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«Enhancing Sustainable Performance in the Juice Industry: A Balanced Scorecard approach»

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Contents

1. Introduction	6
1.1. Introduction to Sustainability	6
1.1.1. Defining Sustainability in Business.....	6
1.1.2. Sustainability's Emergence in Industry	7
1.1.3. The Business Case for Sustainability	7
1.1.4. SDGs (Sustainable Development Goals).....	8
1.1.5. Reporting Standards and Frameworks.....	10
1.2. Purpose of the Thesis	11
1.2.1. Exploring the Role of Sustainability Metrics	11
1.2.2. Why Investigate Sustainability in Industry?	12
1.3. Theoretical Foundations of Sustainability Balanced Scorecards	12
1.3.1. Four Perspectives of the Balanced Scorecard	13
1.3.2. Extending the Balanced Scorecard for Sustainability.....	16
1.3.3. Conceptual Framework of SBSC.....	18
1.3.4. Theoretical Underpinnings.....	19
1.4. Problems Addressed by Sustainability Balanced Scorecards.....	20
1.4.1. The Challenge of Comprehensive Sustainability Assessment.....	20
1.4.2. Bridging the Gap Between Strategy and Sustainability	21
1.4.3. Stakeholder Expectations and Reporting.....	21
1.5. Incorporating Hybrid Renewable Energy into Sustainability	22
1.5.1. The Role of Renewable Energy in Sustainable Practices.....	22
1.5.2. Advantages of Renewable Energy.....	23
1.5.3. Combining Multiple Renewable Sources	25
1.5.4. Enhancing Energy Reliability and Cost-efficiency.....	26
1.6. Rationale for Using the Balanced Scorecard.....	27
1.6.1. Why Adapt the Balanced Scorecard?.....	27
1.6.2. Advantages of the Balanced Scorecard.....	27
1.7. Structure of the Thesis	28

1.7.1.	Navigating the Research Journey	28
1.7.2.	In-Depth Exploration in the State-of-the-Art Section	28
2.	State of the Art.....	29
2.1.	Theoretical Foundations of Sustainability Balanced Scorecards (SBSC)	29
2.1.1.	Review of Existing Literature on the Balanced Scorecard Framework.....	29
2.1.2.	Exploration of SBSC in Research and Practice.....	30
2.2.	Rationale for Using the Balanced Scorecard in Sustainable Industrial Practices.....	31
2.2.1.	Existing Research on the Effectiveness of the Balanced Scorecard	31
2.2.2.	Advantages and Benefits of SBSC Adoption.....	32
2.3.	Gaps and Challenges in Current Research	32
2.3.1.	Identification of Research Gaps in SBSC and HRES Integration	32
2.3.2.	Addressing Challenges and Limitations from Existing Studies.....	33
2.3.3.	Opportunities for Further Research and Innovation.....	33
2.4.	Conclusion of the State of the Art	33
2.4.1.	Summarization of Key Findings and Insights from Existing Literature	33
2.4.2.	The Relevance of Previous Research to the Thesis Objectives	34
2.4.3.	Setting the Stage for the Research Methodology and Empirical Analysis	34
2.5.	Significance of the Study	34
3.	Methodology.....	36
3.1.	Case Study Description	36
3.2.	Balanced Scorecards.....	38
3.3.	KPIs	39
3.4.	Scenarios Conceptualization.....	49
3.4.1.	Control Variables.....	49
3.5.	SWOT	52
4.	Results.....	53
4.1.	Baseline case scenario results	53
4.2.	Scenario 1 – 10 KPI results.....	55
4.2.1.	Financial pillar KPI results	57
4.2.2.	Customer pillar KPI results	61
4.2.3.	Internal process pillar KPI results.....	66
4.2.4.	Learning & Growth KPI results	71
4.2.5.	Environmental sector KPI results	74

4.2.6.	Social sector KPI results	79
4.3.	SBSC and SWOT analysis presentation for each case scenario	84
4.3.1.	First case scenario BSC and SWOT analysis.....	84
4.3.2.	Second case scenario SBSC and SWOT analysis	88
4.3.3.	Third case scenario SBSC and SWOT analysis	91
4.3.4.	Fourth case scenario	94
4.3.5.	Fifth case scenario SBSC and SWOT analysis	97
4.3.6.	Sixth case scenario SBSC and SWOT analysis.....	100
4.3.7.	Seventh case scenario SBSC and SWOT analysis.....	103
4.3.8.	Eighth case scenario SBSC and SWOT analysis.....	106
4.3.9.	Ninth case scenario SBSC and SWOT analysis.....	109
4.3.10.	Tenth case scenario SBSC and SWOT analysis.....	112
4.4.	Detailed analysis of the scenario outcomes	115
5.	Conclusion.....	124

Abstract

In today's business environment, sustainability has gained significant attention by helping companies to implicate social, economic, and environmental sectors to the strategy and management of the company. Although the sustainability concept has been known for its perks for a while now, many organizations still do not know how to implement or measure its outputs. This thesis explores the Sustainability Balanced Scorecard (SBSC) as a strategic tool designed to integrate sustainability metrics into corporate management systems. The initial chapters lay the groundwork by defining sustainability in the context of business, illustrating its evolution from a niche interest to a global imperative due to increasing environmental challenges and stakeholder pressures. It further details the growing emphasis on sustainability in industrial sectors propelled by regulatory shifts, changing market demands, and heightened public consciousness.

The thesis delineates the theoretical foundations of the SBSC, extending the classic BSC model—traditionally focusing on financial outcomes—to embrace sustainability. This expansion involves four perspectives: financial, customer, internal processes, and learning and growth, with a significant addition of sustainability metrics. Empirical data and case studies within the thesis illustrate the practical application of the SBSC in various industries, highlighting both the achievements and challenges faced by organizations in integrating these principles into their operational and strategic frameworks. Quantitative information was gathered alongside qualitative perspectives to formulate the SBSC. The methodology included the adaptation of Key performance indicators (KPIs) to the research followed by a thorough SWOT analysis to assess the efficacy of the Strategic Balanced Scorecard (SBSC) across different situations. It includes a detailed review of literature and existing models, proposing enhancements tailored to specific industry needs, particularly focusing on hybrid renewable energy systems (HRES) and their integration into the SBSC framework.

The concluding section repeats the relevance of the SBSC in modern business practices by connecting traditional business strategy with the emergent of sustainability context. As this thesis demonstrates through analysis and systematic argumentation, the SBSC represents a critical instrument to secure continuity and long-term competitiveness of a company within the dynamics of an ecologically conscious market environment.

1. Introduction

1.1. Introduction to Sustainability

1.1.1. Defining Sustainability in Business

In today's business environment, sustainability has emerged as a prevailing phenomenon which can allow companies to integrate social, economic and environmental pillars into the strategy and management of the company. One of sustainability's biggest benefits was managing to encompass the concept of meeting the immediate requirements of the present generation while simultaneously guaranteeing that forthcoming generations will be able to fulfill their own necessities[1]. Nowadays, the concept of sustainability has evolved into an imperative of global significance, as communities worldwide confront the obstacles presented by climate change, the diminishing availability of resources, and the persistent issue of social diversity. Enterprises, in particular, possess a central position in the attempt to attain sustainability through the implementation of methods that effectively harmonize economic expansion, societal welfare, and the protection of the environment[2], [3]

Sustainability means going beyond short – term financial gain to consider the wider social and environmental consequences of company decisions while balancing social justice, economic prosperity and environmental protection. Sustainability is an urgent strategic need for businesses. Businesses must embed sustainability in all their processes and plans

As organizations adapt their sustainable methodologies, they possess the capability to produce value not solely for their stockholders, but also for their workforce, patrons, localities, and the ecosystem within which they function[2]. The quest for sustainability incorporates the examination of considerate choices that acknowledge the connection between economic, societal, and ecological factors. This necessitates businesses to embrace inventive methodologies, technologies, and business frameworks that foster resource efficiency, social inclusivity, and environmental responsibility.

Sustainability is a complex perception which to be successful must combine the collective efforts of multiple organizations and groups. Such operations include governmental bodies, commercial enterprises, ordinary individuals, and societal organizations. The burden of this responsibility cannot be borne by one lone individual or a solitary group operating in seclusion. A shift in viewpoint and a commitment to evaluating and strategizing for what lies ahead are both necessary.

As a concept, sustainability is in a constant state of development as novel challenges and prospects emerge within a constant transformation of global landscape. Businesses must always adjust and introduce in order to uphold a competitive advantage and endure as a viable entity within the continuously developing global market [3], [4]. Ultimately, the objective of sustainability is to establish an improved future for everyone, wherein economic affluence, social welfare, and environmental integrity are intricately interconnected and mutually reinforcing.

1.1.2. Sustainability's Emergence in Industry

The heightened emphasis on sustainability within the industrial sector can be ascribed to several factors. Some of these factors include alterations in the expectations of stakeholders, changes in regulations, and legal frameworks that force companies to adopt new tactics, as well as the recognition of potential business threats and prospects [5]. The expectations of stakeholders have transformed over the years, as individuals who consume products or services, investors and personnel have started to attach more significance to the concepts of protecting the environment and fulfilling social obligations.

These changes in the industrial field have led businesses to prioritize sustainability to meet these expectations and maintain their reputation. The emphasis on sustainability has been significantly influenced by regulatory and legal factors. Governments worldwide have imposed stiffer and more demanding environmental regulations and policies, compelling enterprises to incorporate sustainable approaches to adhere to these mandates[6]. The identification of business risks and opportunities has motivated companies to prioritize sustainability. Business entities have been compelled to engage in proactive measures to lower the threats posed by unsustainable practices owing to the acknowledgement that these practices have the potential to detrimentally impact their standing, legal obligations, and financial impediments.

In contrast, enterprises have acknowledged the fact that sustainability can offer prospects for groundbreaking ideas, financial gains, and a competitive edge. By embracing sustainable methodologies, corporations can delve into untapped markets, allure ecologically aware consumers, and set themselves apart from rivals [7].

The merging of evolving stakeholder expectations, governmental pressures, and acknowledgment of commercial risks and opportunities has resulted in an increased emphasis on sustainability within the industrial sector. This inclination continues as enterprises aspire to obtain enduring prosperity and make meaningful contributions to a more sustainable forthcoming period.

1.1.3. The Business Case for Sustainability

Companies that prioritize sustainability are better prepared to adjust to market conditions and regulatory demand. Consequently, these companies improve their ability to withstand uncertainties and disruptions. Moreover, the concept of sustainability holds significant importance in guaranteeing that companies will continue to operate successfully (enduring feasibility of enterprises) by safeguarding and making accessible resources, while also minimizing the detrimental effects on the environment[8].

Through the integration of sustainability into their operational plans, enterprises could enhance their ingenuity and promote the creation of innovative merchandise and services that correspond to the ever-changing demands and desires of consumers. Additionally, sustainable practices have the potential to attract highly skilled individuals and responsible investors, given that they are both progressively searching for organizations that are in harmony with their principles and provide meaningful employment that contributes to the development of a sustainable future[5][6]. By prioritizing sustainability, a company can gain trust and support for its businesses. When engaging in such strategies in their plans, they are more likely to build strong relationships with customers,

employees and investors by promoting transparency, collaboration, and responsible sourcing, with minimal disruptions.

The principle of sustainability encourages ongoing enhancement, innovation, and adoption of optimal methodologies that augment efficiency and efficacy and can create positive outcomes for businesses and society in general, thereby contributing to the overall welfare of communities and the environment[9].

1.1.4. SDGs (Sustainable Development Goals)

Sustainable Development Goals (SDGs) are a comprehensive set of global development targets that aim to address various economic, social, and environmental challenges. Society is the direct beneficiary of the SDGs but bears the lowest expenditures for their implementation and, thus, supports them. The government protects society's interests, and the implementation of SDGs is among its main responsibilities. The notion of SDGs holds significant prominence in the realm of business practices as it entails the synchronization of strategies with the United Nations' agenda about sustainable development[3].

During the United Nations General Assembly in September 2015, the global community embraced a comprehensive sustainable development program, called the 2030 Agenda for Sustainable Development. It comprises 17 SDGs and 169 detailed sub-targets for a fairer and more peaceful future. By comprehending the 17 objectives articulated by the United Nations General Assembly, businesses can incorporate SDGs into their operational strategies[10]. The discussed strategy offers an ambitious and forward-looking framework for creating an improved and enduring future for humanity and the planet, with the target year set at 2030. The embodiment of corporate strategies necessitates the establishment of quantifiable objectives for each goal and striving toward their accomplishments[11].

Furthermore, corporations possess the capability to render significant input to global undertakings directed towards overcoming obstacles such as poverty, inequality, sustainable development and climate change. To successfully execute SDG strategies [12], it is important to make combined efforts and ensure cooperation among governments, corporations, educational institutions, non-governmental organizations, and grassroots communities. In this particular process, it is of utmost importance to place a significant focus on guaranteeing that no individual is overlooked or left behind.



Figure 1. Sustainable Development Goals

Businesses can contribute significantly to achieving the SDGs and impact on the overall sustainable development agenda. Understanding SDGs and their relevance to their operations and stakeholders is crucial. By aligning their strategies with the SDGs, there are some important potential benefits that businesses will have. Some of them are improving their reputation, increasing customers loyalty, and earning access to new markets[11], [13].

Barriers that businesses may face in integrating SDGs into their practices could be a lack of awareness, limited resources, and conflicting priorities. Businesses can choose from various approaches to integrate SDGs into their strategies to overcome these difficulties[14]. A suggested framework for companies is Balanced Scorecard, and that highlights the benefits of cooperation between companies, governments, and civil society in obtaining the Sustainable Development Goals. This approach covers the need to measure and report their progress towards SDGs, while transparency and accountability are the main factors of the process.

In this thorough examination of the notion of SDGs and their incorporation into commercial operations, the objective is to generate awareness and comprehension among readers regarding their importance for enterprises and the potential possibilities and obstacles linked to their integration.

1.1.5. Reporting Standards and Frameworks

Sustainability reporting standards encompass guidelines or frameworks that afford organizations a methodical strategy to disclose their economic, social, and environmental achievements. These established criteria assist organizations in providing pertinent details regarding their practices, effects, and objectives about sustainability to the public. Prominent examples of a universally adopted set of standards for reporting sustainability are the General Reporting Initiative and Carbon Disclosure Project which have an important role in the progress of sustainability reporting standards. Their capability to encompass various aspects such as economic performance, social impacts and stakeholder engagement while keeping the acquired transparency has progressively made them an obligation in certain jurisdictions starting from 2024.

GLOBAL REPORTING INITIATIVE

The Global Reporting Initiative (GRI) is an establishment that offers directions and criteria on sustainability across multiple sectors and industries. The act of sustainability reporting reveals the organization's societal, environmental, and monetary impact on stakeholders. GRI's guidelines companies in assessing and disclosing their sustainability achievements using a systematic approach. Their reporting framework encompasses an extensive array of subjects, including governance, human rights and community involvement[15].

The significance of GRI lies in its ability to offer objective standards and indicators that can be embraced by organizations to achieve precise evaluation and reporting of sustainability performance. By following the guidelines established by GRI, organizations can showcase their dedication to promoting sustainability and implementing responsible business strategies[15], [16]. This, in turn, could heighten their standing and engender trust among stakeholders. It should be noted that GRI's guidelines are revised and refined to address evolving sustainability concerns and meet stakeholders' expectations.

GRI's function additionally endeavors to foster the acceptance and execution of sustainability reporting practices on a global scale. Partnerships with various stakeholders are made, encompassing both governmental and non-governmental organizations, and industry associations, to propel the advancement of sustainability reporting and cultivate a common language for the assessment and communication of sustainability achievements. The target is to encourage companies to not just conform but to strive for ongoing improvement in their sustainability performance. Companies are assisted in recognizing and overcoming significant sustainability issues that are relevant to their business operations [17].

The adoption of GRI in the implementation of Balanced Scorecards helps measure and report the degree to which sustainable practices are being upheld. Through the integration of GRI indicators into the framework of the Balanced Scorecard, organizations are empowered to monitor and assess their ecological, societal, and governing accomplishments, while simultaneously aligning them with their overarching business objectives.

CARBON DISCLOSURE PROJECT

The Carbon Disclosure Project (CDP) represents an innovative and influential initiative that motivates companies to reveal crucial data about their carbon emissions and climate change-

associated information. Using this admirable undertaking, the CDP effectively gathers considerable and comprehensive information from companies regarding their environmental performance, thereby fulfilling a convenient and accessible platform through which investors, customers, and policymakers can readily and effortlessly access this invaluable data and information[18].

Integrating CDP into Sustainability Balanced Scorecards provides valuable data on the aspects that SBSC analyzes and helps companies track and measure their progress in reducing carbon emissions and meeting sustainability targets. The utilization of the CDP data is capable of aiding companies in the identification of both risks and opportunities that are closely associated with climate change and as a result, create business initiatives that are much more effective.[18], [19]

Similarly, GRI serves the purpose of providing stakeholders with vital information concerning a company's environmental performance; CDP also showcases concerted efforts to mitigate the adverse effects of climate change and their unwavering commitment towards the achievement of environmental sustainability. Consequently, they attract investors, customers, and partners who prioritize the idea of sustainability.

When organizations opt to integrate CDP data into the Balanced Scorecard, they essentially harmonize their sustainability efforts with internationally acknowledged frameworks and initiatives, such as the Paris Agreement and the United Nations Sustainable Development Goals[20]. A substantial contribution will be made to the overall effectiveness and credibility of sustainability reporting, primarily because it enables the provision of standardized and comparable data regarding carbon emissions and other information related to climate change.

1.2. Purpose of the Thesis

1.2.1. Exploring the Role of Sustainability Metrics

Sustainability metrics in Balanced Scorecards serve as a bridge connecting corporate strategy with sustainable development goals, ensuring long-term viability. These measures effectively enable a comprehensive perspective, combining economic performance alongside the supervision of the environment and the obligations towards society. By adjusting sustainable practices, organizations cannot only manage their impact on the environment, society, and economy but also pinpoint areas that require enhancement, establish challenging yet feasible sustainability objectives, and oversee their advancement[21]. They facilitate stakeholder involvement through the provision of clear and measurable information regarding the organization's endeavors toward sustainability, helping companies adhere to evolving environmental regulations.

