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Use of the break-even point analysis method in cost management

Bachelor Thesis

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2. HAINEMANN, Mareike; CLEARY, Peter; SCHUSTER, Peter. *Management Accounting*. Cham: Springer, 2021. 313 p. ISBN 978-3-030-62021-9.
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BEA	Break-even analysis
BEP	Break-even point
AMD	Armenian Dram
RA	“ROSE ART” LLC

Introduction

The purpose of the work can be identified as studying the break-even point analysis method in cost accounting of a production, understanding how the costs, prices and volume affect the financial output of the company and using gained knowledge in a real case.

The main aim of the bachelor thesis is to find and analyse the break-even point of a selected company and to find the volume of production in case of inhomogeneous production. The work can be divided into three sections, with the first two dealing with theory and the third being the case solution and analysis.

First chapter is the description of different types of costs in terms of cost accounting. For this chapter several books were read and summarised, by using induction method. The description of types of costs, as unit and overhead costs, direct and indirect costs, fixed and variable costs alows the thurder research by giving a proper understanding of the costs.

Chapter two deals with the break-even point in homogeneous and inhomogeneous production, by using the same research methods as in chapter one, it represents the guide on the BEP identification. The comparison of the BEP calculations between homogeneous and inhomogeneous productions provides an understanding on which aspects of costs and prices have a certain effect on the financial soundness of the producer.

The third chapter applies the knowledge gained from the previous parts to analyse a selected company, which has an inhomogeneous, agricultural production. Firstly, the analyse of the costs was made. By using the deductive method, the calculation of the BEP was done. After that, having all the data collected and calculated, by correctly synthesis the financial appearance of the company, proposals can be made for production optimisation.

Objectivity in this work has a high importance, since only by dealing with the components objectively and looking at them from multiple perspectives, it is possible to give a correct assesment of the numbers gained from calculations.

1 Description of different types of costs in terms of cost accounting

In the increasingly complex landscape of business operations, a nuanced understanding of cost structures is pivotal for sound financial management and strategic planning. Breakeven analysis, a cornerstone of business decision-making, requires a comprehensive grasp of different cost categories – fixed, variable, direct, and indirect costs. Each type of cost has unique implications for how a company budgets, prices its products, and manages financial risk. Fixed costs, for example, remain constant regardless of production levels, necessitating precise forecasting to safeguard profitability across varying operational scales. In contrast, variable and direct costs fluctuate with production activity, directly impacting unit costs and pricing strategies (LAWSON, 2020). This section explores these costs in detail, illustrating their distinct roles in financial analysis and decision-making, and underscoring the importance of differentiating between them to effectively conduct breakeven analysis and enhance business profitability.

1.1 Fixed costs

Fixed costs remain constant regardless of changes in production or sales volumes, making them predictable but sometimes burdensome for businesses. They include expenses such as rent or mortgage payments on business property, salaries of permanent staff, and depreciation of long-term assets like machinery and vehicles. Such costs are independent of the business's operational success, meaning they accrue even during periods of low production or sales. This characteristic can be advantageous for businesses during high production phases as the cost per unit decreases, enhancing profitability. However, during downturns, fixed costs can strain financial resources, necessitating careful planning and management. The ability to accurately forecast these expenses is critical, as it affects everything from budgeting to strategic decision-making and pricing strategies to ensure coverage of all expenses and maintenance of profit margins (SCOTT, 2018).

Consider a company like Netflix, which incurs substantial fixed costs in the form of content acquisition and licensing fees. These costs remain constant regardless of the number of subscribers or the amount of content streamed by users. Additionally, infrastructure costs such as servers and data centres are also fixed, as they are

necessary to support streaming services around the clock. For a manufacturing example, an automotive company might have fixed costs associated with long-term leases on factory buildings and the depreciation of assembly robots and other equipment. Despite fluctuations in car sales, these costs do not change, emphasizing the need for consistent production levels to maintain profitability.

Understanding and managing fixed costs are crucial for financial stability and strategic pricing. Companies must ensure that their pricing strategies cover fixed costs under varying production levels to maintain profitability and competitive advantage (COKINS, 2001).

1.2 Variable Costs

Variable costs, in contrast to fixed costs, scale directly with production levels. This includes expenses such as raw materials, utilities based on usage, and wages for hourly workers. These costs rise as production increases, which can lead to bulk purchasing discounts and economies of scale in some cases. However, they also add an element of financial unpredictability, especially in industries with fluctuating demand. Effective management of variable costs involves close monitoring of production processes and market trends to make informed purchasing and production decisions. This dynamic nature of variable costs makes them a focal point in marginal cost analysis, which examines the cost to produce one additional unit. By understanding these costs, businesses can optimize production schedules and pricing models to better align with market demands and cost structures (SCOTT, 2018).

A classic example of variable costs can be observed in the restaurant industry. For instance, a restaurant's expenses for ingredients like meat, vegetables, and spices increase directly with the number of meals prepared. Labor costs also vary, as more staff hours are needed during peak dining times. Similarly, in the textile industry, costs for fabric and other materials rise with an increase in production volume. Businesses managing variable costs effectively often use just-in-time inventory systems to keep these costs in line with current demand levels, reducing waste and improving cash flow.

Variable costs are vital for operational planning and marginal cost analysis. Businesses must monitor these costs closely to adapt quickly to changes in

production needs and market conditions, ensuring that production levels are always aligned with current demand to optimize profitability.

