ns = (D1 / N) * n

Where,

Ns = sample size for each strata

N = Total Number of population

D1= Population size of the strata

n = Sample size

The total number of sample from the employee strata one is 15

Ns 1= (22 / 200)*133 =15

The total number of sample from the employees, strata two is 118

Ns 2= (178/ 200)*133 =118

3.3 Sources, Procedure and Methods of Data Collection

The study used descriptive survey to collect detailed data and factual information that describes an existing phenomenon.. The purpose of data collection is to obtain information to keep on record, to make decisions about important issues, or to pass information on to others. Data are primarily collected to provide information regarding a specific topic. Data collection usually takes place early on in an improvement project, and is often formalized through a data collection plan. Both primary and secondary sources of data were used.

3.3.1 Primary Data

Primary data are the first hand information that was obtained by the researcher himself from the field. This is obtained when the researcher does a descriptive or survey and uses a number of methods under the case. Primary data was collect from respondent that was included in the sample.

Instrument used in this research is a self-completion questionnaire to collect the data from the research sample.

Besides, semi-structured key informant and in depth interview was also the other instrument of data collection. Interview participants were purposively selected. Accordingly, 4 interview participants were selected, that consists of 2 from managers and senior non managerial employee who were working for many years on post harvesting department.

3.3.2 Secondary Data

In addition to using primary data collection methods, documentary secondary data were used in this thesis. Documentary data include company written materials, local government laws and other government circulars related to the topic, journal articles, books and other records relevant to this research proposal.

3.4 Method of Data Entry and Analysis

Obviously, the raw data has no meaning by itself unless it is arranged and analyzed properly. First, the quantitative data were cleaned, coded and entered into SPSS and analyzed. The analysis was carried out by using the statistical package for social science (SPSS) version 25 with employing descriptive statistics.

Qualitative data analysis was conducted under the assumption of organizing data, breaking it into manageable units, synthesizing it, searching for patterns, discovering what was important and what was to be learned. Consequently, after the collection of the data, the researcher transcribed the tape recorded data and data resulted from note taking activities. Reading the transcripts and studying the notes, all of the key issues, concepts, and themes were identified

and the raw data were rearranged according to the appropriate part of the thematic framework to which they relate.

Subsequently, based on the similarity of the themes, qualitative data were integrated with the quantitative ones concurrently based on themes in sequences of the study objectives.

3.5 Ethical Considerations

As Creswell (2009) argued in the progress of research, researchers need to respect the participants and the sites for research. Accordingly, support letter was obtained from ST. MARY'S UNIVERSITY to get permission and permission was sought from the company before the study was conducted.

Purpose of the study and issue of confidentiality was briefly explained by the researcher and trained data collectors for the study participants. Assuring them that their response will not be used to harm them and there is no need to write their name or any identification on the questionnaire has helped to obtain their consent. In addition, they were informed that they can withdraw from the study at any point of time if they felt unpleasant. Informed verbal consents were obtained from the study participants and oral agreement was reached.

To have the participants consent, the researcher/data collectors have encouraged them to give honest response. The researcher/data collectors conducted the study in open places to avoid disturbances. The data was conducted at places where the participants had preferred. Generally the data was collected in a way that did not harm the participants' wellbeing and privacy.

CHAPTER FOUR

4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter provides the major findings of the study, based on the data obtained through survey questionnaire, interviews and document. The data are presented and organized in a sequential order in line with the specific objectives stated under the first chapter of the thesis.

The quantitative data was obtained from 133 randomly selected study participants. Therefore, responses of 133 survey participants were used in analysis.

Moreover, qualitative data was collected through interviews from four purposively selected informants. Besides, secondary data was obtained from the documentary sources from organizational report, different published and unpublished related literatures.

The information obtained from interviews and secondary sources were used to complement, and in some cases explain the study findings obtained through survey questionnaire. The findings in this section, as best as possible, provided answers to the research questions, and therefore achieved the objectives of the entire study.

4.1 Demographic Background of the Study Participants

Figure 4.1 below shows that 89% of the study participants are female and 11% of the respondents are male. Considering age distribution of the study participants, 57% and 30% of respondents are under the age distribution of 25-35 years and 20-25 years old respectively; the

remaining found above 35 years old (see table 4.1 below) .This indicates that much of the study respondents are fall under productive age. Regarding educational attainment of respondents, about 84% of the respondents have attend primary level education, 7% have completed first degree, 4% have complete diploma, 2% of the study participants have Master degree and above, and the remaining 3% know reading and writing (see table 4.1 below). This shows that, respondents are addressed from different educational background mostly Primary school. With regards to years of working experience, 67% of respondents have been working between 1 and 5 years, 19% of respondents have 6-10 years of working experience, and 14% of respondents have been working for above 10 years (see table 4.1below).