Organizations can hedge environmental and social risks through sustainability metrics. Sustainable metrics push innovation – encouraging companies to adopt sustainable metrics. Sustainable metrics push innovation encouraging companies to adopt sustainable technologies and practices. The use of sustainability metrics provides substantial support in the process of establishing priorities and effectively allocating resources because an increasing number of investors are concentrating on environmental, social, and governance standards. They facilitate the adoption of both internal and external reporting, thereby fostering a heightened degree of transparency and accountability[22], [23].

The utilization of sustainability metrics facilitates the evaluation of performance in relation to other enterprises within the identical sector, thus fostering an ongoing commitment to enhancement. Additionally, these metrics aid in identifying and exploiting emerging market opportunities related to sustainability. A culture of sustainability is fostered within the organization, exerting an influence on employee behavior and decision-making. Consequently, they possess the capability to augment customer loyalty and brand value, as consumers are progressively inclined towards favoring sustainable enterprises. They can enhance customer loyalty and brand value, as consumers increasingly favor sustainable businesses.

The inclusion of sustainability metrics in Balanced Scorecards plays a crucial and noteworthy part as they indicate a transition towards a business model that prioritizes sustainability and fairness, thereby making a valuable contribution to worldwide endeavors aimed at addressing climate change and promoting social equality[23].

1.2.2. Why Investigate Sustainability in Industry?

Sustainability plays a crucial role in the domain of industry, as industries have historically played a significant part in causing environmental deterioration and societal challenges. Throughout history, industrial activities primarily focused economic expansion, frequently neglecting the environmental consequences such as contamination and the depletion of resources[5]. This particular methodology often disregards the social dimensions, including the well-being of employees and the effects on the community. Nevertheless, the increasing recognition of climate change, limited resources, and social disparity has brought about a significant change[7].

Industries are presently experiencing recognition on the adoption of sustainable practice not only as an ethical obligatory but also as a requirement for ensuring long-term viability. The shift towards sustainability is an understanding that being a conscientious environmental steward and actively participating in society are essential components for achieving success in business. Hence, it is essential to redefine the industrial approach to incorporate sustainability and ensure a balanced and resilient future[24].

1.3. Theoretical Foundations of Sustainability Balanced Scorecards

The realms of performance measurement and management systems have captured the attention of both managerial and accounting scholars. A performance measurement system encompasses activities designed to assess the efficacy of planning, control, measurement, reward and learning mechanisms within an organization. Traditional performance evaluation systems have a common weakness in that they overemphasize financial parameters, and other perspectives have been neglected[25]. In the new market context, where information strongly influences companies' success, no single performance indicator can fully capture the complexity of an organization's performance. With multiple and often conflicting demands from various stakeholders, a company's performance objectives are multidimensional[25], [26].

Responding to this call for broad based performance measurement system models such as integrated performance measurement system/balanced scorecard were developed. This study employs a **Balanced Scorecard (BSC)** approach (Kaplan and Norton 1992, 1996, 2001). Kaplan and Norton started developing the Balanced Scorecard in the early 1990s to address shortcomings

of standard business financial performance measured[25]. Kaplan and Norton's work on the balanced scorecard has influenced some of the world's leading organizations and provided strategic insights into organizational alignment and performance measurement[25].

Kaplan and Norton (1992, 1996, 2001) propose the use of four performance dimensions: Learning and Growth Perspective, Internal Business Perspective, Customer Perspective and Financial Perspective. The ultimate goal of implementing BSC is the achievement of superior, long-term financial results. The Balanced Scorecard framework rapidly gained traction due to its ability to offer a more equitable and balanced perspective for the performance of organizations, aligning with the wider trend towards total quality management and strategies centered around the customer that were prevalent during that period[27].

Over the years, additional development has been made, demonstrating flexibility in responding to the requirements of a broad spectrum of entities. It has evolved into a comprehensive framework that not only assesses effectiveness but also aids in clarifying the objectives and tactics of organizations, aligning business operations with said tactics, prioritizing projects and endeavors, and utilizing data-based observations to improve the process of making strategic decisions[26], [27].

As organizations conducted operations within progressively intricate and rapidly changing contexts, the Balanced Scorecard (BSC) developed from a rudimentary tool for evaluating performance into a comprehensive system for strategic management[27], [28]. This transformation was characterized by the integration of strategic maps in the latter part of the 1990s, which facilitated the articulation of organizational objectives and the visualization of the interdependencies among various strategic components. The BSC's adaptability and ability to link strategic objectives with operational performance continue to make it a relevant and valuable tool in modern business management.

1.3.1. Four Perspectives of the Balanced Scorecard

The original balanced scorecard as articulated by Kaplan and Norton, includes four perspectives that can guide companies as they translate into actionable items. These aspects are the Financial Perspective, Customer Perspective, Internal Process and Learning and Growth [29] which will be analyzed in this section.



Figure 2. Fundamental pillars of BSC

1.3.1.1. Financial Perspective

This aspect concentrates on conventional financial performance indicators, which are of utmost importance for the success of any business enterprise. Indicators such as revenue growth, profit margins, return on investment, and overall financial well-being are encompassed from this perspective[25], [30]. The financial perspective holds great significance for shareholders and serves as a guiding force in formulating long-term strategies. However, it is important to note that this perspective is prospective in nature as it primarily highlights the outcomes of future actions. The Balanced Scorecard theory asserts that achieving financial success is a consequence of effective performance in other domains, thus advocating for a harmonious equilibrium between short-term financial gains and the creation of long-term value proposes that the business life cycle consists of various financial stages, wherein three stages establish a connection between financial objectives and business unit strategy[25]. During the growth stage, enterprises prioritize the utilization of resources for the development of products or services, aiming to capitalize on potential growth. During this stage, financial objectives revolve around achieving sales growth, expanding into new markets and customer groups, and investing in the development of products, processes, employee capabilities, and distribution channels[25], [30].

In the sustain stage, companies direct their efforts towards attaining exceptional returns on their invested capital, while simultaneously maintaining and expanding their market share. The objectives related to profitability play a crucial role during this stage. Lastly, during the harvest

stage, companies endeavor to maximize cash inflows by minimizing their investments and focusing on short payback periods.

Increasing revenue, improving cost and productivity, enhancing asset utilization, and reducing risk are important financial themes for organizations, with ROI, ROCE, and EVA being commonly used metrics. Growth and productivity are key strategies for driving financial performance[31].

1.3.1.2. Customer/ Stakeholder Perspective

The customer viewpoint focuses on the organization's interaction with its customers and its position in the market. Important measures of performance in this area include customer contentment, customer retention rates, market share, and brand strength. This perspective highlights the significance of comprehending and satisfying customer needs and expectations, as customers play a pivotal role in the triumph of an organization. Further focus is placed on customer loyalty and involvement, acknowledging that these aspects play a crucial role in driving long-term financial performance[26]. This viewpoint prioritizes the use of customer feedback tools, such as satisfaction evaluations and analysis of social media trends, to gain a deeper understanding of customer needs and desires[31].

Companies pinpoint critical interactions and enhance overall customer experience, thereby strengthening client relationships. By categorizing customers based on different factors such as purchasing patterns and preferences, companies can customize their services to cater to the distinct requirements of various customer segments, creating a more personalized and engaging experience[28], [31]. Customer-centric strategies with other aspects of the balanced scorecard highlight how customer satisfaction aligns with financial health, internal operations, and the growth and learning of an organization.

Kaplan and Norton (2001) depicted three distinctive factors that contribute to a company's value proposition: product leadership, customer intimacy, and operational excellence. Furthermore, the process of recognizing the customer value proposition aids in the targeting of the clientele.

1.3.1.3. Internal Business Processes Perspective

This perspective examines the internal assessment of a business's operational efficacy and efficiency. It encompasses the metrics associated with product and service quality, process efficiency, delivery timelines, and innovation. By directing attention toward internal procedures, this perspective strives to recognize and enhance pivotal components that directly influence customer contentment and monetary achievement[28]. It spurs organizations to streamline operations, diminish excess, and incessantly refine processes for heightened efficiency and effectiveness.

Critical performance indicators such as error rates, production capacity, and stock quantities are closely tracked to assess the effectiveness of processes and pinpoint potential areas for enhancement. Additionally, this viewpoint involves leveraging technological innovations such as automation and artificial intelligence to streamline operations and minimize manual mistakes. Operational strategies also incorporate eco-friendly practices, aiming to reduce waste and energy use and align with broader environmental and societal objectives[25].

Continuous internal evaluations and assessments are conducted to maintain adherence to industry norms and encourage ongoing progress. This strategy also focuses on refining supply chain management, ensuring effective supplier relations, and providing logistics support for uninterrupted operations. Innovation extends beyond products and services, encompassing new methods to advance internal procedures, boost employee participation, and enhance interactions with customers[26].

1.3.1.4. Learning and Growth Perspective

The perspective commonly known as the "perspective of innovation and improvement" focuses on the intangible assets possessed by the organization, primarily encompassing the skills of its employees, the culture that pervades within it, and the systems of information it employs. Notable indicators include training and development of employees, management of knowledge, and fostering technological innovation[32].

Additionally, it evaluates an organization's responsiveness to evolving market dynamics and its capability to implement agile strategies effectively. Emphasis is placed on the significance of collaborative efforts across various departments, crucial for nurturing an innovative and continuously improving work environment[28]. This approach includes leveraging data analytics and extensive datasets for informed decision making and aligning strategies with the organization's overarching objectives. The effectiveness of an organization's internal communication systems in facilitating knowledge exchange and fostering a learning environment has also been examined[32].

This perspective acknowledges the premise that an organization's capacity to innovate, refine, and acquire knowledge constitutes the foundation of its long-term prosperity. This accentuates the crucial significance of investing in human capital, systems, and the culture that permeates the organization, all of which combine to provide a sustainable competitive advantage. Consideration is given to how environmental sustainability is integrated into business operations, reflecting the organization's dedication to social responsibility[25], [28]. The perspective assesses how the organization navigates risks associated with innovation, striking a balance between creative initiatives and practical risk control, while measuring the impact of organizational transformations to ensure they are in line with the long-term vision and strategic goals of the company.

1.3.2. Extending the Balanced Scorecard for Sustainability

Evidence suggests that firms now regard sustainability not only as a foundation for launching their business but also as a strategy for ongoing financing by attracting customers, investors, and suppliers of resources. Nonetheless, without initially concentrating on their workforce, emphasizing the workers' knowledge, awareness, and principles, altering the corporate ethos towards prioritizing profit maximization over embracing sustainability as a standard practice beneficial to everyone remains unlikely. Consequently, an increasing number of companies are organizing human resources sessions dedicated exclusively to understanding sustainability and its implications[33].

Numerous enterprises, ranging from technology companies to footwear manufacturers, are now committed to integrating environmental sustainability into their business framework from the outset. They aim to implement sustainable practices that benefit the environment, their

employees, partners, and customers, who in turn support their brand through personal endorsements. Many of these businesses and start-ups have their roots in academic institutions, with younger entrepreneurs launching ventures that represent more than mere sustainability. These businesses are perceived as fully green, positioning themselves as guardians of both the environment and society at large [33].

Sustainability has also become a socially acceptable and relevant sign to customers and markets that the company that has accepted and enforced such a concept is more culturally relevant, and that they recruit and retain more consumers than companies who do [34]. There is also the concept of reducing the carbon footprint, and many companies that have incorporating sustainability into their business scorecards have seen cost savings in the efficient and optimal uses of resources such as electricity, water, and other raw materials. And these companies have also embraced the reduction of waste and the recycling of used materials to listen to stakeholders, customers, and investors [35].

The potential to generate or maintain value significantly differs across various sectors: some organizations might lower expenses by enhancing the management of energy and water usage, whereas a retail firm could lessen its resource consumption and costs by overhauling its supply chain. This is because the largest environmental footprint in this industry is frequently linked to raw materials, like the agricultural products utilized in food or clothing. Conversely, an energy firm might find more chances to create value compared to other industries through innovative products—such as by bringing to market investments in smart grids [33]. A sustainable, or green, business is identified by its minimal adverse effects on the global or local environment, community, society, or economy. Such enterprises typically exhibit forward-thinking policies in environmental conservation and human rights. A business is green if it meets four criteria: etiquette and sustainability are fundamental principles that guide every business decision; it provides eco-friendly products or services that reduce demand for non-sustainable alternatives; it is more environmentally friendly than its conventional rivals; and it is an example of an organization that has been committed to environmental principles throughout its operation. [36].

The necessity for incorporating sustainability into corporate governance has been recognized as a strategic response to escalating market forces that increasingly threaten business stability. These challenges, driven by the exacting demands of stakeholders and significant sustainability issues, underscore the rationale for embedding corporate sustainability practices. The anticipated advantages of employing a sustainability-focused balanced scorecard, along with weaving the three pillars of sustainability into the prevailing Balanced Scorecard business strategy, are diverse. Expected outcomes include reinforcing a corporation's reputation, improving its brand image, obtaining, or maintaining a "social license" to operate, and enhancing or establishing relations with investors, regulatory entities, banks, alongside a forecasted reduction or adept management of business risks [33].

1.3.3. Conceptual Framework of SBSC

Because businesses increasingly recognize the need for sustainability to shape a resilient and responsible future, sustainability is now an important strategy for the Balanced Scorecard. In this chapter an innovative Balanced Scorecard adapted to sustainability metrics is presented creating a **Sustainability Balanced Scorecard (SBSC)**. With environmental, social, and economic considerations woven throughout organizational strategy, the SBSC offers a holistic set of parameters for companies seeking to achieve sustainable success alongside business objectives. Here, we describe the process and benefits of crafting a SBSC for a deeper dive into its transformative potential[23].

Integration may be approached in several ways, reflecting the flexibility and adaptability of the SBSC to organizational contexts. For one thing, sustainability issues can be incorporated directly into the four dimensions of the Balanced Scorecard dimensions. This implies including environmental/social indicators within the financial, customer, internal process, and learning and growth perspectives. Such an approach ensures that sustainability is not a standalone issue but interconnected with organizational strategy and performance measurement [37], [38].

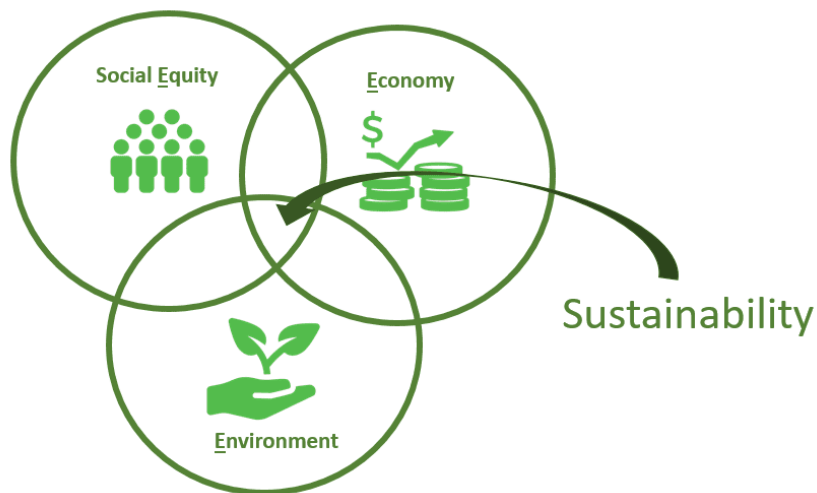


Figure 3. Sustainability integration

Another method involves the addition of sustainability as a distinct fifth aspect to the traditional four-dimensional Balanced Scorecard framework [39]. This scenario expands the Balanced Scorecard by creating a separate sustainability perspective that focuses exclusively on environmental and social goals. This distinct aspect could encompass a wide range of sustainability metrics, from greenhouse gas emissions to community engagement initiatives, thereby providing a clear view of the organization's sustainability performance. This approach allows organizations to spotlight their commitment to sustainability and facilitates a detailed tracking of progress towards these goals[37], [38].

A third pathway to integration is through the development of a parallel, sustainability-specific scorecard that operates alongside the traditional Balanced Scorecard. This separate but complementary scorecard focuses entirely on sustainability objectives and can be particularly

useful for organizations looking to make a significant, strategic leap in their sustainability endeavors. It enables a focused analysis of sustainability initiatives and outcomes, while still maintaining a connection to the broader organizational strategy through the traditional Balanced Scorecard framework[37], [38].

No matter the method selected for incorporation, achieving success hinges on the clear definition, measurability, and tight alignment of sustainability goals with the organization's overarching strategy. The SBSC evolves into a vibrant instrument for evaluating performance and catalyzing strategic moves towards sustainability. Through selecting one of these methodologies, organizations can customize the integration procedure to align with their strategic aspirations and practical conditions, guaranteeing that sustainability is embedded deeply within their strategic management framework.

1.3.4. Theoretical Underpinnings

1.3.4.1. Systems Thinking in Sustainability

In sustainability, systems thinking highlights how different components within a business and its environment are interlinked. This viewpoint acknowledges the extensive effects of corporate decisions on environmental, social, and economic realms promoting comprehensive strategies for addressing issues, rather than isolating them. Systems thinking entails recognizing the reciprocal effects between a company's actions and external factors like environmental shifts and societal demands[40].

This methodology urges the adoption of sustainable, future-oriented practices in business. It involves embedding sustainability in every facet of an organization, from overarching strategy to daily tasks[37]. Transitioning from traditional linear business approaches to sustainable circular economies is advocated and cross-sectoral and interdisciplinary collaboration is used to solve complex sustainability issues. Employing this method leads to innovative, environmentally and economically balanced solutions.

Emphasis is given in the necessity of ongoing adaptation and learning due to evolving environmental situations, moving from a reactive approach to proactive sustainability measures. Leadership's role in cultivating an organizational culture of sustainability is highlighted in this approach[33]. Systems thinking in sustainability demands effective measurement and reporting mechanisms for sustainability efforts, underlines the importance of creating scalable, replicable sustainability solutions and overall aids in building organizations resilient to global changes[40].

1.3.4.2. Stakeholder Theory and Engagement

In sustainability's stakeholder theory all those who are affected by a company's operations have to be considered. This theory extends corporate responsibility to include employees, customers, suppliers, communities and the environment besides shareholders. It demonstrates that ethical, transparent business practices that consider all stakeholders' interests are needed.

Stakeholder engagement involves these groups taking part in corporate decision making. It should add value for stakeholders not just maximize shareholder profits. Engagement with stakeholders involves dialogue, respect and integration of viewpoints[41].