1.3 Direct Costs

Direct costs are explicitly tied to the production of specific goods or services, making them straightforward to trace and assign to specific product units. These include the costs of materials and parts used in the manufacture of products, as well as the wages of employees directly involved in production. Because these costs can be directly linked to specific items, they are critical for accurate cost accounting and profitability analysis. This precise allocation helps in setting prices that not only cover costs but also generate desired profit margins (KAPLAN, 2001). Moreover, understanding direct costs supports businesses in strategic decision-making, such as identifying cost-cutting opportunities or potential areas for investment in efficiency improvements. This level of detail is also instrumental in developing competitive pricing strategies and can influence decisions related to product design and feature enhancements.

Direct costs are particularly clear in businesses like custom furniture manufacturing, where the wood and hardware costs can be directly traced to each piece of furniture, and the labour costs directly associated with crafting these bespoke items. Another example is in construction, where the costs of bricks, cement, and wages of construction workers can be directly allocated to specific projects, allowing companies to precisely assess the profitability of each job and adjust project quotes accordingly.

Tracking and controlling direct costs allow businesses to set competitive prices and manage costs effectively. This is essential for maintaining a clear understanding of product profitability and for making informed decisions about which products to emphasize or expand (BALAKRISHNAN, 2014).

1.4 Indirect Costs (Overhead Costs)

Indirect costs, or overheads, include expenses like factory maintenance, utilities for non-production areas, and salaries for support staff. These costs are not directly attributable to specific product units, which complicates their allocation. Properly allocating overhead costs is crucial for determining the true cost of producing an

item and for ensuring equitable cost distribution among different products or services (ANDERSON, 2009). This allocation often relies on sophisticated costing methodologies, such as activity-based costing, which assigns costs based on activities that drive cost incurrence. The complexity of these methods can vary significantly depending on the business size and sector, underscoring the importance of precise overhead management in maintaining competitive pricing and profitability (BURNEY, 2020).

A software development firm provides a good example of how indirect costs function. Such a company may incur overhead costs like software licenses, utilities, and administrative salaries that support the entire operation but are not directly linked to any single software project. These costs must be apportioned among various projects based on their duration or the resources utilized. In the healthcare sector, a hospital has indirect costs such as facility maintenance and administrative staff, which are essential for hospital operations but not directly billable to specific patient care services.

Effective management and allocation of indirect costs, highlight, are critical for accurately pricing products and services. Businesses need sophisticated costing methods to ensure that all products bear a fair share of the overhead costs, thus maintaining pricing fairness and profitability across the board (GUPTA, GALLOWAY, 2003).

1.5 Unit Cost

Understanding unit cost is vital for comprehensive cost management and pricing strategy. It encapsulates all categories of costs – fixed, variable, direct, and allocated overhead – per unit of product produced. Accurate calculation of unit cost provides a clear picture of what it costs to produce each unit and is instrumental in setting selling prices that achieve profit targets. Additionally, insights from unit cost analysis can lead to strategic decisions about product lines, such as which products to emphasize based on profitability, which to discontinue, and where to focus improvement efforts (GUPTA, GALLOWAY, 2003). Moreover, unit cost plays a critical role in budgeting and financial forecasting, serving as a basis for measuring financial efficiency and operational performance.

An electronics manufacturer producing smartphones is a suitable example for understanding unit cost. The unit cost would include the direct costs of components like chips and screens, the variable costs of assembly labour, and an allocation of fixed and indirect costs such as the machinery depreciation and factory utilities. This unit cost calculation is crucial for setting competitive pricing that covers costs and generates a profit margin. Another example might be a coffee shop calculating the cost of producing a single cup of coffee, considering coffee beans, water, cup, labour, and a portion of the monthly rent and utilities, to determine pricing that ensures each cup sold contributes to overhead coverage and profitability.

Knowing the unit cost is essential for determining pricing strategies that can sustain a business's financial health. It allows companies to make informed decisions about which products are financially viable, where to cut costs, and how to optimize production processes to maintain competitive market positioning and profitability (KAPLAN, 2001).

This discussion clarifies the critical roles that fixed, variable, direct, and indirect costs play in business operations. Understanding these cost distinctions helps businesses develop effective pricing strategies, manage financial risks, and optimize operational efficiencies. Effective cost management not only enables businesses to withstand market fluctuations but also strengthens their competitive position. By examining various industry examples, from digital streaming to manufacturing, it is evident that strategic cost management is integral to a company's long-term success (BURNEY, 2020). Moreover, accurate cost identification and analysis, particularly in unit cost calculations, are crucial for making informed pricing and production decisions, ensuring that businesses remain financially viable in a challenging economic landscape.

2 Identification of a break-even point in homogeneous and inhomogeneous production

Break-even analysis (BEA) stands out as an essential tool in financial management, employed to precisely identify the moment at which a business reaches a state of financial equilibrium. This point, commonly referred to as the break-even point (BEP), is characterized by the company's total revenues matching its total costs, resulting in neither a profit nor a loss. The significance of this analysis is multifaceted, as it provides critical insights into the financial dynamics that govern various production scenarios, whether they involve consistent, homogeneous product lines or diverse, inhomogeneous ones. Understanding where the break-even point lies helps managers and stakeholders make informed decisions regarding cost management, pricing strategies, and the potential profitability of new products or services (HAINEMANN, 2021). This analysis is particularly crucial in sectors where the cost structures are complex or where market conditions fluctuate significantly, offering a clear metric by which to gauge performance and plan future operations.