Table 4.1 Frequency of Age, Sex, Educational level of respondent and working experience of study participants

No.	Item		Response	
			Frequency	**Percent**
1	Sex of respondent	Male	118	89%
		Female	15	11%
2	Age of respondent	18-25	40	30%
		26-35	76	57%
		Above 35 years	17	13%
3	Educational level of respondent	Primary	112	84%
		Diploma	9	7%
		BA and BSC degree	5	4%
		MA and Above	3	2%
		Know reading and Writing	4	3%
4	Years of experience of the respondent in the organization	1-5	89	67%
		6-10	25	19%
		Above 10 years	19	14%

Source: Own Survey

4.2 Major Problems of Floricultures in Relation to Post-harvesting Management

Findings under this section provide detailed descriptions about major problems of floricultures in relation to post-harvesting managements in Linssen rose's plc. Ethiopia. Considering the reality on the ground, the major problems of floricultures arising from post harvesting managements could be related with organizational post-harvest handling practice. Therefore, survey questionnaire designed to examine organizational post-harvest handling practice was administered by employees working in the post harvesting unit.

4.2.1 Harvesting Practice of the Company

The study participants were asked to describe harvesting practice of their organization. Accordingly, most of the study participants (90.98%) has mentioned that harvesting practice in their organization is made manually, while the remaining (9.02%) has argued that harvesting practice in their organization is made with the help of machine (see table 4.2below). Therefore, from the survey data we can understand that harvesting is mainly made manually.

Table 4.2: Tools used in harvesting

	Response	**Frequency**	**Percent**
How do you harvest the flowers (record all that apply)?	Manually	121	90.98%
	Using machine	12	9.02%
	If any other (please specify it)	0	0
Total		**133**	**100%**

Source: Own Survey

According to the data gained through interviews, informants have noted that harvesting is normally done by hand using scissors. However, correct harvesting of the flower is the first stage of preparing high quality flowers for delivery to the market. Therefore to avoid infections the employee have to use sharp cutting tools and cleaning them with disinfectant (Sodium-hypo-chloride).

In relation to harvesting practice of the organization study participants were asked to mention type of container's used while harvesting. In line with this, most of survey participants (87.97%) mention that traditional buckets were mainly used while harvesting. However, about 12.03% of the total study participants have mentioned that they are using trays while harvesting (see table 4.3 below).

Table 4.3: How do you placed the harvested flowers

	Response	**Frequency**	**Percent**
What type of container's do you use when harvesting?	Traditional buckets	121	90.98%
	Trays	12	9.02%
Total		**133**	**100%**

Source: Own Survey

In this regard, interview participants have argued that, buckets selection and management are very important to protect the flower from bacteria. Bacteria the growing in post-harvest water can move in to and block the xylem. This impedes water uptakes and results in a severe

reduction in the vase life of the flowers. Therefore, use of post-harvest disinfectant is not sufficient on its own to control bacteria growth during post-harvest. Segregation of buckets and through cleaning of the buckets after each use is essential to minimize loss of production. Therefore, keep green house and pack house buckets separate and wash buckets thoroughly sock in disinfected water.

4.2.2 Sorting, Storing, and Packing Practices of the Company

As survey participants have noted, in most cases they have sorted the harvested flower. Along with this, the company loses many product due to poor sorting mechanisms. Hence, the company should work on developing employee capacity building trainings on how to sort product.

One of the informant have also mentioned that packing is an important stage in the post-harvest process specially the carton quality and carefully packing will help to preserve the quality of work done in the pack house and poor packing will result in severely damaged flowers in the market.

By far the most important part of maintaining the quality of harvested flowers is ensuring that they are cooled as soon as possible after harvest and that optimum temperatures are maintained during distribution. With this respect, the study has revealed that the company stores harvested flowers in cold rooms before exporting. However, in some cases sheds are used to store products.

In line with this, informants have also mentioned that flowers can be cooled quickly; it is also true that flowers brought out of cool storage into a warmer packing area will warm quickly and develop condensation prior to packing. The simplest method of ensuring that packed flowers are adequately cooled and dry is, therefore, to pack them in the cool room. One of the key informant has argued that the company has failed to train employees on how operate greenhouses and packing areas. Employee working on post harvesting unit should recognize the high rate of respiration and the high temperatures of most greenhouses and packing areas result in heat build-up in packed flower containers unless measures are taken to ensure temperature reduction. It is therefore necessary to cool the flowers as soon as possible after packing.