Such engagement enables more sustainable and informed decision making. The theory stresses the corporate social responsibility role in business strategies. Interacting with stakeholders helps identify sustainability risks and opportunities and builds trust-based relationships.

Harmonizing business goals with social and environmental needs is a central tenet of this theory. Innovations in products, services, and business models often result from stakeholder engagement, help the company raise the company's public image and credibility[37].

1.4. Problems Addressed by Sustainability Balanced Scorecards

1.4.1. The Challenge of Comprehensive Sustainability Assessment

In sustainability balanced scorecards, the comprehensive assessment of sustainability presents a multi-dimensional challenge, intertwining environmental, social, and economic aspects with the core strategic objectives of an organization. The complexity lies in effectively defining and quantifying these interrelated components, ensuring that sustainability goals are not just complementary but are seamlessly integrated into the broader business strategy[33]. This integration is fraught with complexities, particularly in the measurement of intangible assets such as social impact and environmental stewardship. These elements often defy traditional quantification methods, posing a significant challenge in creating accurate and meaningful metrics.

Data collection and analysis further compound these challenges. Organizations are tasked with managing the intricate balance between qualitative understanding and quantitative information, guaranteeing precision and pertinence. It's crucial to keep this balance, as any change or bias in the data could result in a misinterpretation of the organization's performance in sustainability. Integrating this data into the company's strategic framework is similarly challenging. Harmonizing sustainability objectives with business aims for a significant shift in strategic planning, steering away from traditional models focused primarily on profits to an all-encompassing strategy that takes into account the enduring impacts on the environment and society[37].

Involving stakeholders is another very important aspect. The challenge here is the fact that stakeholders usually have different and often conflicting interests. In order to include them effectively, transparent communication and committing to the incorporation of diverse perspectives should be made in decision-making processes. When aiming for informed and sustainable decision-making the company's strategy should be based on fostering long-term relationships with trust and shared values[37], [41].

The dynamic nature of sustainability adds to the assessment challenge. Organizations need to stay flexible, constantly adjusting their approaches to sustainability as environmental regulations, societal norms, and economic scenarios change. Organizations are challenged with the task of openly communicating their sustainability actions, complying with set standards and frameworks, and maintaining a sense of accountability[38]. Essential for identifying areas of improvement and for driving continuous progress in sustainability practices is comparing their sustainability performance against peers and industry standards, ensuring these comparisons are fair and meaningful.

1.4.2. Bridging the Gap Between Strategy and Sustainability

The gap between a business's strategy and sustainable practices often arises from challenges in aligning immediate business objectives with long-term sustainability goals. Several matters make the bridging of this gap of high importance and requires companies to adopt a holistic view of sustainability, integrating it into the core of their strategy and operations.

Sustainable practices possess the ability to foster product differentiation within the marketplace and augment the overall organizational image in the eyes of investors and customers. This has as a result the potential increase in the profitability of the company. Implementing environmentally friendly initiatives might lead to a decrease in profit margins because of the additional expenses required for their adoption and ongoing application[42].

Nevertheless, amidst the current economic fall, justifying such elevated costs becomes challenging unless a business can clearly show the advantages of adopting sustainable practices. In order to have a transparent view of how sustainability interacts with corporate strategies and affect the profitability of the company and bridging the gap between sustainability and business strategies, the Balanced Scorecard framework can be used efficiently[6].

1.4.3. Stakeholder Expectations and Reporting

With the constantly changing landscape of global commerce, stakeholder demands in relation to sustainability are now the central issue for corporate accountability. In today's era of transformation, organizations face the enormous challenge of balancing economic growth with environmental stewardship principles. This chapter unravels the web of expectations that stakeholders hold and the reporting on sustainable matters, highlighting how sustainability is shaping the future of business [43].

In a study about understanding the normative notions of sustainability held by different stakeholder groups in the Western Baltic Sea fisheries, which encompasses their personal beliefs and values about what sustainable practices and results look like in a given situation. The viewpoints of these stakeholder groups have considerable variations, influenced by their distinct interests, values, and goals. Research within the Western Baltic Sea fisheries sector uncovered a wide range of opinions on sustainability among these groups. Nevertheless, in spite of these disparities, there exists a shared consensus among all parties involved regarding the validity of the respective entities' entitlements to the Western Baltic Sea. This highlights a shared acknowledgment of the significance of responsibly utilizing its resources[44].

When it comes to stakeholders reporting, they are essential in the reporting of sustainability. The progression of sustainability reporting has been propelled by the increasing significance of sustainability investors and other stakeholders [23], [43]. Stakeholders are pivotal in driving and supporting sustainability across various sectors, encompassing anyone from government bodies and industry insiders to local communities, environmental advocates, and researchers, all of whom have a vested interest in specific issues, projects, or systems[23]. However, new approaches are required in order to encourage quality reporting, especially among companies that have not yet published numerical data. It is important for stakeholders to be aware of strategic behavior in reporting and to engage in ongoing conversations about what companies report.

1.5. Incorporating Hybrid Renewable Energy into Sustainability

1.5.1. The Role of Renewable Energy in Sustainable Practices

Using renewable energy is redefining sustainability. It addresses resource depletion, environmental degradation and climate change directly. By redirecting our attention towards sustainable alternatives, renewable energy is not just a solution, but rather a declaration of our dedication to conserving the economic stability, social equality, and environmental integrity of the planet. This attempt to avoid fossil fuels is essential for addressing immediate environmental challenges and protecting future generations' well-being[45].

In the need for enhancement of energy efficiency and creating public awareness, renewable energy promotes urban development, emphasizing the shift from conventional fossil fuels to renewable alternatives. The concept of Renewable Energy Communities (CER) [46] is a key strategy for urban regeneration, promoting sustainability and overcoming challenges like resource scarcity and biodiversity loss. The CER approach revitalizes industrial areas into sustainable industrial zones, highlighting their role in sustainable urban planning[45], [47].

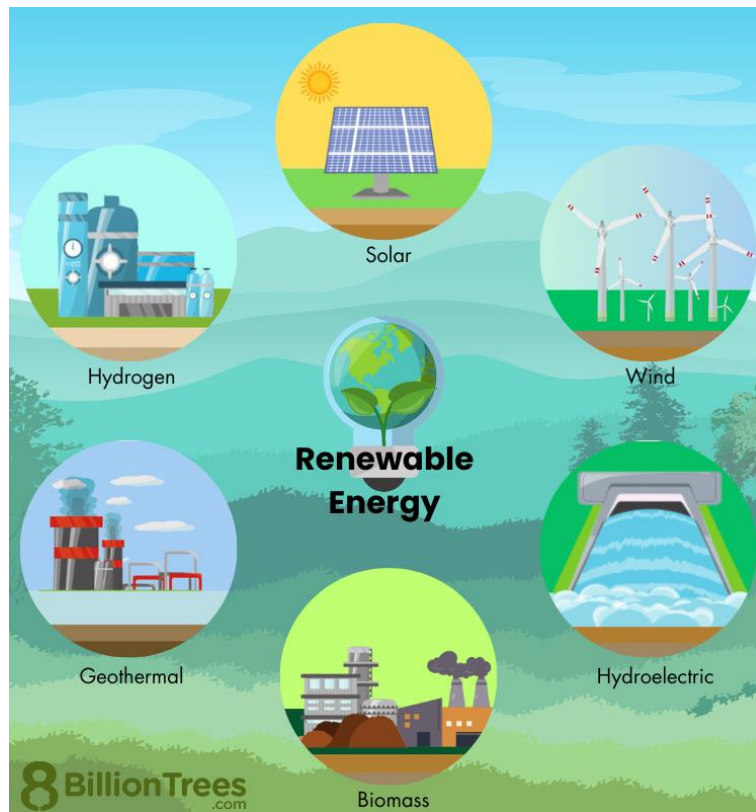


Figure 4. Renewable Energies

Implementing effective strategies for sourcing and predicting renewable energy has a fundamental role in incorporating these resources into the power grid affordably. By adopting renewable energy in their operations, businesses can not only avoid environmental harm, resource depletion, and pollution but also drive forward sustainable growth. Furthermore, renewable energy reduces emissions and pollution, offering a cleaner alternative to traditional fossil fuels[47], [48]. This shift

not only stimulates economic prosperity and job creation but also improves access to energy, affecting water supply, agriculture, health, and education positively. Solar and wind energy, noted for their limitless and eco-friendly nature, face hurdles such as storage solutions and wildlife considerations that need addressing [48].

1.5.2. Advantages of Renewable Energy

With renewable energy sources we're not only talking about technical advancements but about preserving our world for future generations as well. Among the environmental benefits are considerable reductions in air/water pollution, greenhouse gases and biodiversity. These improvements make the planet healthier and better for everyone [48].

They are increasingly recognized for long term cost savings. Unlike fossil fuels which have volatile market prices and high extraction and transport costs, renewables like solar power and wind have low running costs. Once the initial infrastructure investment is made, the costs of generating energy from such sources are relatively stable and predictable because wind and sunlight are never ending. This economic efficiency benefits consumers with lower energy bills and also strengthens financial resilience of communities and nations [48], [49].

A shift towards renewable energy provides for energy independence, reducing import dependency of fuels which are potentially geopolitical targets for supply disruptions. With local energy resources countries can secure energy supply, national security and control their energy futures. This independence nourishes the economy as well as the communities by assisting local job creation and creating a sense of shared responsibility towards a sustainable energy landscape [49]. The switch to renewable energy sources delivers a triple win: preserving our environment, generating economic savings and increasing energy independence.

1.5.2.1. Intermittency, Storage, Initial Costs

The intermittent nature of supply makes the integration of renewable energy sources - especially wind and solar sources - into established power grids difficult because the output of such energy sources varies [50]. The inconsistent distribution of electricity may thus become complicated during operations. Potential solutions including batteries and flywheels are suggested to buffer such fluctuations in microgrids while addressing the issue of integrating renewable energy in the existing power grids [51].

Also, dispersed renewable energy installations can take advantage of the geographical dispersion to smooth out localized weather influences on energy production. Strategies also include advanced information systems and market mechanisms to balance supply and demand and maintain grid stability. They are measures taken to counter the intermittency of renewable energy and its reliability and integration.

To deal with this problem energy storage systems (ESS) like flywheel energy storage and batteries are used to cope with RER intermittency in microgrids [51]. Capturing extra energy during high production and redistributing during low output is crucial to avoid energy availability gaps and to ensure that renewable sources can be counted on as part of our energy mix consistently.

Another strategy is to exploit geographical dispersion of renewable plants, where distance smoothing can reduce the effect of weather events on power output [52]. Also, information systems and market mechanisms may be applied to manage electricity production, consumption and transfer to preserve grid equilibrium [52]. They're designed to make renewable energy integration more reliable and efficient while addressing intermittent issues.

A significant factor when an industry examines the integration of renewable energy sources in its strategy, is the initial cost needed for the installation and configuration of renewable energy systems. The decision-making process will be based on the need to balance the initial financial outlay. The goal is to pursue a balance between these costs and the long-term benefits of including renewable energy in their strategies.

Costs for renewable energy technologies integration may vary significantly with respect to technology as well as location. For example, optimizing the setup of renewable energy sources and diesel generators of a small remote research facility can save up to USD 27,000 USD for biomass, USD 49,500 USD for wind systems & USD 136,500 USD solar [53]. In Europe a wind turbine costs about EUR1,230 a kilowatt and will cost you between EUR1,400 and EUR1,000 per kilowatt [54]. The original investment for a 1MW solar photovoltaic system is USUSD 1,564,286.70 and can decrease to USUSD 265,425.28 by the tenth year. Wind speed and site location affect wind power generation costs by about 5-10 cents per kWh[53]. Wind and hydro create the most economical electricity coming from renewable sources at between 0.01 and 0.02 / kWh for geothermal, 0.03 for wind and hydro, and for photovoltaics and marine currents at between 0.05 and 0.06 / kWh [55].

1.5.2.2. Hybrid Renewable Energy Systems for Industry

In an era where the pursuit of sustainable energy solutions is of utmost importance, Hybrid Renewable Energy Systems (HRES) emerge as a token of creativity and ecological responsibility. Customized for the industrial sector, these systems proclaim the arrival of a revitalized period of power production, blending the dynamic forces of wind and solar power to pave the way toward a cleaner and more resilient future[56].

By combining wind and solar energies, Hybrid Renewable Energy Systems suggest a practical, eco-friendly power solution, especially for remote spots left off the grid. These setups not only bridge the energy gap affordably but also stand out by keeping our skies clean. They're a testament to how blending nature's forces can light up lives and sustain our planet, proving we can indeed power progress without paying the earth. They are considered viable solutions for rural electrification, providing environmentally sustainable and affordable energy[56].

Incorporating Hybrid Renewable Energy Systems (HRES) in industries is a game-changer, offering a path to affordable and sustainable electricity. By reducing both costs and carbon footprints, these systems make economic and environmental sense. They're a beacon of hope for rural and remote communities transitioning from diesel to renewables, leveraging both classical and innovative optimization models. These models, which factor in social benefits, are pivotal in tackling energy poverty and pushing for rural electrification. As the focus on environmental impact and social considerations grows, HRES stands at the forefront, promising a greener, more inclusive future[51].

By harnessing wind, solar, and sometimes even hydro power, Hybrid Renewable Energy Systems (HRES) can completely transform the way industries approach their energy needs. If multiple renewable sources are included, not only reduces carbon emissions but also ramps up reliability and efficiency [51]. Innovatively, these systems can be woven into flexible networks like microgrids, ensuring industries receive a consistent energy flow. This shift towards greener, more adaptable power solutions marks a pivotal step in battling climate change, showcasing a commitment to sustainable development and a healthier planet[57].

1.5.3. Combining Multiple Renewable Sources

Blending wind, solar, and biomass into one energy system is like creating a powerhouse of sustainability. Imagine catching the sun's rays, the wind's strength, and the earth's raw materials all working together. This isn't just good for the planet; it's a smart move for energy reliability. With each source covering for the other's off times—sun at day, wind at night, biomass all the time—we're looking at a future where power outages could be a thing of the past. This idea isn't just a win for keeping our lights on; it's a leap towards reducing our carbon footprint, making a real dent in climate change.

The innovative realm of hybrid power plants spotlights the synergy between renewable energy sources—wind, solar, and hydropower—and energy storage solutions. This fusion not only promises a constant energy flow but also boosts efficiency and reliability. Different energy types are combined, especially when solar joins forces with either wind or hydropower [58], can smooth out power supply fluctuations, enhance output, and cut costs. With a keen eye on regional and seasonal patterns, there are showcased areas where this complementary energy mix could revolutionize power transmission and interconnection, urging a balanced view that weighs both the technical and economic benefits[57].

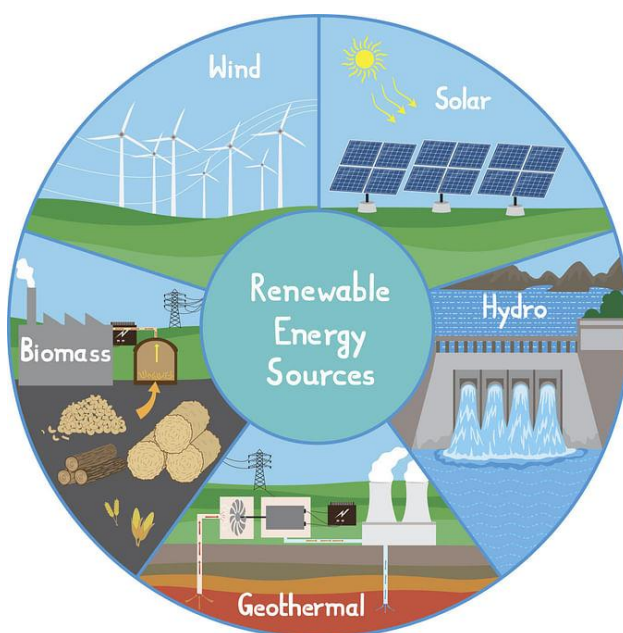


Figure 5. Renewable energy sources

A converter system that cleverly combines various renewable energy sources for both DC and AC power grids, enhancing the efficient use of energy is introduced, which saves costs with its low component count and high efficiency but also enhances performance across the board. With capabilities like buck-boost operation, it improves power quality and versatility in handling diverse energy inputs. Moreover, the adoption of a multilevel inverter design ensures effective and dependable power conversion, facilitating the seamless incorporation of renewable energy into the grid, while an innovative auxiliary circuit simplifies control and boost reliability[57].

1.5.4. Enhancing Energy Reliability and Cost-efficiency

In the forthcoming chapter the challenges posed by the intermittency of renewable energy sources head-on are presented. This section aims to uncover the complexities of incorporating innovative solutions that stabilize and enhance the energy provision from renewable sources such as wind, solar, and biomass. By performing a thorough examination of cutting-edge energy storage technologies, advancements in smart grid systems, and measures to improve efficiency, we will explore how these strategies collectively contribute to establishing renewable energy as a more dependable and economically feasible choice for the next years.

Exploring intermittency across different domains reveals a variety of strategies to address its challenges. In the realm of hydrology, an investigation into the cycle of intermittency hypothesis illustrates how rising water demand can lead to the depletion of groundwater and a reduction in streamflow, suggesting the use of intermittency as a measure for drought in both streamflow and groundwater[51]. Within the field of turbulence, a proposed stochastic model aims to depict intermittency through the multifractal properties of energy dissipation. Regarding renewable energy, a set of strategies is introduced to counteract the intermittency issue inherent in solar PV systems, including the development of dispatchable solar PV solutions and creating a market that accommodates the variable supply of electric power[59].

Boosting energy resilience of integrated energy systems against disasters and minimize losses, it's essential to adopt a dual strategy encompassing both pre-disaster hardening and efficient disaster-time operations. This approach includes crafting optimal strategies for system reinforcement before calamities strike, ensuring efficient energy storage management for enhanced operational efficiency, and improving system robustness to maintain operation during extreme events. Moreover, intertwining preventive and operational measures helps swiftly restore energy supply, promoting a more resilient and sustainable global energy landscape[59]. This includes a three-tiered approach focusing on prevention before disasters, operational strategies during emergencies, and managing energy storage effectively. Enhancing community resilience involves preemptive strategies like adopting clean energy initiatives, microgrid development, and energy storage investment to diversify sources and lessen reliance on centralized grids, ensuring uninterrupted energy during disruptions. Operational tactics include establishing robust infrastructure capable of enduring severe conditions, adjusting energy use dynamically, and shifting towards renewable resources for a steadier and more disruption-resistant energy landscape. Efficient energy storage management plays a crucial role in balancing supply, storing surplus energy for use in challenging times, and bolstering the system's resilience[60].