2.1 Homogeneous production

In homogeneous production environments, characterized by the manufacturing of identical products, the process of calculating the break-even point (BEP) is relatively straightforward and direct. This simplicity arises because each unit produced incurs the same variable cost and is sold at the same price. The standard formula used to determine the break-even volume requires dividing the total fixed costs by the contribution margin per unit. The contribution margin per unit is defined as the difference between the selling price of each unit and its variable cost (ALEXANDER, 2018). Essentially, this margin represents the amount each unit contributes towards covering fixed costs and generating profit after variable costs have been met. The formula, critical for financial planning and analysis, is expressed as follows:

$$BEP\ (units) = \frac{Fixed\ Costs}{Price\ per\ Unit - Variable\ Cost\ per\ Unit} \quad (1)$$

This calculation operates under the assumption that each unit sold contributes uniformly to covering the fixed costs, thereby simplifying the analytical process involved in determining the break-even point. For instance, consider a company that faces fixed costs amounting to 50,000 USD. If this company sets the selling price of its product at 100 USD per unit and incurs variable costs of 60 USD per unit, the contribution margin per unit – that is, the revenue remaining per unit after variable costs are subtracted – would be 40 USD. To find the break-even point, where the total revenue from sales exactly covers the fixed costs without yielding any profit or loss, you would divide the total fixed costs by the contribution margin per unit. The calculation for the break-even point, crucial for understanding the volume of sales needed to achieve financial stability, would be carried out as follows:

$$BEP = \frac{50{,}000}{100 - 60} = 1{,}250\ units$$

At this specified sales volume, the company successfully covers all its fixed costs, meaning that any subsequent units sold will directly contribute to the company's profit margin. This scenario represents a critical threshold for financial planning, as achieving and surpassing the break-even point can significantly impact the company's profitability.

2.2 Inhomogeneous production

In contrast, the scenario is more complex in inhomogeneous production settings where multiple products are manufactured, each with distinct costs, prices, and contribution margins. These differences introduce variability and complicate the calculation of a single break-even point. To manage this complexity, the weighted-average contribution margin method is often employed. This method calculates a weighted average of the contribution margins of the various products, considering their expected sales proportions in the overall sales mix (HAINEMANN, 2021). By integrating the varying profitability of each product into a unified measure, this approach provides a more accurate reflection of the overall financial performance of diverse product lines. To find the break-even point using this method, one divides the total fixed costs by the calculated weighted-average contribution margin. The formula used to determine this weighted-average contribution margin is:

$$Weighted\ Average\ CM = \sum(CM_i \times Weight_i) \quad (2)$$

$$BEP\ (units) = \frac{Total\ Fixed\ Costs}{Weighted\ Average\ CM} \quad (3)$$

For instance, imagine a business that sells two different products, labelled A and B. Product A, which has a contribution margin of 30 USD, is anticipated to constitute 70% of the company's total sales. Product B, on the other hand, offers a higher contribution margin of 50 USD but is expected to account for just 30% of sales. To calculate the weighted average contribution margin, which helps in determining the break-even point in such a mixed product scenario, one would multiply each product's contribution margin by its respective percentage of total sales (sales mix ratio) and then sum these amounts. This method accurately reflects the overall financial contribution of the product mix, accommodating different sales volumes and contribution margins. The calculation of the weighted average contribution margin for this business scenario would proceed as follows:

$$Weighted\ Average\ CM = (30 \times 0.7) + (50 \times 0.3) = 21 + 15 = 36$$

With fixed costs of 72,000 USD, the break-even point in total units would then be:

$$BEP = \frac{72{,}000}{36} = 2{,}000\ units$$

After the calculation of the BEP in total units, it is important to find out the BEP for each product. This is done by simply multiplying the BEP in total units by sales mix ratio. After doing this calculation, the BEP for product A and B will be identified as 1,400 units for product A and 600 units for product B respectively.

Another method employed in inhomogeneous production environments is the multi-product break-even analysis. This technique involves a more intricate approach where a set of equations is used, each reflecting the individual contribution of each product type to covering the fixed costs (COKINS, 2001). This method is particularly valuable in scenarios where different products have varied prices, costs, and sales volumes, which can significantly influence the overall financial dynamics of a company.

In this approach, each product's specific economic impact is quantified separately, acknowledging that not all products contribute equally to profit margins. The analysis requires calculating the contribution margin for each product and then formulating equations that take into account the proportion of each product's expected sales. These equations collectively determine how many units of each product must be sold to meet the total fixed costs, thus achieving the overall break-even point. This formulaic approach provides a detailed and accurate view of the financial interplay between different product lines, allowing companies to strategically adjust production and sales strategies based on precise profitability forecasts.

In this nuanced approach, the economic impact of each product is quantified individually, recognizing the varying contributions that different products make to profit margins. This necessitates calculating the contribution margin for each product – a key indicator of how much each unit contributes to covering fixed costs and generating profit. Following this, a series of equations is formulated to reflect the expected sales proportion of each product type (KAPLAN, 2001).