The informant has also noted that forced-air cooling of boxes with end holes or closeable flaps is the most common and effective method used in the company for pre-cooling cut flowers. In forced-air cooling, refrigerated air is sucked or blown through a packed box of flowers to reduce their temperature quickly. Most flowers can be cooled to recommended temperatures in 45 min to an hour, and some cut flowers can be cooled in as few as 8 min. For small volumes of packed flowers, this is done by stacking boxes around a fan inside an existing cooler. In larger systems, many fans are permanently mounted against a wall, and pallets or cartloads of flower boxes are positioned next to the fans. The refrigeration system needs to be carefully designed and sized for forced-air cooling.

4.3 Factors Affecting Postharvest Quality

Maintaining quality in export cut flowers depends on an understanding the factors that lead to deterioration. Understanding these factors allows the company to develop and implement optimum postharvest handling technologies. This section presents the study findings examining factors affecting postharvest quality.

As it is show on table 4.4 below survey participants were asked to mention the major problems associated with product losses during post-harvesting phases. To this end, 43.61% of the study participants has mentioned flower maturity, 9.77% has argued mechanical damage, about 23.31% has noted temperature, 16.54% has said water supply, and about 6.77% of the study participants have argued as there are other factors associated with product losses during post-harvesting season. From this data we can say that flower maturity, temperature, and water supply are the major factors that leads to product losses during post-harvesting season (see table 4.4 below).

Table 4.4: Major problems associated with product losses during post-harvesting season

	Response	**Frequency**	**Percent**
What do you think is the major problems that affect post-harvest losses?	Flower maturity	58	43.61%
	Mechanical damage	13	9.77%
	Temperature	31	23.31%
	Water supply	22	16.54%
	If any other (please specify it)	9	6.77%
Total		**133**	**100%**

Source: Own Survey

In addition to the data gained through survey questionnaire, the researcher has conducted an in-depth interview on the issue at hand. Hence, interview data concerning this issue is presented here after in detail.

4.3.1 Flower Maturity

As the informants have mentioned, minimum harvest maturity for a cut-flower crop is the stage at which harvested buds can be opened fully and have satisfactory display life after distribution. Many flowers are best cut in the bud stage and opened after storage, transport or distribution. This technique has many advantages, including reduced growing time for single-harvest crops, increased product packing density, simplified temperature management, reduced susceptibility to mechanical damage and reduced desiccation. Many flowers are presently harvested when the buds are starting to open, although others are normally fully open or nearly so. However, due to lateness in order of the product we store cut flowers in the shed for above minimum maturity time. Hence, when the order comes we failed to sell them out since the flowers are already opened and completed their life time. In this case, we losses many product due to flower maturity.

4.3.2 Temperature

As it is shown in the above table 4.3 temperature is the second major factors that lead to product losses in the company. In order to triangulate the data gained through survey the researcher has conducted interview with senior employee working in post-harvesting department. The informant has mainly said that the company did not work on employee capacity building on how to operate cooling machines in the green house.

Moreover, the informant has noted that respiration of cut flowers, an integral part of growth and aging, generates heat as a by-product. Furthermore, as the ambient temperature rises, the respiration rate increases. For example, a flower held at 30^{o}C is likely to respire (and therefore age) up to 45 times as fast as a flower held at 2^{o}C. The rate of aging can be reduced dramatically by cooling the flowers. Rapid cooling and maintenance of the cool chain are thus essential for maintaining quality and satisfactory vase life of cut flowers. However, many of the employees did not have the expected expertise knowledge to manage the temperature level. As a result, we losses huge number of products.

4.3.3 Water Supply

Water supply can determine product losses in the company. As my informants have argued, cut flowers, especially those with leafy stems, have a large surface area, so they lose water and wilt very rapidly. Therefore, they should be stored at relative humidity above 95% to minimize water loss, particularly during long-term storage. Water loss is dramatically reduced at low temperatures, another reason for prompt and efficient cooling of cut flowers. Even after flowers have lost considerable water (for example during air transportation or long-term storage) they can be fully rehydrated using proper techniques. Cut flowers will absorb solutions without difficulty providing there is no obstruction to water flow in the stems. Therefore, flowers must be put in to water immediately after harvest and taken in to the cold room with in 30 minutes of harvest to minimize production loss

4.3.4 Mechanical Damage

As we can see in table 4.3 above about 9.77% of the study participants have mentioned Mechanical damage is linked with product losses in the company. In this regard, informants have mentioned that mechanical damage my occur at different stage of rose production like at harvesting, transport to the pack house , grading and sorting, deleafing, bunching packaging and leading to cold truck which affect the whole post-harvest cycle of the rose by creating physical quality loss which overall affect the post-harvest life of roses

CHAPTER FIVE

5 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusion

Floriculture is the newest of Ethiopia's export industries, having grown very rapidly over the past years to become the country's fourth largest export industry. The Ethiopian floriculture industry began in the 1980s when state-owned farms started exporting cut flowers to Europe.