1.6. Rationale for Using the Balanced Scorecard

1.6.1. Why Adapt the Balanced Scorecard?

Having delved into the essence of balanced scorecards in previous chapters, it's time to explore the compelling reasons for their adaptation in modern business practices. This section will unravel the strategic value of customizing balanced scorecards to fit organizational goals, focusing on why this tool is not just beneficial but essential for navigating today's complex business landscapes. We'll examine the alignment of balanced scorecards with corporate strategies, facilitating a holistic view of performance that goes beyond traditional financial metrics to include critical non-financial aspects crucial for long-term success[25].

Adopting the Balanced Scorecard (BSC) transforms how businesses measure success, moving beyond mere financial metrics to a broader evaluation of performance across various dimensions. This tool enriches executive performance assessment, fosters strategic management through a results-oriented approach, and promotes continuous questioning and learning[25], [26]. It verifies the attainment of an organization's vision and mission, assesses competitive standing, directs operations, and evaluates learning and growth. The BSC's flexibility benefits entities of all sizes, enabling even small to mid-sized firms to leverage key indicators for informed decision-making. Significantly, it integrates sustainability into strategic management, enriching the traditional BSC framework and has been linked to enhanced productivity, customer satisfaction, and financial performance across diverse sectors[26].

1.6.2. Advantages of the Balanced Scorecard

The Balanced Scorecard really stands out as an invaluable guide, giving a complete picture of how a business is doing. It covers everything - from the hard numbers that show financial performance to how happy customers are, how smooth internal working is, and where the business can grow and learn. It's like having a map that helps businesses navigate through their performance, offering insights across a broad spectrum of areas, all to ensure they're moving in the right direction and growing sustainably.

This strategic approach encourages companies to transcend traditional financial indicators, embracing a more rounded view of success that aligns closely with their vision and mission, competitive positioning, operational strategies, and learning initiatives[61].

It's equally effective for businesses of all sizes, offering small firms a concise set of indicators for sharper decision-making. Notably, its adaptability shines in the banking sector across international markets, where understanding and managing varying cultural, economic, and legal frameworks is critical. Its role in strategic innovation management for smaller and medium-sized businesses highlights its crucial part in ensuring strategic coherence. This adaptability fosters a decision-making culture informed by comprehensive insights, paving the way for sustained achievement and growth[25], [61].

Through the BSC, organizations gain a robust framework for navigating the complexities of modern business landscapes, ensuring a balanced pursuit of strategic objectives that cater to a broad spectrum of stakeholders.

1.7. Structure of the Thesis

This thesis unfolds a detailed examination of the Balanced Scorecard's role in fostering sustainability within organizations. Each chapter is crafted to progressively build upon the insights gathered, starting from a foundational understanding of sustainability and its significance in the modern business landscape to the conceptual underpinnings of the Balanced Scorecard, and its evolution to include sustainability metrics. This work endeavors to establish a cohesive narrative that establishes a connection between theoretical expertise and pragmatic implementation, thereby offering an all-encompassing guide for organizations that aspire to incorporate sustainability within their strategic management methodologies.

1.7.1. Navigating the Research Journey

The most important step in exploring how Sustainability Balanced Scorecards (SBSC) can play in organizations was methodical and comprehensive. For this purpose, academic papers and other theses had to be collected and analyzed extensively. Such exploration helped us understand how SBSC linked strategic management and sustainability goals. From here onwards, subsequent chapters are poised to provide more real-world examples and applications demonstrating how SBSC is being applied and impacting in various organizational contexts. From theory to application this progression shows how sustainability can be realized both in terms of benefits and challenges when embedded in strategic frameworks.

1.7.2. In-Depth Exploration in the State-of-the-Art Section

This section conducts a critical and analytical review of current research and innovations in Sustainability Balanced Scorecards (SBSC). Many scholarly articles and previous theses described how SBSC combined sustainability with strategic management. This constituted the basis for the chapters to come, which will translate these theoretical insights into concrete applications. The thesis employs examples of SBSC implementations in different industries to show how sustainability impacts and challenges of integrating sustainability into organizational strategies can be translated into theoretical as well as practical application of sustainability principles in strategic planning.

2. State of the Art

2.1. Theoretical Foundations of Sustainability Balanced Scorecards (SBSC)

Expanding the original BSC to include critical sustainability dimensions in strategic management practices, this new framework extends environmental stewardship, social responsibility and economic viability as core components of organizational performance evaluation. In doing so, the SBSC follows traditional financial, customer, internal process and learning and growth perspectives but also adopts sustainability as a strategic planning and execution pillar. The SBSC framework thus provides an instrument for organizations seeking to align their business activities with wider societal and environmental objectives in order to measure and manage performance for sustainable success.

2.1.1. Review of Existing Literature on the Balanced Scorecard Framework

Kaplan and Norton's Balanced Scorecard changed how we think about measuring business success. The Scorecard is more than numbers on a page - it's a picture of an organization's health and direction - it combines financial goals with needs and processes that matter. How they see us, how we operate, how we learn, how we improve. Over time, this framework has grown even richer, folding in the critical dimensions of sustainability to address our planet's environmental and social challenges. This evolution towards a Sustainability Balanced Scorecard isn't just about doing good, it's about ensuring businesses can thrive in a world where the health of our environment and communities is paramount. This shift highlights the Scorecard's versatility and its power to guide businesses through the complexities of modern corporate responsibility and sustainability[28].

New long-term goals and tactics for energy efficiency and intelligent management have been implemented due to the imperative need for climate change mitigation. The demand for climate change mitigation, new long-term targets and strategies for energy efficiency and intelligent management have been devised. Research efforts have aimed at addressing these challenges through advancements in unit sizing, optimization, energy management, and modeling of various components in HRES[48]. The application of multi-criteria decision-making approaches and the incorporation of social indicators, such as job creation, into the design and modeling of HRES are considered vital in achieving sustainable and socially beneficial hybrid renewable energy systems.

The BSC approach, which focuses on evaluating the multiple aspects of a strategic initiative, has been effectively employed to analyze investment decisions in RE. The approach of the Balanced Scorecard focuses on examining various facets and benchmarks relevant to investing in green energy sources. A particular study highlighted this by pinpointing four key areas and eight benchmarks, evaluating five distinct options for green energy investments, which encompass biomass, water power, earth heat, air currents, and sunlight-based energy choices. The findings revealed that being ahead in the market was deemed the most crucial area, with continuous innovation and development standing out as the paramount benchmark[62].

Scholars have delved into the best designs, economic assessments, and the sustainability of combined renewable energy setups. One investigation assessed various configurations of power

systems, considering both economic and environmental impacts. An examination was conducted to evaluate different arrangements of power systems, taking into account the economic and environmental consequences. A combination of Photovoltaic Wind, Diesel Generator, and Battery was the most effective option. Similarly, a different analysis compared and prioritized renewable energy technologies alongside battery storage solutions in Turkey through a sustainability index, discovering that combinations of hydro and solar, as well as wind and solar, achieved the top sustainability scores[63].

The literature review vividly demonstrates the Balanced Scorecard's evolution from a traditional performance metric to a pivotal tool for embedding sustainability in business strategies. This journey underlines the framework's capacity to drive organizations towards not only achieving financial success but also contributing positively to environmental and societal goals, marking a significant shift in the landscape of strategic management.

2.1.2. Exploration of SBSC in Research and Practice

This section delves into the practical application and empirical study of the SBSC, showcasing its effectiveness in aligning organizational goals with sustainability principles. Through a series of examples, we will explore how various organizations have adopted the SBSC to not only enhance their sustainability initiatives but also achieve traditional performance targets, shedding light on the tangible impacts of this strategic integration.

One study refers to a special version of the Balanced Scorecard, the Green Sustainability Balanced Scorecard (GSBSC), specifically crafted for the liquefied natural gas (LNG) industry. It's all about integrating sustainability into the heart of strategic management, with a keen focus on aspects like customer feedback and reducing environmental footprints. The GSBSC aims to nudge the LNG sector toward practices that are not only better for the planet but also socially responsible and economically viable. While the paper doesn't dive into the nitty-gritty of the outcomes from deploying the GSBSC in Taiwan's LNG scene, it suggests this approach could be a game-changer for sustainable growth in the industry[64].

In South Africa, banks adopted the Balanced Scorecard (BSC) to combat cyberfraud, crafting a strategy that spans financial, operational, customer, and learning dimensions. This approach aimed not only to curb cyber threats but also to enhance management systems and boost satisfaction among customers and shareholders. Interestingly, the focus leaned more towards non-financial aspects, particularly customer experience and organizational learning. While the broader impacts on environmental or social goals weren't detailed, this strategy represents a forward-thinking blend of conventional banking security with strategic management[65].

Poland's public transport scene is adopting the Balanced Scorecard (BSC) strategy to infuse sustainability throughout its framework. This strategy zooms in on four critical areas: solidifying financial foundations, boosting passenger contentment, fine-tuning daily operations, and seizing opportunities for innovation and expansion. It's a shift from merely focusing on financials and customer feedback to a concerted effort in slashing inefficiencies and elevating the caliber of transport services. Through the BSC's lens, these transport outfits are morphing into dynamic, learning-centric organizations, adept at tackling the evolving demands of the marketplace and

steering towards both technological and organizational growth, with every initiative meticulously aligned with their overarching sustainable development ambitions[66].

In summary, the exploration of the Sustainability Balanced Scorecard (SBSC) across different sectors and geographies underscores its versatility and efficacy in weaving sustainability into the fabric of organizational strategy. From the LNG industry's GSBSC in Taiwan to South Africa's banking sector and Poland's public transport, each example illustrates the potential of the SBSC to foster a holistic approach towards achieving both sustainability and performance goals. These case studies illuminate the path for future research and practice, advocating for a strategic framework that not only supports sustainable development but also enhances organizational performance in a comprehensive manner.

2.2. Rationale for Using the Balanced Scorecard in Sustainable Industrial Practices

2.2.1. Existing Research on the Effectiveness of the Balanced Scorecard

The Balanced Scorecard (BSC) guides sports tourism spots toward a greener future, blending the smart logistics of supply chain management with a keen focus on sustainability. This ingenious mix maps a route for cities to become champions of eco-friendly sports tourism. It offers a rich, multi-angle view, covering everything from financial health to local happiness. It helps make informed decisions, shape strategies that boost the community, and zero in on what makes sports tourism sustainable. Furthermore, by marrying the BSC with the principles of supply chain management, cities can pinpoint exactly what needs to be measured and improved. Essentially, this study lifts the BSC as a powerhouse for fostering and checking green initiatives in the sports tourism world, proving that it is more than just a tool—it is a game changer for the planet and its people.[67].

In another study on the green challenges in Sri Lanka's apparel industry, researchers rolled up their sleeves and crafted a special Sustainability Balanced Scorecard. They pinpointed tricky spots—everything from old-school data handling to the dire need for better waste management and recycling, not to mention the tight purse strings holding back progress. By peeking into the sustainability journeys of three local apparel makers, they combined a scorecard that is not just a guiding light for other companies wanting to tread lighter on the planet, but also a treasure trove of insights for regulators and policy gurus looking to knit tighter, more effective sustainability policies. While this scorecard could be the key to greening Sri Lanka's apparel scene, whether it can weave the same magic in other industries is a question waiting to be unraveled.[68].

In Cartagena's Port Authority, a Balanced Scorecard (BSC) approach transformed sustainability from a sideline to the main event, integrating green goals across every level of the organization. This large shift brought their eco-ambitions into sharper focus and set a shining example for other Spanish ports on marrying operations with sustainability. Meanwhile, over the world of Shared Service Centers (SSCs), the BSC received a green makeover, embracing the Triple Bottom Line—People, Planet, and Prosperity—alongside its classic perspectives. This move is crafting a new playbook for managing sustainability, indicating that when you blend traditional business smarts with a heart for the planet and its people, you have a winning formula for the future. Both stories

hint at the BSC's magic in making sustainability a core part of business strategy, proving that it is a game changer for any organization looking to do well by doing good.[69].

2.2.2. Advantages and Benefits of SBSC Adoption

Embracing the Sustainability Balanced Scorecard (SBSC) offers several benefits to every company it is integrated into. It combines the green and growth aspects of your business into your strategy. Imagine being able to weigh your company's impact on the planet and society alongside the usual numbers game of finances and operations. That's the magic of the SBSC—it doesn't just add sustainability to the mix; it weaves it through the very fabric of your strategic planning. SBSC is a practical guidebook for turning those green goals into steps everyone in your organization can follow. It's about improving how your business ticks on every level of sustainability, making sure you're doing well by doing good. And in a world increasingly conscious about how businesses contribute to the greater good, the SBSC helps bridge the gap between chasing profits and being genuinely sustainable.

Incorporating SBSC's dimensions within a unified framework designed to evaluate sustainability outcomes guides organizations toward achieving sustainable competitive advantage ensuring a balanced focus across financial success, environmental stewardship, and social responsibility. By embedding sustainable strategies into strategic management, the SBSC facilitates a holistic view of corporate success, promoting practices that contribute positively to societal well-being and environmental preservation, thereby securing a future-proof competitive edge.[70].

The Sustainability Balanced Scorecard (SBSC) framework aids organizations in navigating beyond the conventional "profit vs. sustainability" dichotomy, enabling a dual focus where profitability and sustainability objectives enhance each other rather than compete. This transformative approach contributes to enriching the overall welfare economy by fostering synergy between economic achievements and sustainability efforts. Implementing the SBSC helps organizations harmonize their strategic objectives with sustainability mandates, ensuring economic prosperity coexists with environmental and social care, promising an immediate uplift in organizational performance across sustainability metrics and a lasting positive impact on societal welfare.[71].

The organizational culture, entrepreneurship, and the efficacy of accounting information systems can be strengthened thereby enhancing overall business performance and sustainability assessments through balanced scorecard methodologies. The SBSC's adaptability promotes a culture of continuous improvement and innovation within organizations, driving them toward sustainable competitive advantage by aligning business practices with broader sustainability goals.[72].

2.3. Gaps and Challenges in Current Research

2.3.1. Identification of Research Gaps in SBSC and HRES Integration

Exploration of SBSC with HRES in the industry sector reveals a pioneering domain in which sustainable business practices meet renewable energy applications. Despite the potential for synergistic benefits, current scholarly work largely addresses SBSC and HRES as distinct areas and scarcely probes their combined impact. This oversight reveals a crucial research gap: the absence

of tailored frameworks that merge HRES initiatives with the SBSC model for the industry sector. Moreover, there is a notable deficiency in case studies that show the real-world implementation and benefits of such an integrated approach, underscoring the urgent need for holistic models that blend sustainability indicators with renewable energy efficiencies tailored to the nuances of this sector.

2.3.2. Addressing Challenges and Limitations from Existing Studies

A review of the scholarly contributions on intertwining SBSC with HRES reveals significant hurdles and shortcomings. Central to these is the challenge of effectively weaving sustainability metrics into the SBSC framework, making seamless melding with HRES a complex task. Further complicating this integration is the need for these models to be flexibly applied across the varied operational sizes and environmental settings encountered in juice manufacturing. Additionally, the dependency of sources such as solar and wind energy on weather conditions introduces unpredictability in strategic planning for renewable energy utilization. To overcome these issues, there is a pressing need for innovative approaches that bolster the robustness and adaptability of the SBSC framework, thereby enabling a more effective fusion of HRES. This would cultivate flexible and resilient sustainability strategies that are tailored to the juice sector.

2.3.3. Opportunities for Further Research and Innovation

Diving into the confluence of SBSC and HRES in the realms of the industry sector uncovers exciting avenues for groundbreaking research and advancements. A promising area is crafting adaptable SBSC frameworks that harness the power of real-time data analysis to enhance the efficiency and sustainability of HRES. Exploring cutting-edge technologies, like blockchain, offers the potential to improve transparency and responsibility for sustainable practices. Moreover, there's fertile ground for investigating how consumers react to using more environmentally friendly practices and whether they are willing to change their habits to be consistent with sustainability regulations. The result of this synergistic approach is potentially positioning sustainability as a compelling market advantage. These prospects underscore the potential for pioneering research that not only pushes the boundaries of theoretical knowledge but also prepares the industry for a future where sustainability and energy efficiency are seamlessly integrated.

2.4. Conclusion of the State of the Art

2.4.1. Summarization of Key Findings and Insights from Existing Literature

The SBSC framework successfully blends sustainability aspects into traditional Balanced Scorecards, aligning business strategies with environmental and social objectives. Research consistently underscores the importance of integrating sustainability metrics into financial, customer, internal process, and learning and growth perspectives. This combination offers a complete view of organizational performance, extending beyond just financial results to include environmental and social impacts. The utilization of SBSC was demonstrated that it has the capacity to enhance resource utilization, stakeholder involvement, and long-term financial performance. Nevertheless, existing literature highlights obstacles in the adoption of SBSC, including the necessity of robust data collection mechanisms and the mitigation of internal resistance to organizational change. Notably, several case studies demonstrate clear benefits,

including lower operational costs, enhanced brand reputation, and greater investor confidence. These findings provide a solid basis for understanding the benefits and challenges of SBSC, setting the stage for its application in the juice production sector, particularly for a company like Aspis committed to sustainability.

2.4.2. The Relevance of Previous Research to the Thesis Objectives

Findings from previous Sustainability Balanced Scorecard (SBSC) studies are relevant to the purposes of this thesis, which develops and applies a detailed SBSC for Aspis, a juice production company. Past research has provided tips for integrating sustainability into business performance measurements. This study argues that KPIs should reflect industry-specific operational, environmental, and social aspects. For Aspis, this means going beyond financial metrics to consider the effects of circular economic practices, energy consumption, and employee satisfaction. The literature also lists problems that Aspis may encounter, such as data collection and integration. Typical strategies used in the industrial sector are presented to address these issues. The research pointed out the need to align sustainability objectives with a company's overall strategic vision for consistent and effective implementation. Using insights and frameworks from earlier studies, this thesis builds an SBSC that supports Aspis' strategic goals and improves its sustainability performance. Learn from similar industries to anticipate problems and find solutions.