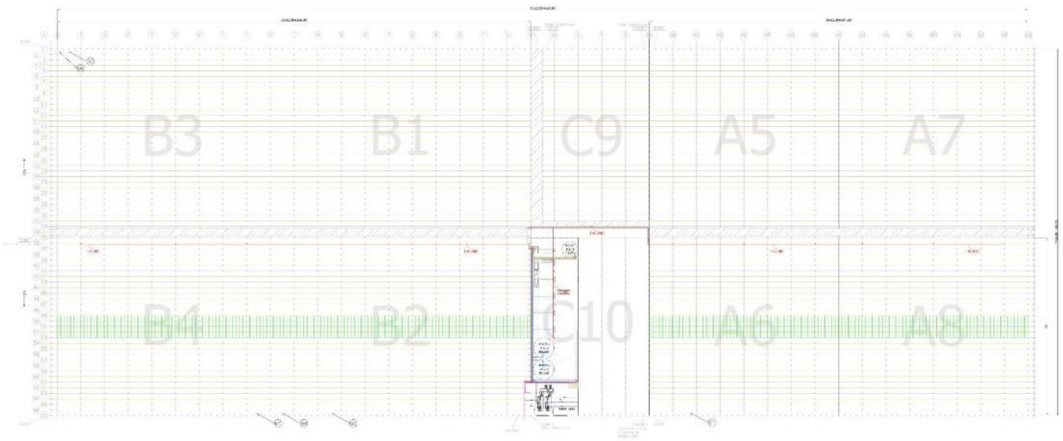
These equations are crucial as they enable a company to determine how many units of each product need to be sold to collectively meet the total fixed costs, thereby pinpointing the overall break-even point. This method allows for a detailed and accurate analysis of the financial interrelations among diverse product lines. By providing a clear picture of how each product contributes to the financial health of the company, this approach empowers businesses to make strategic decisions regarding production and sales, tailoring strategies to maximize profitability based on precise, product-specific data. This sophisticated analysis is particularly beneficial in environments where product offerings are varied and financial dynamics complex, offering a roadmap for financial stability and strategic growth.

3 Analysis of the break-even point of the selected company based on actual data, assessment of identified results and offering proposals on how to ensure the better financial soundness of the company

This chapter introduces in detail the company under research, it is located and is operating in Republic of Armenia, hence all the financial reports are done in the national currency. Based on the request of the company costs, prices and revenues are multiplied by a fixed constant number in order to keep the corporate privacy.

3.1 Introduction to the company under study

Established in the Kotayk region of the Republic of Armenia, "ROSE ART" LLC (hereinafter referred as “RA”) stands as a pioneering enterprise in the agricultural sector, operating a considerable 25-hectare greenhouse facility dedicated to rose cultivation. As the first to introduce rose cultivation in the region, the company has maintained a leadership position for over a decade, continually advancing through the integration of cutting-edge agricultural technologies. Figure 1 shows the greenhouses map.



Source: ("ROSE ART" LLC presentation, 2024)

Figure 1 Greenhouses scheme

Specializing in the production of two varieties of roses – single-flowered and spray roses – RA strategically positions its offerings within a unique market niche. Single-flowered roses, noted for their prominent single bloom per stem, are ideally suited for formal displays and bouquets, while spray roses feature multiple smaller blooms per stem, creating a lush, voluminous appearance perfect for both standalone and mixed floral arrangements. The quality of these roses benefits significantly from the region's conducive climate and the adoption of sophisticated cultivation technologies, ensuring that the products exceed average quality levels yet remain just below the premium luxury category, thus offering an excellent balance of affordability and superior quality. Figure 2 shows the company's logo.

Source: ("ROSE ART" LLC presentation, 2024)

Figure 2 "ROSE ART" LLC Logo

RA holds a significant market presence, supplying half of Armenia's rose market and maintaining a substantial share in Georgia. The company's largest market is Russia, where it enjoys robust sales. Additionally, RA exports various quantities of roses to European and West Asian countries, demonstrating its extensive production capacity and the successful fusion of traditional agricultural practices with modern technological advancements.

Through its predominant sales in Russia and comprehensive export activities, RA continues to uphold its competitive edge by committing steadfastly to innovation and quality. The company's strategic market positioning and pioneering status underscore its influential role in transforming the horticultural landscape both locally and internationally.

3.2 Methodology

This section outlines the methodology employed to analyse the financial performance of RA, specifically focusing on calculating the break-even point and

determining the production volumes required for profitability in the context of inhomogeneous production. The primary tool used in this analysis will be Cost-Volume-Profit (CVP) Analysis, a traditional economic model that helps elucidate the relationship between cost, production volume, and profit. This model involves categorizing costs into fixed and variable and determining the sales volume at which total revenues will match total costs, resulting in neither profit nor loss.

To address the company's production of two distinct types of roses – single-flowered and spray roses – a Segmented Break-Even Analysis will be essential. This approach allows for assessing the break-even points for each product segment separately, taking into account their specific cost structures and pricing strategies. In addition, the Contribution Margin Technique will be utilized to evaluate how each type of rose contributes to covering the fixed costs and achieving overall profitability. This technique calculates the contribution margin, defined as sales minus variable costs, for both types of roses to better understand which product is more financially viable under different scenarios.

Data required for these analyses will be collected from the company's financial records, including details on costs, production quantities, and sales figures. Additional market data will be sourced from industry reports and validated market research to ensure the analysis is comprehensive and well-informed. Supporting the analytical process, software tools such as Microsoft Excel will be used for numerical calculations and data visualization, enabling efficient management of complex calculations and clear presentation of findings.

3.3 Break-even point analysis of the company

To ensure a comprehensive and accurate evaluation, the financial and operational records necessary for determining the profitability thresholds and assessing output levels of RA were thoroughly gathered from the company’s own archives. This information comprises detailed breakdowns of the expenses linked to growing single-flowered and spray roses, along with records of how much of each rose type was produced and the revenue they generated. The comprehensive nature of this dataset provides a robust foundation for conducting segmented break-even analysis and exploring the contribution margins, enabling a deep dive into the financial dynamics and operational efficiencies of RA under varying market conditions.