Different researches have been conducted on exploring several problems resulting in failures of this investment; this study was carried out to identify and understand the underlying factors that lead to losses of products in the company. The study was captured with the help of mixed research method. To this effect, survey questionnaire and interviews were methods used to collect data which is supported with secondary source of data.

It is concluded that post-harvest handling is the final stage in the process of producing high quality fresh product. Being able to the market presents many challenges. A grower who can meet these challenges will be able to compete in the market place. The major problems of floricultures postharvest managements are many but failing to work on employee capacity building regarding product handling on post-harvesting phase is the source of every problem in the company. Flower maturity, temperature, water supply, and mechanical damage are mentioned with regards to major problems leading the company to losses products during post harvesting phase.

5.2 Recommendations

For countries like Ethiopia it is not easy to transform their economy from subsistence agrarian economy to the production and export of products. The problem particularly will be at its climax when countries produce and export products like cut-flower in the sophisticated and highly competitive dynamic world market.

Therefore, measures at different levels should be taken cautiously to enhance its development and expansion for the increment of its contribution to the overall economy.

Based on the study conducted it would be reasonable to give the following recommendations that may help the farmers, exporters, the investment and other policy makers to improve the problems associated with the major challenges of the company interms of post harvest management in linssen roses Ethiopia P.L.C. In particular . These are:

- The company should work on the development of training and workshop designed to enhance employee capacity regarding how to manage and handle products during and after post-harvesting phase.
- Flower maturity should be followed and treated accordingly
- Temperature of the green house and cold room has to be balanced and followed attentively. . After the first harvesting phase, the flower must always be kept in cool environments. The direct light and warm temperatures causing rapid opening of the flower and increase he bacteria in the preservative solution. The temperature in refrigerators and during transportation after packing must always kept between 2 and 6 ^{o}C which the humidity at around 70-80% max.

- Water must be clean and likewise the buckets. All other containers used should be a perfect cleaned and disinfected.
- Linssen Roses Ethiopia P.L.C can achieve its goals if it allows its worker to give their genuine feedback on the farms. Feedback gives all sorts of insights into what what workers want. Here are some ways how to get feedback from workers. Feedback boxes, setting up a workers panel and explain how the feedback will be used, reaching out directly, responding to everyday feedback. Then workers problems will be taken due attention in order to have voluntary compliance.

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Appendix A:

Survey Instrument

ST. MARY'S UNIVERSITY

INSTITUTE OF QUALITY AND PRODUCTIVITY MANAGEMENT

Questionnaire to be filled by Linssen Roses Ethiopia Employees

Preamble

Dear respondent,

My name is ***Tirhas Gebreamlak***. I am currently a student of St. Mary's University Institute of quality and productivity management, doing Master of Science: On "Quality and Productivity Management". Now I am doing a Masters research entitled as *"Assessment on Post-harvest Handling 0f Cut-Flowers in Linssen Roses Ethiopia P.L.C"*.

The aim of this questionnaire is to collect data for the issues under studied. Generally, this questionnaire is designed to examine Performance and Challenges on post-harvest handling of cut-flowers, in the case of Ethiopian Linssen Roses. Trust that the information you will honorably provide is strictly confidential and serve only for academic purpose. To this end, your participation and genuine response to the questions is invaluable to the success of the study. No need of writing your name or any personal identification. Thus, I kindly ask your cooperation in filling this questionnaire truthfully.

Thank you in advance for your cooperation and timely response.

Part I: Socio-demographic questions

Instruction: The following questions asking about your personal background information. Please circle the number that contains the right item. For open ended question please write the correct answer in the space provided after each item.

1. Sex

1. Female
2. Male

2. Age in year _____

3. Highest Educational Level that you attained

1. Illiterate
2. Reading and writing
3. Primary education (Grade 1-8)
4. Secondary education (Grade 9-12)
5. Diploma
6. BA/Bsc degree
7. Masters and above
8. If any other (please specify it) _____

4. Year of Experience

1. 1-5 years
2. 6-10 years
3. Above 10 years

Part II: Items to assess post-harvest handling practice

1. How do you harvest the flowers (record all that apply)?

1. Manually
2. Using machine
3. If any other (please specify it) _____

2. What type of container's do you use when harvesting?

1. Traditional buckets
2. Trays

3. Do you sort your harvested flowers?
    1. Yes
    2. No
4. If yes out of your harvested flower to what extent do you think is thrown away during sorting?