2.4.3. Setting the Stage for the Research Methodology and Empirical Analysis

Here research methodology and practical analysis based on a literature review are planned. It proposes to adopt a Sustainability Balanced Scorecard for Aspis based on lessons learned from previous studies. That means identifying and fine-tuning KPIs in line with industry sustainability targets, devising methods for data collection, and integrating the SBSC into the company's operations. Empirical analysis will assess how the SBSC helped industries improve sustainability performance. That includes analysis of data before and after implementation, scenario analyses to understand how the SBSC performs under various conditions, and temperature, pH, pressure, and number of oranges processed influences performance. Interviewed key stakeholders and employee surveys will also shed light on the practical challenges and benefits of using an SBSC. This all-encompassing approach reviews the SBSC's effectiveness, offers concrete recommendations for improvement, and verifies Aspis meets or beats its sustainability targets.

2.5. Significance of the Study

This study is significant because it can contribute theoretically and practically to sustainability management and performance measurement. In developing and applying a sustainability Balanced Scorecard (SBSC) for Aspis, a juice production company, this research addresses the need to integrate Sustainability in traditional business performance frameworks.

Theoretical Contribution: This work extends the body of knowledge on SBSC by providing a case study in the juice production industry. It demonstrates how sustainability metrics can be incorporated into all traditional Balanced Scorecard pillars: Financial & Customer, Internal Process & Learning 1and1 Growth & dedicated Social & Environmental metrics. It provides insights on selecting relevant KPIs, overcoming implementation challenges, and integrating sustainability goals

with strategic objectives. They may be a reference for future studies exploring SBSC applications in other industries.

Practical Contribution: For Aspis an SBSC is an instrument for setting and measuring sustainability performance. This SBSC will assist Aspis in identifying areas of cost savings through circular economy practices, operational efficiencies, and brand building through demonstrating sustainability commitment to stakeholders. Furthermore, the empirical analysis of the SBSC impact gives practical advice and strategies for Aspis to improve its sustainability efforts.

Further still, it examines how sustainability can contribute to the food and beverages sector given current global environmental issues. Demonstrating how SBSC was implemented in Aspis it encourages other companies in the industry to adopt such frameworks. This widespread adoption may have positive effects on environmental conservation, resource efficiency, and social responsibility of the sector.

3. Methodology

3.1. Case Study Description

Aspis S.A., established in 1971 by Constantinos Dedes, has evolved from a modest family-run fruit and vegetable canning operation in Argos, Greece, into a prominent global player in the juice production industry. With a rich history of strategic expansion and technological advancements, Aspis [73] has set up sophisticated production lines and acquired multiple local companies to enhance its production capacity and product quality. The company proudly operates two advanced processing facilities in Greece, strategically located in Argos and Irinoupoli [74]. These plants are pivotal in producing a diverse range of high-quality products including fruit juices, purees, and canned fruits, serving as the backbone of Aspis's extensive product portfolio.



Figure 6. Aspis Industry logo

All aspects of Aspis's operational ethos are guided by a strong commitment to sustainability. This structured approach helps the company focus on its workforce, environmental assets, and efficiency. This framework organizes their actions in order to achieve environmental and social health protection in addition to business efficiency. This framework ensures sustainability is embedded across all levels of organizational practice. By prioritizing people, Aspis promotes personal development, health, safety, and human rights in line with international standards such as the UDHR and ILO. Environmentally, Aspis focuses on methods that promote agricultural sustainability and reduce ecological impacts. That means increasing energy and water efficiency, reducing waste and advocating sustainable agriculture practices across the supply chain.

Commitment to sustainability through active involvement in global initiatives is focused on ethical practices and sustainability in the supply chain. The company strictly follows the SMETA-4-pillar audit scheme, ensuring it meets high standards in workplace conditions, health and safety, and environmental management. Additionally, Aspis takes part in groundbreaking projects such as the BEe project, which underscores its dedication to preserving biodiversity and ecological health. This

particular project is dedicated to improving the well-being of bees in the Imathia region, a critical factor for sustaining the agricultural practices that provide the raw materials for their products.



Figure 7. Aspis industrial territory

The sustainable procurement practices of the company underscore its commitment to ethical operations, emphasizing the importance of long-standing relationships with local suppliers who share its sustainability values. This approach is complemented by its engagement with platforms like ECOVADIS and participation in AIJN's Fruit Juice CSR initiative, which further solidifies its standing as a responsible business in the global market.

Aspis S.A. states how integrated sustainability strategies can contribute significantly to global sustainability goals. From its beginning to its current operations, Aspis leverages its legacy of innovation and ethical practices to maintain a competitive edge in the market while acting as a steward for environmental conservation and social responsibility. This case study of Aspis highlights the pivotal role of comprehensive sustainability strategies in modern enterprises and serves as a blueprint for other companies aiming to harmonize profitability with planetary and people-centric practices.



Figure 8 & 9. Aspis industry production

Aspis operates a sophisticated juice production process that efficiently converts raw materials into a variety of high-quality products. The process begins with the procurement of water, lime, and oranges, which are meticulously washed. The water used in this initial stage is then reused, demonstrating the company's commitment to sustainable practices. The fruits proceed to an extractor, where the juice is separated. A portion of this extraction is sent for milling, followed by a neutralization reactor and then pressed for dewatering. The output from this process takes three paths: packaging for immediate sale, drying to produce animal feed pellets, or further refining to adjust pH and remove sludge, ultimately producing liquor. The sludge by-product, while currently used for unspecified purposes, enters a molasses production process involving condensation, cooling, and mixing to produce high-quality molasses. This integrated process not only maximizes the utility of all inputs but also underscores Aspis's innovative approach to resource management and product diversification.

3.2. Balanced Scorecards

As demonstrated by the benefits of Sustainability Balanced Scorecard implementation in the food industry discussed in this thesis promotes the strategic management of a company that will decide to use it. Aspis has demonstrated research and has integrated this method as a longtime supporter of sustainable practices. Aspis has a long-term vision to incorporate these practices into its core operations. The structured framework provided by the SBSC aligns with Aspis's operational goals and environmental ethos to ensure sustainability is not an isolated component of its strategy but part of all business decisions and processes. With this tool, the industry can monitor and manage its performance against sustainability targets. SBSC implementation is a perfect way to optimize industry strategy performance - making it easier to track progress, find areas for improvement & ensure that all facets of the organization contribute to broad environmental and social goals.

Introducing a Sustainability Balanced Scorecard at Aspis stands to bring considerable advantages. This approach promotes ongoing improvement across the company by establishing specific benchmarks and performance metrics for guidance. For Aspis's strategy, an SBSC with 5 pillars was conducted, each of which included a separate sector of monitoring the industry's performance: Financial pillar, Learning & Growth pillar, Customer pillar, Internal Process pillar, and Sustainability pillar which consists of an Environmental and Social aspect. A total of 17 KPIs are selected based on the industry's practices and objectives and put in each pillar of the SBSC.

Adding an SBSC to Aspis's strategic management will help the company gain visibility on its sustainability activities so Aspis can effectively combine its economic goals with its social and environmental responsibility. The SBSC framework points out synergies between performance managing aspects so that improvements in one dimension do not compromise another. This integrative approach supports Aspis in achieving high operational efficiency standards, and innovation, and enhancing its competitive advantage in the global market.

An SBSC implemented at Aspis will likely push the company towards a future where sustainability will be the main object of every business operation. It aims to establish Aspis as a benchmark for sustainable practices in juice production. SBSC insights will help make decisions that move the company forward and contribute to global environmental goals and community well-being.

3.3. KPIs

In developing the Sustainability Balanced Scorecard for Aspis, we've carefully chosen the Key Performance Indicators (KPIs) that reflect the company's commitment to sustainable growth. These KPIs will track the progress of Aspis's environmental, social, and operational initiatives, offering clear insights to steer future strategies. This targeted selection ensures that Aspis can effectively measure its impact while fostering a responsible and balanced approach to business development. For each pillar specific KPIs were chosen.

The first category of indices, Financial, is critical for assessing the economic health and sustainability of the citrus processing operation. This category includes three indices: Revenue from Animal Feed, Cost Savings from Circular Activity, and Revenue Growth.

- ❖ Revenue from animal feed is the key indicator describing the financial return on the sale of animal feed produced as a byproduct of citrus processing. With this index, waste becomes a revenue-producing product promoting a circular economy. As production volume and quality affect the quantity and quality of byproducts sold, this index is sensitive to such variations.
- ❖ Cost savings from circular activities can be achieved through recycling and waste reduction. It is an important index to evaluate whether sustainability initiatives have an economic benefit that can be measured alongside environmental stewardship savings. An increase in this index reflects a commitment to circular economic practices in the processing plant.

- ❖ Revenue Growth is a simple but powerful metric that measures the percentage increase in total Revenue over a period. That index measures the company's market dynamics - whether it can expand its market presence and improve product offerings.

The key performance indicators of the financial pillar collectively provide a comprehensive view of the economic aspects of the operation, highlighting both the profitability and the cost-effectiveness of the business's sustainable practices.

The second category of indices, Learning & Growth, focuses on the developmental aspects of the organization's human resources and its overall workplace environment. This category encompasses two indices: Training & Staff Development and Work-Life Balance.

- ❖ Training and Staff Development evaluates investment in employees through organized Training programs. This index reflects the organization's commitment to advancing employee skills and knowledge essential for a competitive edge and innovation. It measures average training hours per employee - how well the company trains its employees for operational excellence and future challenges. Its higher values indicate proactive employee development aiming at increased productivity and job satisfaction.
- ❖ Work-life balance measures how well the organization supports its employees in balancing professional obligations with personal life. It is an important index for measuring organizational culture health as well as morale and retention of employees. A supportive work-life balance suggests a positive work environment that cares about its employees, which might result in higher job satisfaction and lower turnover rates.

In the Learning & Growth pillar, the indices offer a refined view of the organization's efforts in human capital development and its cultural approach to employee welfare. They point out the strategic importance of supporting the workforce because it is essential for long-term sustainability and success in a competitive market environment.

The third category of indices, Customer, is instrumental in evaluating the organization's relationships and reputation with its client base. This category includes three indices: Customer Profitability, Customer Satisfaction, and Product Safety & Quality.

- ❖ Customer Profitability focuses on the profit margins achieved with each customer or customer segment, highlighting the financial value derived from specific customer relationships. This index helps in identifying the most lucrative segments and tailoring business strategies to maximize profitability from these interactions. It underscores the importance of understanding customer contributions to revenue and adjusting service or product offerings to enhance these relationships effectively.
- ❖ Customer Satisfaction measures the extent to which the company meets or exceeds customer expectations in terms of product and service quality. This index is typically assessed through customer surveys that gauge satisfaction levels, providing direct feedback from consumers about their experiences and perceptions of the company's offerings. High scores in customer satisfaction are crucial for building customer loyalty, enhancing brand reputation, and increasing market share through positive word-of-mouth and repeat business.

- ❖ Product Safety & Quality evaluates the compliance of products with established safety standards and quality controls. This index is a critical indicator of the reliability and trustworthiness of the company's products, affecting customer trust and loyalty. High performance on this KPI reassures customers about the safety and quality of their purchases, which is especially significant in industries where product integrity directly impacts consumer health and satisfaction.

The third category of indices, Customer, is instrumental in evaluating the organization's relationships and reputation with its client base. This category includes three indices: Customer Profitability, Customer Satisfaction, and Product Safety & Quality.

- ❖ Customer Profitability measures profit margins with each Customer segment per customer and the financial benefit of Customer relationships. This index helps to identify profitable segments and tailor business strategies to realize maximum profit from such interactions. This highlights the need to understand customer contributions to revenue and adjust service or product offerings to improve these relationships.
- ❖ Customer Satisfaction measures whether the company meets or exceeds Customer expectations regarding product and service quality. That index is normally calculated using customer satisfaction surveys - which give direct feedback from consumers about their experiences and impressions of the company's offerings. Good scores on customer satisfaction help build customer loyalty, brand reputation, and market share through positive word of mouth and repeat business.
- ❖ Product safety & quality evaluates compliance of products with established Safety standards and Quality controls. This index reflects the reliability and trustworthiness of the company's products which affects customer trust and loyalty. High performance on this KPI assures customers that their purchases are safe and high quality, which is especially true for industries where product integrity is critical to consumer health and satisfaction.

In the customer pillar an evaluation of how well the company handles its customer relations, maintains product standards, and achieves customer-driven success is made. Such metrics are crucial for any business wishing to keep or expand its market share with good customer service and quality product services.

The fourth category of indices, Internal Process, is essential for understanding the efficiency and effectiveness of the organization's operational activities. This category encompasses three indices: Amount of Liquor Produced, Productivity Growth, and Production of High-Quality Molasses.

- ❖ Amount of Liquor Produced quantifies the total liquor volume generated during production. This index is critical for monitoring production levels and aligning them with market demand. By tracking the output, the organization can assess its capacity utilization and identify opportunities for optimizing production schedules and resource allocation. A higher volume of liquor produced generally indicates a well-functioning production process capable of exceeding customer demands.
- ❖ Productivity Growth quantifies the proportional enhancement in output relative to each input unit across a designated temporal interval. This index is a key indicator of improvements in operational efficiency, reflecting how effectively the organization enhances its processes to produce more with less. Determinants influencing productivity

enhancement may encompass technological innovations, improved workforce education, and the more effective allocation of resources.

- ❖ Production of High-Quality Molasses monitors the quantity of molasses produced that meets high-quality standards. This index is vital for assessing the organization's ability to generate valuable by-products that enhance revenue streams and support sustainability initiatives. High-quality molasses production indicates effective process control and quality assurance practices, important for maintaining product integrity and customer satisfaction.

The indices encompassed within the Internal Process category collectively furnish a comprehensive perspective on the operational efficacy of the organization and its aptitude for generating superior outputs with optimal efficiency. Such metrics are imperative for the ongoing enhancement of processes, allowing the organization to discern opportunities for refinement and to ascertain that its production methodologies are congruent with both strategic goals and market demands.

The fifth and last category of indices, Sustainability, is critical for assessing both the environmental and social categories which are crucial for assessing the organization's impact on the environment and society, ensuring that its operations align with sustainable practices. This category includes three distinct indices for each sector: Co2 emissions, Energy consumption, and Amount of water reused for the environmental sector and Employee satisfaction, Green-labeled products, and Consumption of virgin raw materials for the social sector.

- ❖ Co2 emissions serve as a pivotal metric that quantifies the aggregate volume of carbon dioxide equivalent emissions generated by the operational activities of the enterprise. This KPI reflects the ecological impact of the company, elucidating potential domains for the mitigation of greenhouse gas emissions and the enhancement of sustainable practices. A diminished CO2 emission figure signifies more optimized operational processes and a robust dedication to the minimization of the organization's carbon footprint, which is essential for compliance with environmental legislation.
- ❖ Energy consumption the assessment of diminished operational expenditures attained via sustainable methodologies, including recycling and waste minimization, is with great precision tracked. This metric is critical for assessing the budgetary consequences of sustainability efforts, offering a measurable advantage that integrates ecological management with economic savings. Elevations in this metric signify improved operational efficiency and a more robust dedication to circular economic methodologies within the processing facility.
- ❖ Amount of water reused Tracks the volume of water recycled and reused from the company's operations. efforts. This indicator provides a clear image on the company's ability to reduce water waste and reliance on freshwater resources. Higher water reuse rates indicate better sustainable water management and contribute to reducing the environmental impact, supporting long-term operational sustainability.

Environmental sector indices collectively provide a comprehensive view of the sustainable aspects of the operation, highlighting the company's efforts to lower its ecological footprint via emission reduction, energy conservation, and efficient management of water resources.

The social sector is the last sector of the sustainability pillar and significantly influences the industry's performance. And its indicator is presented below.

- ❖ Employee Satisfaction is an important measurement of Employee engagement. This KPI is extremely useful in understanding the work environment/culture. This index reflects effective managing practices and the company's ability to keep a motivated & productive workforce. If employee satisfaction is higher this indicates increased productivity and a good work environment.
- ❖ Green labeling is the degree to which a corporation's offerings are recognized for their ecological benefits through formal certifications or eco-labeling schemes. Such a KPI is important for consumer confidence and for identifying the company as offering environmentally sustainable alternatives in the market. Outstanding green labeling performance reflects an effective implementation of sustainability principles in product innovation and promotional activities in line with brand prestige and consumer preferences for environmentally conscious products.
- ❖ Consumption of Virgin Raw materials track new, non-recycled Materials used in the company's production. This is an important KPI that helps see how reliant the company is on natural resources and how it is moving towards more sustainable practices. If the virgin raw material consumption is lower, this indicates a transition to recycled or alternative materials and a circular economy orientation.

The social sector indices provide an extensive picture of the operation from a social perspective and highlight the good performance that the industry should aim for. They are important metrics that help stakeholders understand the organization's commitment to social responsibility.

Bellow there is a comprehensive table which presents each SBSC sector and their KPIs with a description of how this KPI works and why it is important to be measured, an equation and the measurement unit used for each KPI. The equations presented are mandatory for measuring each KPI in order to build the SBSC and conduct the SWOT analysis.