Table 1 below provides a comprehensive breakdown of the various cost components associated with the production of single-flowered and spray roses at RA. This detailed categorization includes expenses such as electricity fees, water costs, payroll, packaging expenses, chemicals, gas fees, taxes, and more. By itemizing these costs, the table offers a precise overview of the direct and indirect expenses that are integral to the financial structure of the company's operations. Highlighting each category of expense is essential for conducting the Cost-Volume-Profit analysis, allowing for a precise calculation of break-even points across the company's diverse product lines.

Table 1 Annual cost in AMD

Gas	1,653,280,569
Electricity	633,601,823
Water	16,646,000
Packaging	762,206,400
Fertilizers	401,404,760
Chemicals	163,544,080
Payroll	2,321,124,800
Taxes	302,809,600
Seedlings	783,510,000

Source: (Modified from "ROSE ART" LLC presentation, 2024)

Each cost category listed in Table 1 will be examined in detail within the subsequent sections of this analysis. For clarity and thorough understanding, individual paragraphs will address and dissect the implications of each specific expense, including electricity fees, water costs, payroll, packaging expenses, chemicals, gas fees, and taxes, among others. This detailed exploration will not only illuminate how each type of cost contributes to the overall financial framework of RA but will also assess these costs in terms of their classification as fixed or variable. Understanding this distinction is critical, impacting the company's profitability and efficiency, and essential for conducting a precise Cost-Volume-Profit analysis. Such a segmented approach ensures a comprehensive evaluation of the cost structure, crucial for

identifying potential areas of financial optimization and strategic decision-making within the company.

Gas:

In analysing the costs associated with RA, gas expenses stand out as one of the highest operational expenditures, second only to payroll. Gas serves a dual purpose in the greenhouse operations of the company. Primarily, it is used for heating the extensive greenhouse facilities, which is essential for maintaining an optimal growing temperature year-round, particularly during the colder months. Additionally, gas combustion provides an often overlooked but vital benefit: the production of carbon dioxide, a by-product that is critical for plant photosynthesis. This enhanced CO2 environment accelerates plant growth and improves the quality of the roses.

In the context of Armenia, the supply of gas is monopolized, meaning a single company controls the entire market supply. This monopoly can have significant implications for RA, as it restricts the company's options for sourcing gas and potentially subjects it to price volatility and supply instability. The lack of competition in the gas supply market could lead to higher operational costs if the monopolist decides to increase prices. The classification of gas costs as a variable expense is appropriate, as the amount of gas used can vary significantly based on seasonal temperature changes and production scale adjustments. Thus, the cost directly correlates with production levels, making it a critical factor in the company’s overall cost management strategy and its impact on the break-even analysis.

Electricity:

Electricity costs also represent a significant operational expense for RA, crucial for the extended lighting of the greenhouses during night hours. The artificial lighting is essential not just for extending the growing hours beyond natural daylight but also for enhancing flower growth and quality. By providing additional light, the company ensures that rose production is not solely dependent on seasonal changes, which is particularly important during the shorter and darker days of winter. This extended exposure to light stimulates photosynthesis, promoting growth and improving the quality and consistency of the roses produced.

Given the nature of greenhouse operations, the use of electricity fluctuates with the seasonal variance in daylight hours. During winter, when days are shorter and

darker, the greenhouses require significantly more artificial lighting compared to the longer days of summer. The lightning is done by using strip lights, which allows variability in electricity usage and categorizes it as a variable cost for RA. The cost of electricity directly correlates with the production activities, increasing during times when more lighting is necessary to maintain optimal growth conditions. Managing this cost effectively is vital for maintaining the profitability of the business, particularly during the winter months when energy usage spikes.

Water:

Water costs, while essential for the operation of RA, represent the smallest portion of the company's operational expenses. Water is primarily used for irrigating the roses, a critical task that ensures their health and vitality. Recognizing the importance of sustainability and cost efficiency, the company implemented a recirculation technology in 2021. This system reuses water that has already been utilized in the greenhouses, reducing overall water consumption by 25-30 percent. Such innovation not only contributes to environmental conservation but also significantly reduces the water expenses during peak usage times.

The need for water varies significantly with the seasons, particularly as the summer months demand substantially more irrigation due to higher evaporation rates and increased plant transpiration. During these warmer periods, RA uses up to three times as much water as in the cooler winter months to maintain optimal growing conditions and prevent heat stress among the plants. Despite this seasonal variability, the overall expense associated with water remains relatively low compared to other costs such as gas and electricity. As a variable cost, water expenses directly correlate with the seasonal needs of the roses, increasing during summer and decreasing in winter. Efficient management of water resources, bolstered by the new recirculation technology, is crucial for minimizing this cost further, especially during peak usage periods, to ensure it continues to constitute a minor part of the company’s overall expenditure profile while still supporting effective and sustainable rose cultivation.

Packaging:

Packaging expenses are a critical component of the operational costs at RA, crucial for ensuring that the roses reach their markets in optimal condition. This category includes the costs associated with materials such as wrappers, and other protective

packaging that help preserve the integrity and aesthetic appeal of the roses during transit. These materials are essential not only for safeguarding the product but also for enhancing the brand image through attractive and functional packaging designs. The cost of packaging is directly related to the volume of roses produced and sold, making it a variable cost. As production increases to meet higher demand, packaging expenses rise correspondingly, and vice versa.