_____

_____

_____

5. How do you store the flowers you harvested on the farm before exporting?
    1. Under the shed
    2. In cold rooms
    3. In sacks in the open
    4. If any other (please specify it)_____
6. If your answer is in cold room in the above question, have you ever been trained about cold chain?
    1. Yes
    2. No
7. How long do you store the flowers on the farm before exporting?
    1. Less than 1 hour
    2. 1 to less than 3 hour
    3. 3 to less than 6 hour
    4. More than 6 hour
8. To what extent do you think flowers go to waste due to poor handling?

_____

_____

_____

9. Which one is the typical problem that arises as a result of poor post-harvest handling?
    1. Disease
    2. Wilting Flowers
    3. Open flowers

4. Bent stems
5. Heat damage flower and burning
6. If any other (please specify it) _____

10. What is your opinion on the major problem that affect post-harvest losses and product in Linssen roses Ethiopia?
    1. Flower Maturity
    2. Mechanical damage
    3. Temperature
    4. Water supply
    5. If any other (please specify it) _____
11. What do you think flowers may become damage or dehydrated?
    1. During harvesting
    2. During the flower moved from green house to pack house
    3. During the flower moved from pack house to cold room
    4. During grading and bunching
    5. If any other (please specify it) _____
12. Have you ever been trained on the post-harvest handling?
    1. Yes
    2. No
13. On which area do you think Linssen roses Ethiopia losing a lot of flower because of poor post-harvest handling of flowers?
    1. Green House
    2. Pack house
    3. Cold room
    4. If any other (please specify it) _____
14. How do you explain the rate of losing flower in the post-harvesting season?

_____

_____

_____

15. What do you think is the reason for losing flower in the post-harvesting season?

16. What do you think is the most notable solution to protect losing flower in the post-harvesting season?

17. How do you explain the overall post-harvesting practice of the company?

Appendix B:

Interview Guide for In-depth interview with employees engaged in post-harvesting activities

Hello, my name is ***Tirhas Gebreamlak.*** I am doing my thesis for my *Master's Degree in* Quality and Productivity Management. I would like to thank you in advance for meeting me today.

In our discussion, my aim is to comprehend the overall *Post-harvest Handling 0f Cut-Flowers in Linssen Roses Ethiopia P.L.C.*

Thus, taking my interest in to consideration, you should be able to see why I am asking most of the subsequent questions. If you have other information that you think is important and that I have not asked you please feel free to share it with me.

Please be aware that you have the right to refuse to participate in the study and answer any particular question. Your accurate and truthful responses are relevant for the success of the study. I promise and guarantee you the discussion between you and I will be kept confidential.

1. **Identification**

   1.1. Interview NO. _____

   1.2. Date of Interview _____

   1.3. Beginning of time _____

   1.4. Termination time _____

2. **Demographic Variables**

2.1. Age? _____

2.2. Position? _____

2.3. How long have you been serving in the company? _____

3. **Exploring post-harvesting experience**

3.1. For how long have you been working on tasks related with post-harvesting?

3.2. Was there anything about the experience you found surprising while you are working tasks related with post harvesting?

3.3. Was there anything about the experience you loved in the company's post-harvesting practicing strategies?

3.4. Was there anything about the experience you really disliked in the company's post-harvesting practicing strategies?

3.5. How do you explain the rate of losing flower in the post-harvesting season?

3.6. What do you think is the reason for losing flower in the post-harvesting season?

3.7. What do you think is the most notable solution to protect losing flower in the post-harvesting season?

3.8. How do you explain the overall post-harvesting practice of the company?

Thank You So Much!!

Appendix C:

Interview Guide for Key Informant Interviews

Hello, my name is ***Tirhas Gebreamlak.*** I am doing my thesis for my *Master's Degree in* Quality and Productivity Management. I would like to thank you in advance for meeting me today and I would love to appreciate your participation in the study. Your genuine information is very relevant for the success of this study. Whatever information you provide would be kept strictly confidential so I request you to respond the questions frankly.

1. **Identification**

   1.1. Code given to an interviewee

   1.2. Position

   1.3. Year of service

2. **Main Issues**

   2.1. How post-harvesting activities are undertaking in the organization? (Probing questions: How do you define the success and challenges of your organization on post-harvesting activities? What you are doing to minimize the losses of flowers occurs in the post harvesting season?)

   2.2. Is there anything you would like to add?

Thank You So Much!!