Table 1: total KPI indexes with description and calculation methods

Pillar		Index	Description	Equation	Measurement Unit
Financial	1	Revenue From Animal Feed	Measures the income from the sale of animal feed. It highlights the economic value of converting waste into a profitable product, based on principles of the circular economy.	Revenue = <i>units sold * price per unit</i>	M€
	2	Cost Savings from Circular Activity	Monitors operational cost reduction achieved through circular economy, such as recycling, reuse, and waste reduction. It quantifies the economic benefits of sustainability practices.	Cost savings = <i>revenue from by – products</i> + <i>operational cost savings from circular activity</i>	€
	3	Revenue Growth	Assessment of the percentage increase in total revenue over a specific period. Key indicator of the company's economy and its ability to expand its market presence and product offerings.	Revenue Growth = $[(\text{current period revenue} - \text{previous period revenue}) \div (\text{previous period revenue})] * 100\%$	%
Learning & Growth	1	Training & Staff development	Evaluates the organization's investment in enhancing the skills and knowledge of employees through training programs. Demonstrates commitment to workforce development and long-term growth.	Average Training Hours per Employee	Hours

	2	Work – Life Balance	Assesses how effectively the company supports its employees in achieving a healthy balance between work responsibilities and personal life. High scores indicate a supportive workplace culture.	Work-life balance satisfaction score	Qualitative
Customer	1	Customer Profitability	Evaluates the profit margin achieved by each customer or customer segment, identifying the most valuable relationships with the business.	Customer Profitability = <i>revenue from customer – cost to serve customer</i>	€
	2	Customer satisfaction	It measures how well the company meets or exceeds customer expectations through its products or services. It is usually evaluated through surveys where customers rate their satisfaction.	Customer Satisfaction = <i>sum of satisfaction scores / number of respondents</i>	%
	3	Product Safety & Quality	Evaluates product compliance with safety standards and quality control policies. High performance on this KPI indicates that products are reliable and meet customer expectations for quality and safety, enhancing customer trust and loyalty.	Product Safety & Quality = <i>[(number of products returned for safety or quality – total number of products sold) / total number of products sold] * 100</i>	%

Internal Process	1	Amount of Liquor Produced	Quantifies the total volume of liquor produced. Important for understanding production levels and linking production to market demand	<i>Total amount of liquor produced</i>	Liters
	2	Productivity Growth	Measures the percentage increase in output per unit of input over time, indicating improvements in operational efficiency. It evaluates how improvements in various processes enhance overall productivity.	<i>Productivity Growth =</i> $[(\text{current period productivity} - \text{previous period productivity}) \div (\text{previous period productivity})] * 100\%$	%
	3	Production of High-Quality Molasses	Monitors the quantity produced, shows the company's ability to produce high-quality by-products, enhancing sustainability and revenue streams.	<i>Total amount of molasses produced</i>	Tons

Sustainability Pillar					
Environmental	1	CO2 emissions	It measures the total greenhouse gas emissions produced by the company. It is important for mitigating the organization's impact on climate change.	$\sum (emissions\ from\ each\ source)$	kgeq
	2	Energy Consumption	It calculates the total amount of energy used by the body within a certain period. Tracking reductions in energy use shows improvements in operational efficiency and environmental stewardship.	Total energy used	kWh
	3	Amount of water reused	It quantifies the volume of water recycled and reused in the company's industrial operations. High reuse rates demonstrate effective water management and conservation efforts.	Total weight of water reused	kg
Social	1	Employee Satisfaction	It measures overall employee satisfaction with their work and work environment. High scores indicate a positive work atmosphere.	Employee Satisfaction = <i>sum of satisfaction score / number of respondents</i>	%
	2	Green Labeling	It quantifies the number of products certified with eco-labels. It shows the company's success in meeting environmental standards for its products, signaling a	Total percentage of green labeled products	%

			commitment to sustainability to consumers.		
	3	Consumption of Virgin Raw Materials	Tracks weight/volume of new, non-recycled materials used in manufacturing processes. lower percentages indicate a reduced environmental footprint.	<i>Total weight of new materials used</i>	kg

3.4. Scenarios Conceptualization

3.4.1. Control Variables

For the continuation of our research, it is necessary to evaluate the impact of various scenarios on the performance of the ASPIS juice industry using a Sustainability Balanced Scorecard (SBSC). To make these scenarios control variables should be chosen. Every control variable has different rates in each scenario which are presented in [table 2].

3.4.1.1. Temperature

In the product-making process that Aspis follows, temperature is an important control variable that affects different aspects of the industry's performance. It can affect the quality of the extracted juice, the amount of animal feed produced and the heat evaporation necessary for making a significant by-product, high-quality molasses. With higher temperature degrees, juice quality could be decreased but the molasses produced might increase their amounts. In each scenario, different temperature degrees are chosen within a $\pm 5^{\circ}\text{C}$ range. Based on the contrasting control variable mixing, each scenario reflects differently on the general performance of the industry. Temperature variations can affect the financial pillar, the customer pillar, and the internal process pillar.

On the financial pillar, based on the quality and the amount of by-products each process gave each index could be increased to enhance the economic growth of the company or decreased to indicate that the temperature chosen in relation to the other control variables rates chosen has to be changed.

For the customer pillar temperature is important to maintain the correct degree to which the oranges will be tasteful and likeable but also extract as many by-products as possible to address the financial needs of the industry and the demand each by-product has. All three indices, customer profitability and satisfaction and product safety and quality should be increased for an optimal temperature result.

The internal process pillar indicates whether the chosen temperature made a considerable amount of high-quality molasses and liquor in order to maintain high productivity growth rates.

Other KPIs this control variable could affect is the amount of water reused since higher temperatures cause more evaporation so less water can be reused and the energy efficiency the industry provides as higher temperatures will result in higher energy usage.

3.4.1.2. Quantity of oranges

Another control variable chosen for the conduction of this research is the quantity of oranges used for the industry's processes. This control variable was chosen to have a quantity spectrum from 15 to 22.5 oranges. Even though more oranges are expected to give higher profits and amounts of by-products the rates that the combination of the rest of the variables have determine the final results. Since the quantity of oranges processed in each scenario is probably the most important variable, it can affect all pillars and hence all indexes chosen for the balanced scorecard approach.

In the financial pillar, a higher amount of oranges strongly affects the revenue growth and the amount of animal feed produced as more oranges result in more by-products for the industry. Cost

savings from circular activities can mostly be affected by the processes the industry uses and secondarily by the amount of oranges they use.

For the learning and growth pillar, a higher quantity of oranges might require more work from the employees resulting in a lower rate of work-life balance and more hours necessary for their training to get to know the procedures used to process the oranges.

The internal process pillar indicates the amount of liquor produced and the amount of high-quality molasses the oranges used in the particular scenario resulted in. Higher amounts of by-products will probably result in increased productivity growth.

The customer satisfaction and profitability rates reflect the good quality and process the oranges had by ordering larger amounts of the products the industry provides or recommending these products to other customers making an adequate amount of clientele.

Finally, in the sustainability pillar, indices of the social sector (employee satisfaction, green-labeled products, and use of virgin raw materials) might increase with larger amounts of oranges that should be processed. Indices of the environmental sector will most likely also increase if a large amount of oranges has to be processed since more energy consumption and CO₂ emissions will be used, and more water used to wash these oranges will get reused.

3.4.1.3. Maturity of oranges (pH)

This control variable is linked with the type of oranges chosen for the process. Oranges with higher pH are more mature and might need less neutralization during the procedures that lead to all the by-products Aspis makes. This control variable has oranges with pH used from 1 to 3 across the different scenarios. Different pH rates result in better or worse quality of by-products and consequently more or less sales. The maturity of oranges particularly affects the financial, customer, and environmental pillars.

For the financial pillar, it is clear that the optimal pH rate can increase all three indices. A proper neutralization rate will result in the right amount of animal feed (and consequently molasses and liquor produced) increasing its revenue since the products made will have better and more demanding quality.

Customer satisfaction is highly affected. More mature oranges tend to be more flavorful, increasing this index. Too ripe oranges may negatively affect the flavor and lower this. The customer profitability index is connected to the increase or decrease of customer satisfaction so it will also be affected.

Maturity of oranges also affects the environmental process indicators because based on the type of oranges the industry has collected more energy consumption could be needed in order to neutralize their pH and make it flavorful resulting in higher CO₂ emissions produced by the overall process.

3.4.1.4. Humidity of oranges

The last control variable chosen for this research is the humidity of oranges. The amount of water each fruit has can affect the overall production process. This variable was chosen to rate between 65%-85% of the humidity of oranges. It affects procedures related to water usage such as the amount of water being reused and the amount of water that has to be dried out from the processes to make products like animal feed, orange liquor, and high-quality molasses. This control variable mainly affects the sustainability, customer, and financial pillars.

In the sustainability pillar, the most affected KPI is the amount of water reused during the processes followed by Aspis. To be aligned with regulations and sustainable policies the water used to wash the oranges, and the water extracted from them in the stages of centrifuge, heat evaporation, and drying should be reused.

In this pillar, another significant index affected is the amount of energy consumed to dry, evaporate, and centrifuge the water. Higher energy consumption leads to higher rates of CO₂ emissions which reflects badly on the sustainable performance of the industry.

The social aspect of the sustainability pillar is also affected since employee satisfaction could be decreased if more work is needed to do the necessary procedures related to water processing.

Customer and financial pillars are aligned with one another because the quality and amount of by-products each scenario results in will heighten customer satisfaction and profitability and subsequently revenue growth, revenue from animal feed, and cost savings from circular activities.

Table 2: Control Variables across the 10 Scenarios – Temperature, Quantity of Oranges, Maturity (pH), and Humidity

Scenarios	Temperature	Quantity of oranges	Maturity of oranges (pH)	Humidity of oranges
1	20	22.5	1	70
2	21	20	1	75
3	21	17.5	2	75
4	19	25	3	70
5	20	15	3	75
6	18	22.5	1	85
7	22	22.5	2	70
8	19	17.5	1	75

9	21	22.5	2	65
10	21	20	2	80

3.5. SWOT

SWOT analysis identifies internal and external factors that determine factors that determine the success and competitiveness of a project, business or individual. Unique resources, robust patents or efficient leadership could be strengths in a SWOT analysis. The weaknesses are internal roadblocks to advancement – high costs, lack of focus on product offerings or low employee engagement that an industry could be facing. Opportunity means something external that can be tapped for expansion, such as new market segments, emerging technologies, strategic partnerships etc. Each opportunity presented in the analysis must be taken under careful consideration so that the industry makes the appropriate effort to enhance or manage to exceed it. Threats may be external hazards like new competitors, shifting market conditions or regulatory issues. The use of SWOT analysis provides a strategic framework to understand and address issues related to circular economy and overall sustainable thinking in juice industry processes. With this methodology strategic plans are developed that capitalize on project strengths and opportunities while addressing project weaknesses and threats. They provide a solid basis for decision making and project management.

Opportunities and threats are external influences that could affect the project but are usually outside the direct industry jurisdiction. In reverse, strengths and weaknesses represent inner matters which relate to the industry as well as to the specifics of the project. By integrating SWOT analysis into every scenario implementation Aspis can systematically evaluate how different strategies and conditions affect its performance in sustainability goals. Such iterative methodology allows dynamic evaluation in which modifications affects are observed and adaptations are made in real time. For instance, implementing a new circular economy practice may introduce unexpected weaknesses or threats that the company can address proactively. This feedback loop keeps the strategic plan relevant and effective to internal as well as external changes in the market.

Through SWOT analysis the organization is creating a culture of continuous enhancement. It forces team members to periodically reflect on company direction and performance. By identifying strengths Aspis can tap into its core competencies to drive growth and innovation. Addressing weaknesses improves operations and reduces inefficiencies. Recognizing opportunities can open new markets or products, but understanding threats prepares the company for potential problems. Such a holistic approach supports the company's sustainability goals and positions it competitively in the juice industry.

4. Results

In this chapter the findings of the study are reported. Results analyzed per KPI and are presented according to the Sustainability Balanced Scorecard followed by a SWOT analysis validating the effectiveness of the Strategic Balanced Scorecard – SBSC. First, there is a baseline framework and then a scenario with results in SBCS and SWOT figures is presented. Graphs of the difference between the baseline framework and the measures of each scenario, to show how upgraded or downgraded each metric was with respect to the scenario conceptualization.

4.1. Baseline case scenario results

The baseline case scenario represents the company standard or typical operational conditions before adjustment of control variables is taken as a reference point. That benchmark versus which all other scenarios can be compared allows an easier identification of the effects of temperature, quantity of oranges, maturity and humidity changes on the company. This baseline helps us evaluate each scenario - to identify what adjustments improve or worsen key performance indicators (KPIs). Doing so shows that different operational strategies may benefit the company in terms of sustainability and growth, but also keep the analysis grounded and realistic. For this thesis the baseline numbers for each KPI were the first scenario results. This ensures that the baseline reflects the actual performance of the company under typical operational conditions without controlling variables being changed. Using these results as benchmark we can measure how each subsequent scenario differs from this standard and identify improvements, challenges in energy consumption, product quality, and revenue. The baseline results driven by this research are depicted in table 3.

Table 3: baseline results for each KPI

KPI	Result
Revenue from animal feed (M€)	1
Cost savings (€)	500
Customer Profitability (€)	200
Amount of liquor produced (liters)	85
CO2 emissions (kgeq)	60
Revenue growth (%)	5
Training & development (hours)	10
Product safety & quality (%)	95

Production of high – quality molasses (tons)	100
Work – life balance (score)	8
Costumer satisfaction (%)	85
Productivity growth (%)	2
Energy consumption (kWh)	1000
Amount of water reused (kg)	200
Consumption of Virgin Raw Materials (kg)	1130
Employee satisfaction (%)	72
Green labelled products (%)	33

4.2. Scenario 1 – 10 KPI results

The 17 key performance indicators were measured for each case scenario based on the use and combination of control variables chosen for each specific scenario. These results are presented in table 4, showcasing how good or not each scenario reflected on the chosen KPIs.

Table 4: Total KPI indexes results across the 10 different Scenarios:

Index	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10
Revenue From Animal Feed(M€)	1	1,4	1,6	1,1	1,8	1,9	1,2	1,7	1,5	1,5
Cost Savings from Circular Activity (€)	500	600	650	520	700	720	530	680	640	560
Revenue Growth (%)	5	6	7	5,5	6,5	7,2	5,2	6,8	7	4,5
Training & Staff development (Qualitative)	10	12	15	10	12	15	10	12	15	10
Work – Life Balance (score)	8	7	9	8	7	9	8	7	9	8
Customer Profitability (€)	200	260	300	210	280	320	220	270	310	230
Customer Satisfaction (%)	85	88	90	86	89	92	87	90	91	88
Product Safety & Quality (%)	95	93	97	96	94	98	95	92	99	91

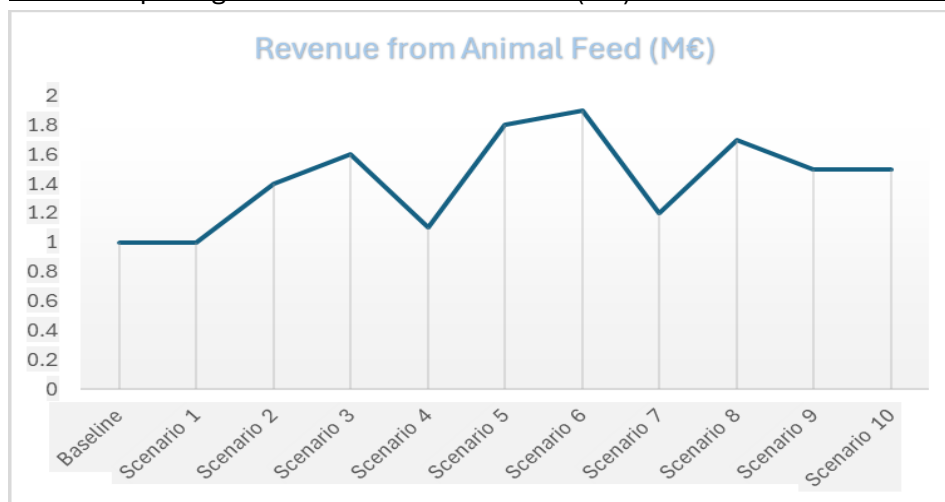
Amount of Liquor Produced (Liters)	100	130	120	105	140	150	110	145	135	145
Productivity Growth (%)	2	2,5	3	2,1	2,6	3,1	2,2	2,8	3,2	2,3
Production of High-Quality Molasses (Tons)	100	130	120	105	140	125	110	135	95	145
CO2 emissions (kseg)	50	60	58	51	67	70	53	66	63	73
Energy Consumpti on (kWh)	1000	1200	1150	1020	1250	1300	1050	1280	1230	1300
Amount of water reused (kg)	200	250	240	210	270	260	220	260	230	280
Employee Satisfaction (%)	78%	76%	72%	74%	73%	77%	71%	76%	72%	75%
Green Labeling (%)	37%	36%	33%	34%	35%	38%	32%	36%	34%	35%
Consumpti on of Virgin Raw Materials (kg)	1,100 kg	1,120 kg	1,200 kg	1,130 kg	1,140 kg	1,080 kg	1,210 kg	1,110 kg	1,190 kg	1,130 kg

4.2.1. Financial pillar KPI results

Outcomes for the Revenue from Animal Feed index across 10 different scenarios are as follows:

1. **Scenario 1:** 1.0 M€
2. **Scenario 2:** 1.4 M€
3. **Scenario 3:** 1.6 M€
4. **Scenario 4:** 1.1 M€
5. **Scenario 5:** 1.8 M€
6. **Scenario 6:** 1.9 M€
7. **Scenario 7:** 1.2 M€
8. **Scenario 8:** 1.7 M€
9. **Scenario 9:** 1.5 M€
10. **Scenario 10:** 1.5 M€

Chart 1 depicting Revenue from Animal Feed (M€) Across Different Scenarios



Commentary on "Revenue Animal Feed (M€)" Index Outcomes:

That “revenue from animal feed(M€) index is partly dependent on all off the chosen control variables. Animal feed production relies on the number of oranges processed, orange maturity and operational efficiency in order to provide favorable outcomes.

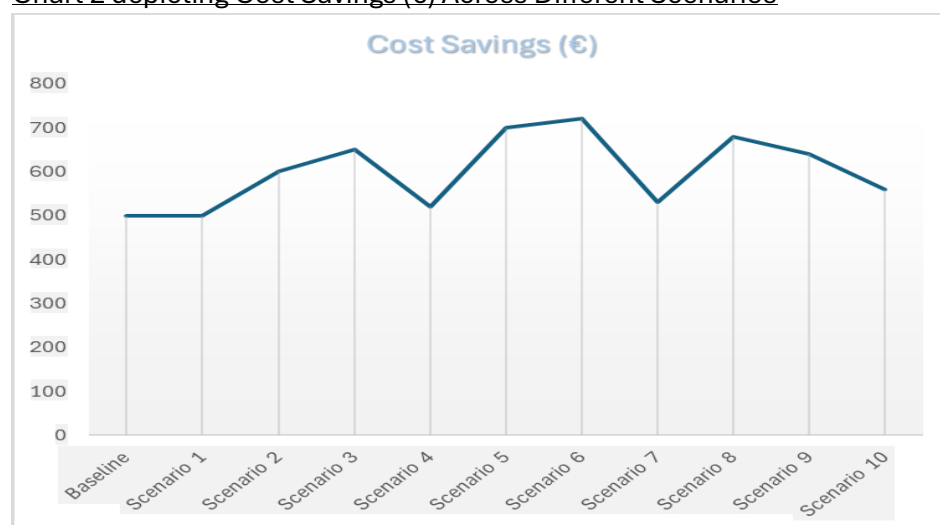
1. Higher quantities of processed oranges (Scenarios 5, 8, and 10) and higher maturity (Scenarios 3, 6, and 9) lead to animal feed revenue increase, while scenarios with moderate increases either in quantity or maturity (Scenarios 3, 9 and 10) show a proportional increase in revenue, indicating that both variables are critical to maximizing byproduct sales.