Fertilizers:

Fertilizers play a vital role in the cultivation of roses at RA, providing essential nutrients that enhance plant growth and bloom quality. The company employs a sophisticated method of integrating fertilizers directly into the irrigation system, ensuring an even distribution of nutrients throughout the water supply. This technique not only promotes optimal nutrient uptake by the plants but also contributes to uniform growth and flower quality across the entire production area. The cost of fertilizers is tied closely to the scale of production and the frequency of watering, categorizing it as a variable cost.

Chemicals:

Chemicals, including pesticides and growth regulators, are essential for maintaining the health and quality of the roses at RA. These substances are used to protect the plants from pests and diseases and to regulate their growth to ensure consistency in flower size and stem length. The application of these chemicals is carefully managed to meet the specific needs of both single-flowered and spray roses, ensuring that all plants receive the appropriate treatments to thrive in the greenhouse environment.

The cost of chemicals is directly related to the number of plants being cultivated and the specific requirements for each growing cycle, classifying it as a variable cost. As production volumes fluctuate according to market demand and seasonal changes, so too does the usage of chemicals. This dynamic is crucial for aligning chemical usage with actual production needs, optimizing both the effectiveness of the treatments and the cost-efficiency of their application.

Payroll:

Payroll represents the largest expense for RA, encompassing wages and salaries for all employees, from greenhouse workers to administrative staff and management. Unlike other variable costs that fluctuate with production volumes,

payroll is generally fixed, as the number of employees does not typically vary with the amount of production. This cost includes regular salaries that are paid regardless of the seasonal or market-driven changes in rose production volumes.

Having a consistent and committed workforce is crucial for the continuous operation of the greenhouses and the overall business. Employees are responsible for a wide range of tasks, including planting, maintenance, harvesting, packaging, and various administrative roles that support the daily operations of the company. The stability provided by a fixed payroll ensures that RA can maintain a skilled workforce ready to meet the demands of rose cultivation and sales, regardless of fluctuations in production levels.

Taxes:

Taxes for RA include fixed obligations such as land tax, which is levied on the property where the greenhouses are situated. Unlike taxes that fluctuate with profitability or sales volumes, these taxes are fixed expense, not directly influenced by the company's production levels or financial performance. This type of tax provides a predictable expense that RA must budget for annually, irrespective of its operational outcomes. The fixed nature of this taxes means that it does not adjust seasonally or with changes in the business cycle, making it a consistent part of the company's financial planning.

Seedlings:

To further refine the financial analysis of RA, it is crucial to consider the cost implications of maintaining the greenhouse's production capacity, particularly through the cyclical replacement of rose plants. The greenhouse is divided into two equal parts, each spanning 12.5 hectares, with one section dedicated to single-flowered roses and the other to spray roses. Each hectare supports up to 75,000 plants, highlighting the extensive scale of the operation.

Annually, the company undertakes the replacement of plants in 5 hectares of its cultivation area to sustain optimal growth and production quality, adhering to the optimal lifetime of a rose plant, which is approximately 5 years. This replacement process involves the purchasing and planting of new seedlings. The cost for each seedling is 2,089.36 AMD, it encompasses both the purchase price of the seedling and the associated costs of planting.

The financial burden of this replacement is calculated by multiplying the number of hectares being renewed (5 hectares) by the number of plants per hectare (75,000 plants), and then by the cost per seedling (2,089.36 AMD). This formula provides a clear picture of the annual investment required to maintain the vitality and productivity of the greenhouse operations.

This cost, while periodic, is predictable and essential for the continuous production of high-quality roses. It is treated as a variable cost in the financial documentation, as it depends on the number of seedlings replaced each year, which may vary based on plant health and lifecycle considerations. This detailed analysis helps in forecasting the necessary budget allocations and in assessing the overall financial health and sustainability of the operation.

Production volume:

In RA, production volume is meticulously tracked and recorded in a detailed table that documents both annual and monthly outputs. This table is essential for understanding the seasonal fluctuations in rose production, which are markedly influenced by climatic variations. Notably, the production in the summer months is almost twice as high as in the winter months. This increase is attributed to the optimal growing conditions during the warmer periods, which allow for accelerated growth and increased flowering rates. The table provides a clear, month-by-month breakdown that highlights these seasonal differences, offering valuable insights into the operational cycles of the company (see Appendix 1).

Price and sales:

Table 2 Average monthly and annual prices (AMD)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
single	360.8	410	492	410	360.8	278.8	246	246	328	410	410	410	352.1
spray	738	902	984	902	738	688.8	656	656	738	820	902	984	792.1

Source: (Modified from "ROSE ART" LLC presentation, 2024)

The table 2 outlines the average monthly and annual prices at which the company's roses are sold. The annual prices are found out by calculation of weighted average for whole year. This data is vital for understanding the fluctuations in pricing that occur due to seasonal demand, market conditions, and other influencing factors. It

helps to determine how pricing strategies might affect the revenue streams necessary to reach and surpass the break-even point throughout different times of the year.

Appendix 2 displays the monthly and annual sales volumes, providing a clear depiction of how production aligns with market demands and highlighting the periods of peak and off-peak sales. This table is crucial for identifying trends in consumer purchasing behaviours and understanding the production levels needed to maximize profitability and minimize losses during slower months.

Together, these tables offer a comprehensive view of the financial dynamics at RA, enabling a detailed break-even analysis that considers not just the costs and production outputs, but also the critical role of pricing and sales volume in achieving financial sustainability.

Calculation of total fixed costs:

To determine the total fixed costs, each cost component is identified and quantified from the company's financial records. For instance, salaries are calculated by summing the annual wages paid to all permanent employees, land taxes are determined based on the assessed value of the property as provided by local tax authorities. Each of these costs is then added together to arrive at the total fixed costs for the year. This total is crucial for performing the break-even analysis, as it represents the baseline amount that the company must generate from its sales to avoid a loss. By doing those calculations it was reached a result of 2,623,934,400 AMD.

Calculation of variable costs:

Calculating the variable costs for the products at RA involves a comprehensive approach, where the expenses for gas, electricity, water, fertilizers, chemicals, and replanting are first accumulated to assess the overall variable costs associated with the production process. These variable costs fluctuate depending on production levels and are therefore tallied accordingly to reflect the actual resource utilization.

Given that the greenhouse area and hence the number of plants for single-flowered and spray roses are the same, the summed total of these variable costs is divided by 2. This division ensures that the costs are evenly allocated between the two types of roses, providing a fair baseline for further analysis. However, since the output –

the number of roses produced by each type – varies, this initial cost allocation does not immediately reflect the cost per unit of production.

To determine the precise cost per unit for each type of rose, the allocated variable costs for each category are then divided by the respective production quantities of single-flowered and spray roses. This step calculates the cost per unit produced, reflecting the true cost associated with producing each specific type of rose without the packaging.

To accurately calculate the per-unit packaging costs for both single-flowered and spray roses at RA, it is crucial to recognize that the cost of one package is the same for both types of roses. The process begins by determining the total number of packages needed for each type of rose, which is calculated by dividing the total number of roses produced by the number each package holds: 15 units for single-flowered roses and 10 units for spray roses.

Once the number of packages for each rose type is determined, understanding that the cost of one package is uniform for both types simplify the next steps. The overall packaging expenses are then divided by the total number of packages calculated for both types of roses, providing a singular cost figure for each package.

To finalize the cost per unit calculation, the cost of one package is then divided by the number of units it contains – 15 for single-flowered roses and 10 for spray roses. This step yields the precise cost per unit for packaging each type of rose.

By breaking down the costs in this way, the company can accurately gauge the financial efficiency of producing each variety of rose, enabling more informed pricing and production decisions to optimize profitability and resource use (see Appendix 3).

To perform a break-even analysis for RA, we begin by recalculating the contribution margin for each type of rose, followed by determining the combined weighted average contribution margin (WACM) and finally computing the break-even point in units for both types of roses combined.

Contribution Margin Per Unit for Single-flower roses:

The contribution margin per unit for single-flower roses has been determined as 220.28 AMD. This figure is derived by subtracting the variable costs from the selling price per unit of single-flower roses.

Contribution Margin Per Unit for Spray roses:

Similarly, the contribution margin for spray roses is calculated at 546.03 AMD per unit, which also represents the difference between the selling price and the variable costs per unit of spray roses.

Sales Mix Ratio:

The proportion of single flower to spray roses is crucial for determining the overall financial impact on the company. The sales mix ratio was calculated based on the production volumes:

Single-flower roses make up approximately 66.03% of total production (ratio of 0.6603).

Spray roses account for about 33.97% of the total (ratio of 0.3397).

Weighted Average Contribution Margin (WACM):

Using the sales mix ratios and the individual contribution margins, the WACM is calculated as follows:

WACM = (220.28×0.6603) + (546.03×0.3397) =145.34+185.57=330.91

This value represents the average contribution margin per unit, taking into account the different proportions in which the two types of roses are sold.

Break-Even Point in Units:

The break-even point in units, which is the number of units that must be sold to cover all fixed costs, is calculated using the WACM:

This total indicates the combined number of single-flower and spray roses that "ROSE ART" LLC must sell to cover all its fixed and variable costs.

Translation of Units to Each Product Type:

To find out how many of each type of rose need to be sold to break even:

- Single-flower roses: 7,929,538.34 × 0.6603 ≈ 5,238,483 units.
- Spray roses: 7,929,538.34 × 0.3397 ≈ 2,691,055 units.

The break-even analysis for RA indicates that the company must sell approximately 5,238,483 units of single-flower roses and 2,691,055 units of spray roses to cover all its fixed and variable costs, amounting to a total fixed cost of 2,623,934,400 AMD. The weighted average contribution margin (WACM) calculated at 330.91 AMD, accurately reflects the average amount each unit sold contributes towards covering fixed costs, after variable costs are deducted. This precise calculation helps the company to strategically plan its production and sales to meet these targets, ensuring financial sustainability by aligning their output with the market demand and cost structures efficiently (see table 3)

Table 3 Calculation of Contribution margin Sales mix ratio and BEP

	Total fixed costs (AMD)	*Variable costs per unit (AMD)*	*Price per unit (AMD)*	*Contribution Margin per unit (AMD)*	*Units Produced*	*Sales mix ratio*	*BEP (units)*	*BEP (production type)*
	2,623,934,400						*7,929,539*	
single		*132.32*	*352.6*	*220.28*	*17,051,200*	*0.6604*		*5,236,566*
spray		*246.09*	*792.1*	*546.03*	*8,768,800*	*0.3396*		*2,692,972*

Source: (own contribution)

3.4 Assessment of identified results and offering proposals on how to ensure the better financial soundness of the selected company

The break-even analysis performed for the company provides critical insights into the company's financial operations and the viability of its product lines. By examining the identified results, we can assess the implications for the company’s strategic planning and operational management.