2. **Baseline Revenues:** Scenario 1 generates a benchmark revenue of 1M€. Most scenarios with higher operational inputs generally exceed this baseline, indicating that the industry can grow to meet increased production and better-quality inputs.
3. **Peaking Revenues:** Scenario 6 has high quantity, maturity & optimal humidity for a maximum revenue of 1.9M€. Combined optimal values yield maximal byproduct utilization and revenue. Enhancing animal feed production is crucial for the industry's sustainable practices, as it helps uphold the eco-friendly image that the integration of sustainability into its financial indicators aims to provide.
4. **Stability in Revenue:** Scenarios 9 & 10 both have 1.5 M€ revenue despite different parameter values. This means revenue from animal feed stopped growing and leveled off at some point, possibly indicating a saturation point in the market for these products.

Outcomes for the Cost Savings from Circular Activity index across the 10 scenarios are as follows:

1. **Scenario 1:** 500 €
2. **Scenario 2:** 600 €
3. **Scenario 3:** 650 €
4. **Scenario 4:** 520 €
5. **Scenario 5:** 700 €
6. **Scenario 6:** 720 €
7. **Scenario 7:** 530 €
8. **Scenario 8:** 680 €
9. **Scenario 9:** 640 €
10. **Scenario 10:** 560 €

Chart 2 depicting Cost Savings (€) Across Different Scenarios



Commentary on "Cost Savings from Circular Activity (€)" Index Outcomes:

The "Cost Savings from Circular Activity (€)" index measures the financial benefits achieved through sustainable practices such as recycling, reuse, and waste reduction. With this index the organization can understand if utilization of circular economic principles reduces operating costs.

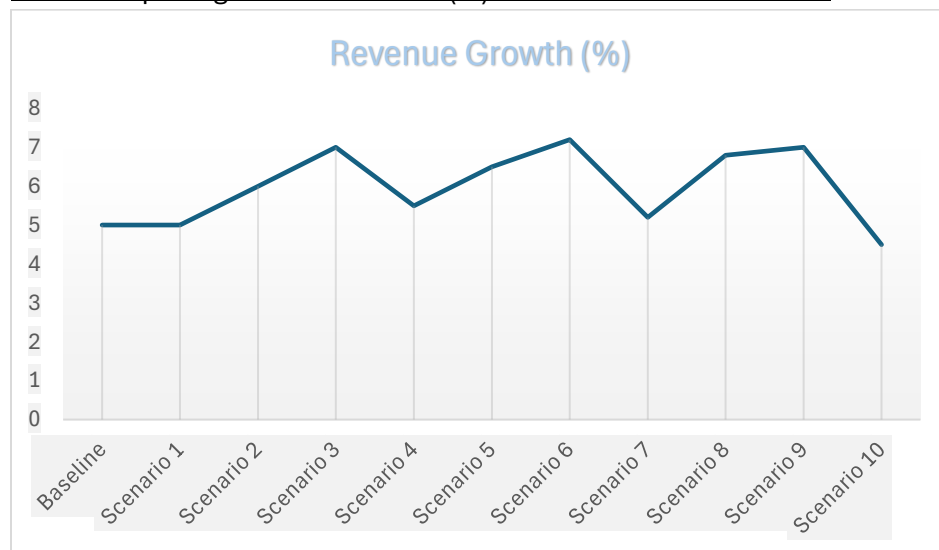
1. **Significant Savings with Higher Inputs:** Scenarios with higher quantities of oranges processed and temperatures (Scenarios 2, 5, 8, and 10) and scenarios with higher maturity levels (Scenarios 3, 6, and 9) exhibit considerable cost savings. Greater production volumes and better-quality inputs enhance the efficiency of recycling and reuse processes, to get higher cost reductions.
2. **Moderate Savings:** Scenarios 2 and 9 with moderate increases in either quantity or maturity show incremental cost savings, reinforcing the importance of optimizing both production and input quality for maximizing circular activity benefits.
3. **Baseline Savings:** Scenario 1, which represents the baseline with moderate values across all parameters, yields a cost saving of 500€, serving as a benchmark. Scenarios with improved operational parameters generally achieve higher savings, demonstrating the scalability of cost reductions with enhanced circular practices.
4. **Peaking Savings:** Scenario 6, combining high quantity, high maturity, and optimal humidity, reaches the highest cost saving of 720€. This scenario shows the effect of optimal conditions on maximizing operational efficiency and reducing costs through circular activities.
5. **Stable Savings:** Scenarios 2, 3 and 9 show relatively stable savings. This stability suggests that beyond certain thresholds, the efficiency gains from circular activities might reach a point where upper limit to cost savings can be achievable through these practices. Having

stable yet high results in circular activity operations reinforces the industry's commitment to sustainability, ensuring efficient resource utilization while maintaining cost-effectiveness.

Outcomes for the "Revenue Growth (%)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 5%
2. **Scenario 2:** 6%
3. **Scenario 3:** 7%
4. **Scenario 4:** 5.5%
5. **Scenario 5:** 6.5%
6. **Scenario 6:** 7.2%
7. **Scenario 7:** 5.2%
8. **Scenario 8:** 6.8%
9. **Scenario 9:** 7%
10. **Scenario 10:** 4.5%

Chart 3 depicting Revenue Growth (%) Across Different Scenarios



Commentary on "Revenue Growth (%)" Index Outcomes:

The Revenue Growth (%) index is extremely relevant to economic growth and to the company's ability to expand market share and product range.

1. Good growth at higher quantity and maturity: Scenarios with more oranges processed per unit amount (Scenarios 2, 5, and 8) and the oranges matured (Scenarios 3, 6, and 9) generally show good revenue growth. That relation seems natural as higher production volumes and

better inputs imply higher revenue due to improved product availability and possibly higher sales prices.

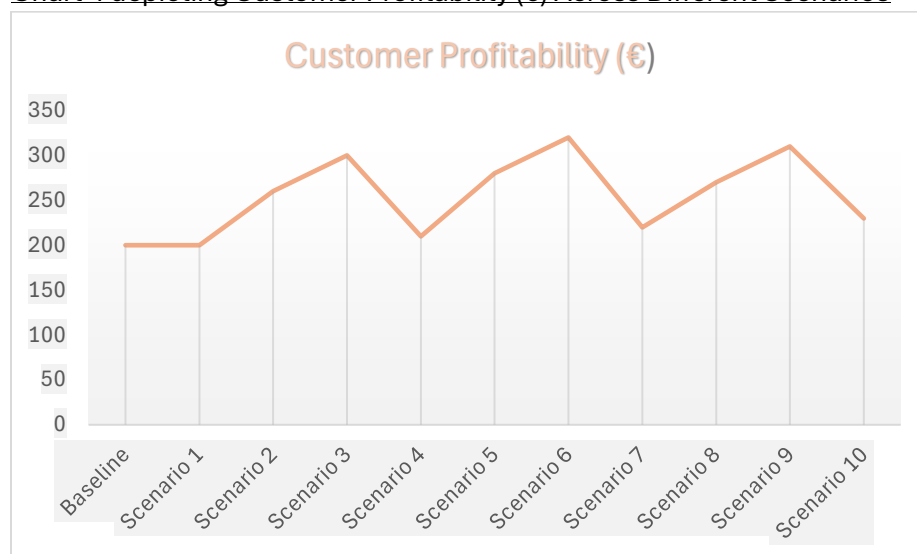
2. **Moderate increase:** Scenarios that show moderate increases either in quantity or maturity (Scenarios 1, 4, and 7) show steady, incremental growth. These outcomes show that even modest improvements in production parameters could drive revenue growth - a sign of continuous operational improvement.
3. **Baseline scenario:** Scenario 1 has a revenue growth of 5% at the baseline with moderate values across all parameters. This is a benchmark for comparing the effect of enriched production parameters on revenue growth, where higher quantities and better maturity lead to generally higher growth rates.
4. **Peak Growth:** With high maturity and large quantities of oranges, scenario 6 achieves 7.2% revenue growth. This illustrates the compounded effect of optimal conditions on maximizing revenue expansion and the industry's capacity to achieve high efficiency and profitability.
5. **Lower growth:** Scenario 10, with the highest quantity but with less favorable maturity and humidity conditions, records the lowest growth at 4.5%. That result means higher production volumes are necessary, but product quality and market conditions are also important to revenue growth. Lowest growth highlights inefficiencies or challenges that need addressing to prevent operational setbacks and maintain competitiveness.

4.2.2. Customer pillar KPI results

Outcomes for the "Customer Profitability (€)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 200 €
2. **Scenario 2:** 260 €
3. **Scenario 3:** 300 €
4. **Scenario 4:** 210 €
5. **Scenario 5:** 280 €
6. **Scenario 6:** 320 €
7. **Scenario 7:** 220 €
8. **Scenario 8:** 270 €
9. **Scenario 9:** 310 €
10. **Scenario 10:** 230 €

Chart 4 depicting Customer Profitability (€) Across Different Scenarios



Commentary on "Customer Profitability (€)" Index Outcomes:

The customer Profitability (€) index evaluates the profit margin with each customer/customer segment and identifies the most valuable relationships with business. This index helps to understand the financial impact of customer interactions and optimize strategies for maximizing profit.

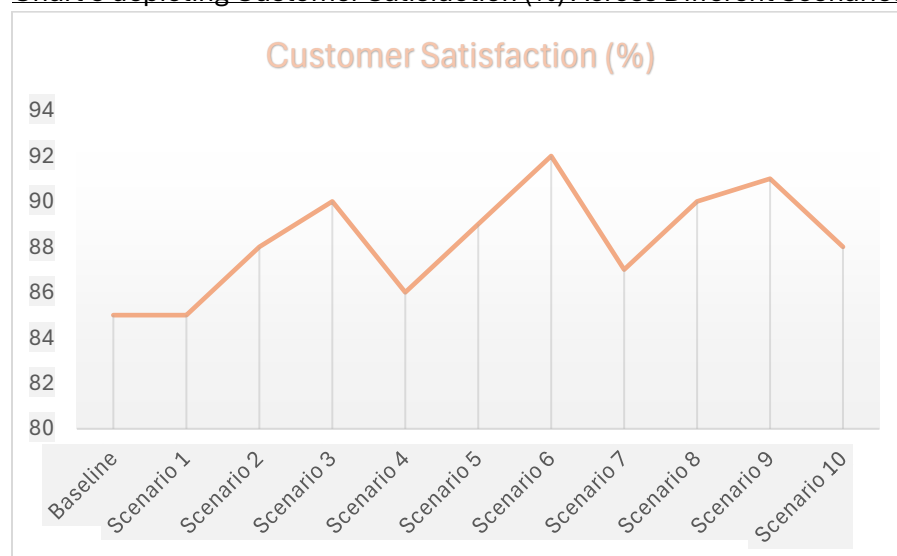
1. **Higher Profitability:** High orange quantity and higher temperature (Scenarios 2, 5, 8 and 10) and maturity (Scenarios 3, 6 and 9) show increased customer profitability. This is logical since oranges in larger amounts and more mature will probably improve product quality and thus increase sales prices and margin.
2. **Incremental Increases:** Scenarios with moderate increases of the above variables (Scenarios 4 and 7) show marginal profitability gains. Such scenarios highlight the need to optimize production volume and input quality to improve financial results of customer transactions.
3. **Baseline Profitability:** Scenario 1 the baseline level, with moderate values for all parameters, shows a customer profitability of 200€. This is a reference point where scenarios with improved operational parameters generally outperform this baseline.
4. **Peak Profitability:** Scenario 6, high quantity, high maturity and optimal humidity results highest profitability of 320€. This case demonstrates the effect of optimal conditions on maximizing financial returns from customer interactions. Understanding these optimal conditions will enable the company to consistently implement processes that lead to high profitability with each product it sells.
5. **Stable Profitability:** Scenarios 1, 4 and 7 have relatively stable profitability despite different parameter values. Its stability suggests that beyond certain levels of production and maturity,

customers will become loyal to the products the industry provides and gains in profitability might start to stabilize within higher rates.

Outcomes for the "Customer Satisfaction (%)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 85%
2. **Scenario 2:** 88%
3. **Scenario 3:** 90%
4. **Scenario 4:** 86%
5. **Scenario 5:** 89%
6. **Scenario 6:** 92%
7. **Scenario 7:** 87%
8. **Scenario 8:** 90%
9. **Scenario 9:** 91%
10. **Scenario 10:** 88%

Chart 5 depicting Customer Satisfaction (%) Across Different Scenarios



Commentary on "Customer Satisfaction (%)" Index Outcomes:

The measurement of how well the company satisfies or exceeds client expectations regarding its services/products is done by the "Customer Satisfaction" Index. And its good scores breed loyalty and high brand reputation.

1. **High Levels of Customer Satisfaction across all Scenarios:** Customers are highly satisfied across all scenarios with scores from 85% to 91%. It means that generally the company

meets or exceeds customer expectations. Sustainable practices integrated to each aspect of the industry has raised quality and reliability of the products Aspis produces.

2. **Maximum Satisfaction with high maturity and production quality:** Ideal customer satisfaction scenarios with high maturity and production quality are scenarios 3, 6, and 9 (90%, 92%, 91%). They present the opportunity for high satisfaction to be maintained and even leveraged to build stronger customer loyalty and retention.
3. **Higher Quality equals to greater satisfaction:** More oranges processed scenarios (2, 5, 8 & 10) tend to have higher satisfaction scores 88%- 89%. That suggests higher production capacity can satisfy increased customer demand without compromising product quality if managed properly.
4. **Baseline Satisfaction score:** Scenario 1 has 85% customer satisfaction score - baseline scenario with moderate parameters. This is a benchmark against which to compare the impact of improved operational parameters on customer satisfaction, with most scenarios improving over this baseline.
5. **Generally Consistent High Scores Despite Variations:** Scores remain constant despite differences in production parameters indicating high customer satisfaction capability. This consistency reflects the company's commitment to quality control and customer service. Scenarios under moderate operational challenge such as Scenario 4 with a score 86% are high but somewhat less satisfied meaning that increased operational pressures can slightly impact overall customer experience and satisfaction levels.

Outcomes for the "Product Safety & Quality (%)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 95%
2. **Scenario 2:** 93%
3. **Scenario 3:** 97%
4. **Scenario 4:** 96%
5. **Scenario 5:** 94%
6. **Scenario 6:** 98%
7. **Scenario 7:** 95%
8. **Scenario 8:** 92%
9. **Scenario 9:** 99%
10. **Scenario 10:** 91%

Chart 6 depicting product safety & quality (%) Across Different Scenarios



Commentary on "Product Safety & Quality (%)" Index Outcomes:

The "Product Safety & Quality (%)" index measures the compliance of products with safety standards and quality control policies. This index is critical for ensuring the reliability and trustworthiness of the company's products, directly impacting customer trust and loyalty.

1. High quality standards across scenarios: Product Safety and quality percentages across scenarios show high percentages of 91% to 99% for most scenarios. Despite some small variations, the overall high scores across scenarios reflect a consistent commitment to Product Safety and quality. This consistency is crucial for building and maintaining customer trust.
2. Impact of increased quantity and maturity: Increase of the quantity and maturity of oranges processed (scenarios 2, 5, 8 and 10) and the scenarios with higher maturity levels (3, 6, 9) result in different Product Safety and quality outcomes. Scenario 6 for instance scores 98% indicating that optimal conditions can improve product quality.
3. Baseline quality: the baseline is set at 90% representing a benchmark for comparing the effects of enhanced production parameters on product quality.
4. Peak quality: Scenario 9, combining high maturity with favorable conditions, achieves the highest Product Safety and quality score at 99%. This outcome underscores the positive impact of integrating sustainable products with high maturity levels and product quality, indicating that the virgin raw materials used, and circular activities conducted contribute significantly to producing high quality, safe products.
5. Lower compliance to quality control: Scenarios 2, 8 and 10 have outputs which are still favorable and can be considered high but are lower than most scenarios. Slight decrease on

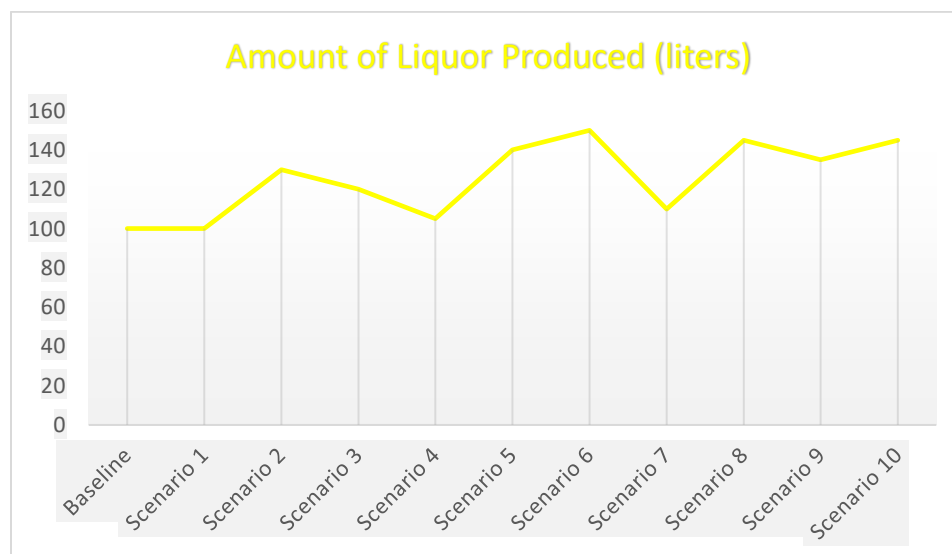
this index should be addressed by the industry as it may affect other aspects of its customer satisfaction and profitability performance.