High Volume Requirement to Break Even:

The calculated break-even point of approximately 7,929,538 units (combined for both types of roses) underscores a substantial production scale required to cover fixed and variable costs. This high threshold indicates that RA operates with significant fixed costs, making efficient production and sales strategies crucial for financial sustainability.

Contribution Margin Insights:

The contribution margins of 220.28 AMD for single-flower roses and 546.03 AMD for spray roses reflect differing profitability profiles for each product line. Spray roses, with a significantly higher contribution margin, may offer a more lucrative opportunity, suggesting that strategic adjustments to increase their production could be beneficial if market demand supports this shift.

Risk Management:

Given the dependency on achieving a high break-even volume, the company is exposed to market volatility and demand fluctuations. Developing a robust risk management strategy, including diversification of product lines and exploring new markets, could mitigate some of these risks.

Given the limited opportunities to reduce fixed and variable costs, such as the non-negotiable high expenses associated with gas supply from a monopolistic provider, RA needs to explore alternative strategies to improve its break-even point. One viable approach is expanding into new markets and developing additional sales channels. Specifically, targeting the European Union countries and the Arabic Gulf states presents a promising opportunity. These regions offer potential due to their market size, purchasing power, and a growing demand for high-quality floral products. By establishing a presence in these markets, the company can diversify its revenue streams, decrease dependency on its current markets, and potentially achieve higher price points, which would significantly contribute to a more favourable break-even point and overall financial stability. This strategic shift requires careful market research, establishing local partnerships, and possibly adapting products to meet local consumer preferences and regulatory requirements.

There is a financial proposal to reduce RA's annual electricity expenses by investing in solar panel technology. By allocating 492,000,000 AMD to this initiative, the company is expected to save approximately 9.06% on its annual electricity costs. The financial analysis shows that the payback period for this substantial investment is 8.5 years. This investment in solar panels would lead to substantial savings on electricity expenses long-term, enhancing the company's financial health and operational efficiency. This strategic move could significantly decrease the overhead costs associated with energy consumption and improve the company's profitability margins over time.

Conclusion

By researching the costs divisions and analysing the differences between BEP analysis in homogeneous and inhomogeneous production, a proper understanding of the analysis method was reached. This method was then used to analyse the selected company. The objectivity and closer analysis of the costs allowed to achieve these results. The assessment of the results allowed the key aspects of the price formation to be seen, which in its turn made possible to offer well-developed and targeted improvements. As a summary it can be said that in order to reach a better financial soundness the company under study should make an effort to enter new markets and invest in long-term project of becoming more independent in energy resources consumption by placing solar panels.

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Appendix 1 Harvest of the products (annual)

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Total	1500 000	2050 000	2100 000	2400 000	2550 000	2800 000	2980 000	2700 000	2080 000	1650 000	1500 000	1510 000	**25820 000**
Single Rose	1000 000	1353 000	1386 000	1584 000	1683 000	1848 000	1966 800	1782 000	1372 800	1089 000	990 000	996 600	**17051 200**
Spray Rose	500 000	697 000	714 000	816 000	867 000	952 000	1013 200	918 000	707 200	561 000	510 000	513 400	**8768 800**

Appendix 2 Sales of the products (annual)

	January	February	March	April	May	June	July	August	September	October	November	December	**Total**
overall sales (single)	360800 000	554730 000	681912 000	649440 000	607226 400	515222 400	483832 800	438372 000	450278 400	446490 000	405900 000	408606 000	**6002810 000**
overall sales (spray)	369000 000	628694 000	702576 000	736032 000	639846 000	655737 600	664659 200	602208 000	521913 600	460020 000	460020 000	505185 600	**6945892 000**

Appendix 3 All variable costs (annual)

	January	February	March	April	May	June	July	August	September	October	November	December	**Total**
Gas	244050 896	219478 513	141660 745	129797 900	110572 860	65988 786	55175 105	55591 464	100480 320	142106 906	170584 017	217793 057	**1653280 569**
Electricity	97202 718	132636 105	36287 191	14485 200	13709 163	11318 907	10435 428	10474 752	33832 155	73693 783	97816 757	101709 663	**633601 823**
Water	820 000	820 000	820 000	1148 000	1968 000	2460 000	2460 000	2460 000	1230 000	820 000	820 000	820 000	**16646 000**
Packaging	44280 000	60516 000	61992 000	70848 000	75276 000	82656 000	87969 600	79704 000	61401 600	48708 000	44280 000	44575 200	**762206 400**
Fertilizers	17351 200	18961 680	24252 320	54771 080	54826 840	54795 680	61575 440	28135 840	19002 680	34440 000	22468 000	10824 000	**401404 760**
Chemicals	13572 640	7626 000	17428 280	15411 080	17300 360	14760 000	12250 800	13402 080	21093 680	6466 520	10660 000	13572 640	**163544 080**
Seedlings													**783510 000**
Total													**4414193 632**

ANNOTATION

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SUMMARY	The main aim of the bachelor thesis is to find and analyse the break-even point of a selected company and to find the volume of production in case of inhomogeneous production.
KEY WORDS	Break-even Analysis, Cost Management, Fixed Costs, Variable Costs, Cost Accounting