4.2.3. Internal process pillar KPI results

Outcomes for the "Amount of Liquor Produced (Liters)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 100 Liters
2. **Scenario 2:** 130 Liters
3. **Scenario 3:** 120 Liters
4. **Scenario 4:** 105 Liters
5. **Scenario 5:** 140 Liters
6. **Scenario 6:** 150 Liters
7. **Scenario 7:** 110 Liters
8. **Scenario 8:** 145 Liters
9. **Scenario 9:** 135 Liters
10. **Scenario 10:** 145 Liters

Chart 7 depicting Amount of Liquor Produced (lit) Across Different Scenarios



Commentary on "Amount of Liquor Produced (Liters)" Index Outcomes:

The "Amount of Liquor Produced (Liters)" index measures the total volume of liquor generated during the citrus processing. This index is essential for understanding production levels and

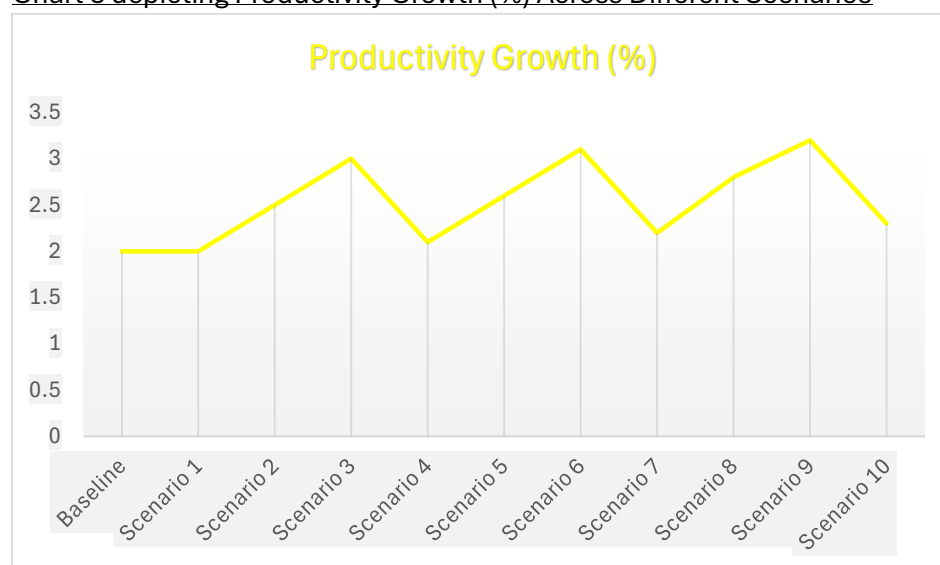
aligning them with market demand, providing insights into the efficiency and capacity of the production process.

1. **Higher Production with Increased Quantity:** Scenarios with higher quantities of oranges processed (Scenarios 2, 5, 8, and 10) exhibit significant increases in the amount of liquor produced. This trend is expected, as a larger input volume directly contributes to higher production output.
2. **Moderate Increases in Production:** Scenarios with moderate increases in quantity or a balance of other parameters (Scenarios 1, 4, and 7) display incremental improvements in liquor production. These scenarios highlight the impact of moderate adjustments in operational parameters on production efficiency, indicating that even small increases in input volume can enhance output.
3. **Baseline Production:** Scenario 1, representing the baseline with moderate values across all parameters, yields a production volume of 100 liters. This serves as a benchmark for comparing the effects of enhanced operational parameters.
4. **Peak Production:** Scenario 6, which combines high quantity with favorable maturity and humidity conditions, achieves the highest production volume of 150 liters. This scenario underscores the compounded effect of optimal conditions on maximizing production output, indicating the potential for significant gains when multiple favorable factors are aligned.
5. **Stable Production Levels:** Scenarios 3, 4 and 7, despite differing parameter values, exhibit relatively stable production volumes at 120 liters, 105 liters and 110 liters. This stability suggests that beyond certain thresholds, the increase in production may begin to increase, indicating a potential maximum efficiency level of the processing system.

Outcomes for the "Productivity Growth (%)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 2%
2. **Scenario 2:** 2.5%
3. **Scenario 3:** 3%
4. **Scenario 4:** 2.1%
5. **Scenario 5:** 2.6%
6. **Scenario 6:** 3.1%
7. **Scenario 7:** 2.2%
8. **Scenario 8:** 2.8%
9. **Scenario 9:** 3.2%
10. **Scenario 10:** 2.3%

Chart 8 depicting Productivity Growth (%) Across Different Scenarios



Commentary on "Productivity Growth (%)" Index Outcomes:

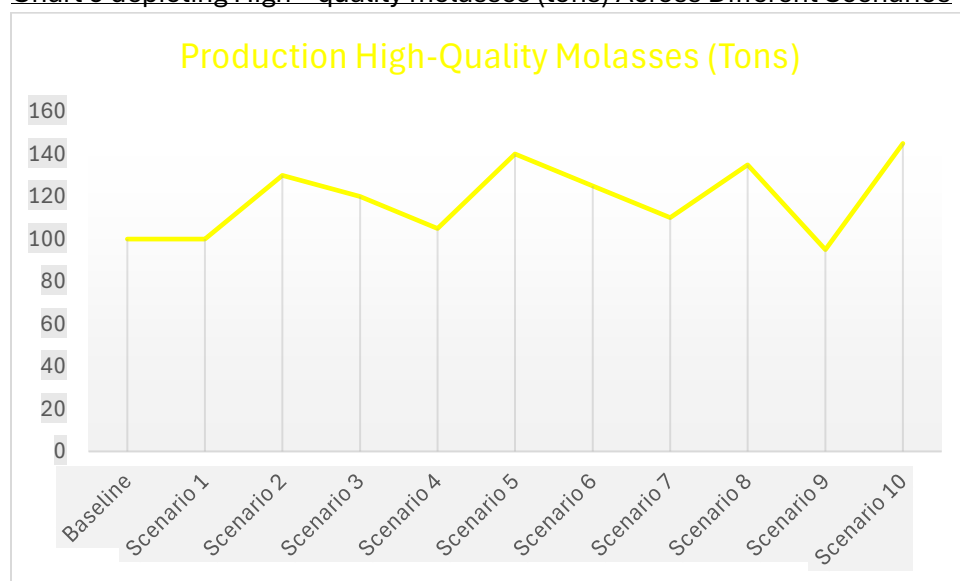
The Productivity Growth (%) index measures the percentage increase in output per unit input over time indicating an improvement in operational efficiency. This index helps to understand how various process enhancements/optimizations improve productivity.

1. **Incremental Productivity Gains:** More oranges processed and higher maturity (Scenarios 2, 5, 8, and 10) generally lead to greater productivity gains with increased quantity and maturity. From these scenarios, increased input volumes together with better material quality indicate higher productivity.
2. **Moderate to low Productivity Growth:** Scenarios with Moderate quantity or balance of other parameters (Scenarios 1, 4, and 7) show steady, incremental Productivity gains. Such results show that even slight improvement of operation parameters can raise productivity indicating the benefit of continuous process optimization.
3. **Baseline Productivity:** Scenario 1, with moderate values for all parameters, reports 2% Productivity growth. This is a baseline against which to compare the effects of enriched production parameters on productivity growth, most scenarios improving over this baseline.
4. **Peak Productivity:** Scenario 9 has high maturity with favorable conditions and a 3.2% Productivity growth. This situation shows how optimal conditions can increase productivity in combination. The continuous growth has led to maximum results indicates the importance of sustainability integration in driving both financial performance and long-term operational efficiency, with eco-friendly practices that contribute to overall business success.
5. **Stable Productivity Growth:** Scenarios 2, 5, and 8, despite differing operational parameters, show relatively Stable Productivity Growth rates of 2.5% to 2.8%. That stability implies some level of production and maturity that could continuously improve productivity.

Outcomes for the "Production of High-Quality Molasses (Tons)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 100 tons
2. **Scenario 2:** 130 tons
3. **Scenario 3:** 120 tons
4. **Scenario 4:** 105 tons
5. **Scenario 5:** 140 tons
6. **Scenario 6:** 125 tons
7. **Scenario 7:** 110 tons
8. **Scenario 8:** 135 tons
9. **Scenario 9:** 95 tons
10. **Scenario 10:** 145 tons

Chart 9 depicting High – quality molasses (tons) Across Different Scenarios



Commentary on "Production of High-Quality Molasses (Tons)" Index Outcomes:

The index "Production of high-quality molasses Tons" measures the total amount of high-quality molasses produced during the citrus processing. This index is important to understand whether the company can produce useful by-products that contribute to sustainability and revenue streams.

1. **Higher Production with Increased Quantity and Maturity:** Scenarios in which more oranges are processed (Scenarios 2, 5, 8 and 10) result in significant increases in the quality molasses production. This is expected as larger input volumes usually lead to higher by-product yields

corresponding to the efficiency of production in converting raw materials into high quality molasses.

2. **Incremental Increases:** Scenarios with moderate increases in quantity or balance of other parameters (Scenarios 1,4 and 7) show steady, incremental increases in molasses production. These outcomes indicate that even small increases in production inputs could contribute to higher quality molasses generation.
3. **Baseline Production:** Scenario 1 - baseline with moderate values for all parameters - records 100 tons Production volume. This is a benchmark for comparison of the effects of different augmented operational parameters on molasses production.
4. **Scenario 10 – Peak Production:** High quantity with good maturity and humidity results in highest production volume of 145 tons. A compounded effect of optimal conditions on maximizing molasses output indicates a potential gain when several favorable factors are aligned.
5. **Lower Production under Less Optimal Conditions:** Scenario 9 is very mature but has the lowest Production volume of 95 tons. This outcome demonstrates that maturity is an important factor, but quantity and operational efficiency also determine the quality of the molasses produced overall.

4.2.4. Learning & Growth KPI results

Outcomes for the "Training & Development (Hours)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 10 hours
2. **Scenario 2:** 12 hours
3. **Scenario 3:** 15 hours
4. **Scenario 4:** 10 hours
5. **Scenario 5:** 12 hours
6. **Scenario 6:** 15 hours
7. **Scenario 7:** 10 hours
8. **Scenario 8:** 12 hours
9. **Scenario 9:** 15 hours
10. **Scenario 10:** 10 hours

Chart 10 depicting Training & Staff Development (h) Across Different Scenarios



Commentary on "Training & Development (Hours)" Index Outcomes:

The "Training and development" index measures the average training hours per employee. That index reflects a commitment by the company to continuously improve employee skills and knowledge through structured training programs essential for a competitive edge and innovation with the organization.

1. **Higher Training Hours with Greater Maturity:** Scenarios with higher maturity Levels (Scenarios 3, 6 and 9) show the highest training hours (15 hours). These results indicate further investment in employee development is probably needed for more complex or advanced

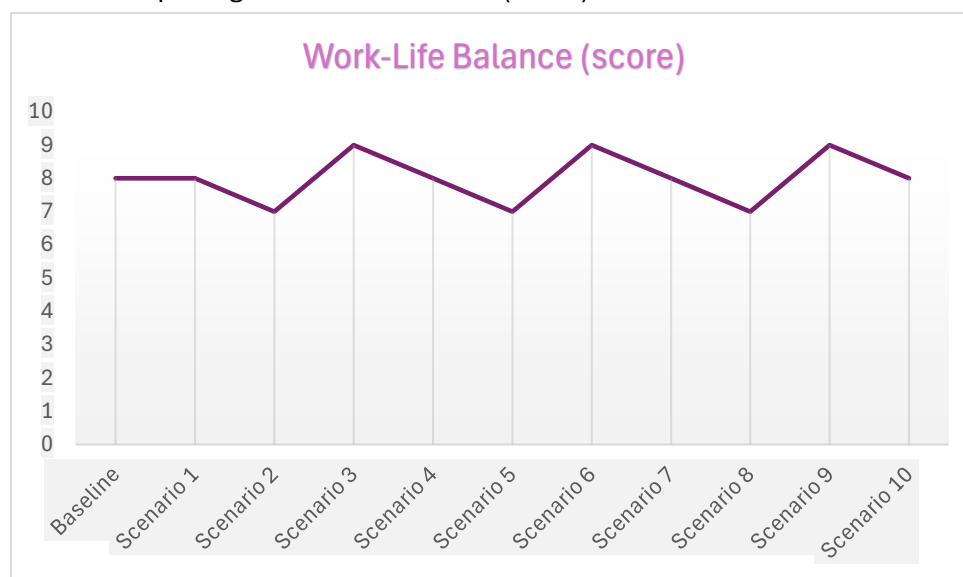
production processes applicable to oranges of higher maturity. Scenarios 2, 5 and 8 with moderately increased production parameters report 12 Training Hours. This reflects a balanced approach where the company accepts more training is required to handle increased production volumes and moderate process complexity.

2. **Baseline Training Hours:** Scenario 1 is the baseline with moderate values for all parameters, accompanied by scenarios 4, 7 and 10 recording 10 hours of training. This baseline represents the standard training commitment required to continue regular operation without significant change in production complexity or volume.
3. **Consistent Training Commitment:** Despite variations in production volumes and other parameters, training hours remain constant within groupings of scenarios. Such consistent approach suggests structured employee development where training programs are developed in accordance with the specific operational environment without great variations.
4. **Strategic training Allocation:** The outcomes show that the organization allocates Training hours according to production process complexity and volume. Increased training hours have a significant effect on indices such as customer satisfaction, productivity and revenue growth and even employee satisfaction since employees better prepared and educated on the products they provide and the procedures they have to perform will enhance the overall performance of the industry.

Outcomes for the "Work-Life Balance (Score)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 8
2. **Scenario 2:** 7
3. **Scenario 3:** 9
4. **Scenario 4:** 8
5. **Scenario 5:** 7
6. **Scenario 6:** 9
7. **Scenario 7:** 8
8. **Scenario 8:** 7
9. **Scenario 9:** 9
10. **Scenario 10:** 8

Chart 11 depicting Work – Life Balance (score) Across Different Scenarios



Commentary on "Work-Life Balance (Score)" Index Outcomes:

The index measures how well the company helps its employees strike a Balance between work and personal life. This index is very useful to evaluate the workplace culture and its influence on employee morale and productivity.

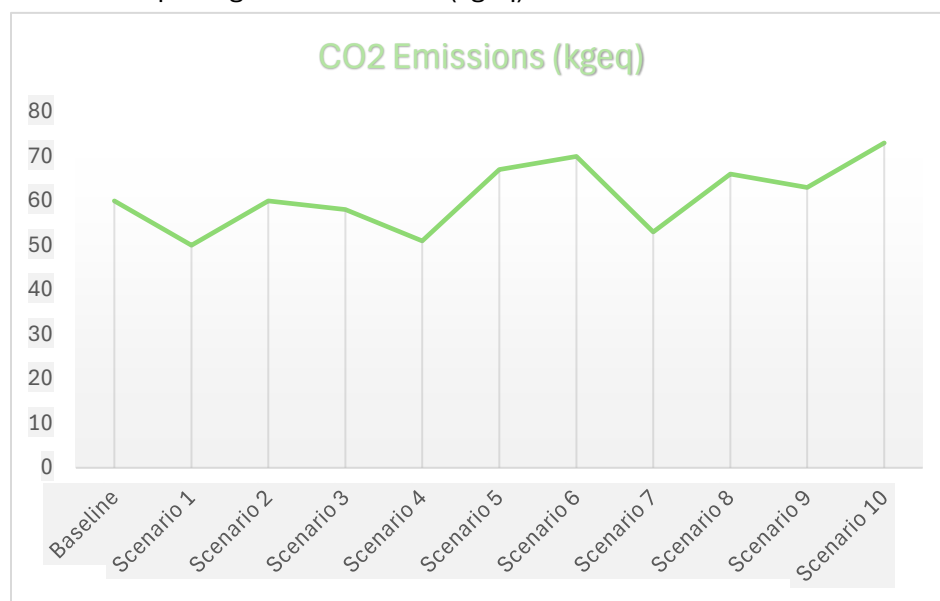
1. **High Scores Indicating positive work environment:** Scenario 1, 4, 7 & 10 all score an 8, representing a generally positive workplace where employees can strike a good balance between their work and personal lives.
2. **Optimal Work-Life Balance with Increased Maturity:** Scenarios 3, 6 & 9, which achieve the highest score of 9, represent optimal work-life balance conditions. They usually involve moderate temperatures and maturity levels that may correlate with more structured/efficient work processes reducing stress and increasing employee satisfaction. Hi maturity likely implies smoother operation, better planning management.
3. **Moderate Scores with Increased Production:** Scenarios 2, 5, and 8, scoring 7, show a moderate decrease in work-life balance. Such scenarios involve higher volumes of oranges processed and higher production demands may result in increased workloads and possibly more stress.
4. **Consistency in Supportive Work Environment:** Despite the differences in production and other operational parameters, the scores are generally high (7 to 9) across all scenarios. This consistency demonstrates a commitment to a supportive work environment irrespective of production conditions. This consistency directly affects employee well-being and productivity, which in turn supports sustainable growth and long-term profitability.

4.2.5. Environmental sector KPI results

Outcomes for the "CO2 emissions (kgeq)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 50 kgeq
2. **Scenario 2:** 60 kgeq
3. **Scenario 3:** 58 kgeq
4. **Scenario 4:** 51 kgeq
5. **Scenario 5:** 67 kgeq
6. **Scenario 6:** 70 kgeq
7. **Scenario 7:** 53 kgeq
8. **Scenario 8:** 66 kgeq
9. **Scenario 9:** 63 kgeq
10. **Scenario 10:** 73 kgeq

Chart 12 depicting CO2 Emissions (kgeq) Across Different Scenarios



Commentary on "CO2 emissions (kgeq)" Index Outcomes:

The "CO2 emissions" index measures the greenhouse gas emissions of the citrus processing operation. This index is very useful to evaluate environmental impact of production and to identify carbon footprint reducing opportunities.

1. Higher emissions with increased quantity: Scenarios with higher quantities of oranges processed (scenarios 2, 5, 8 and 10) result in higher CO2 emissions. This is expected because higher production volumes usually require more energy and resources which in turn cause higher greenhouse gases emissions. A relation between high humidity and CO2 emissions was also observed in scenarios 2, 5, 6, 8 and 9 which is explained by the energy

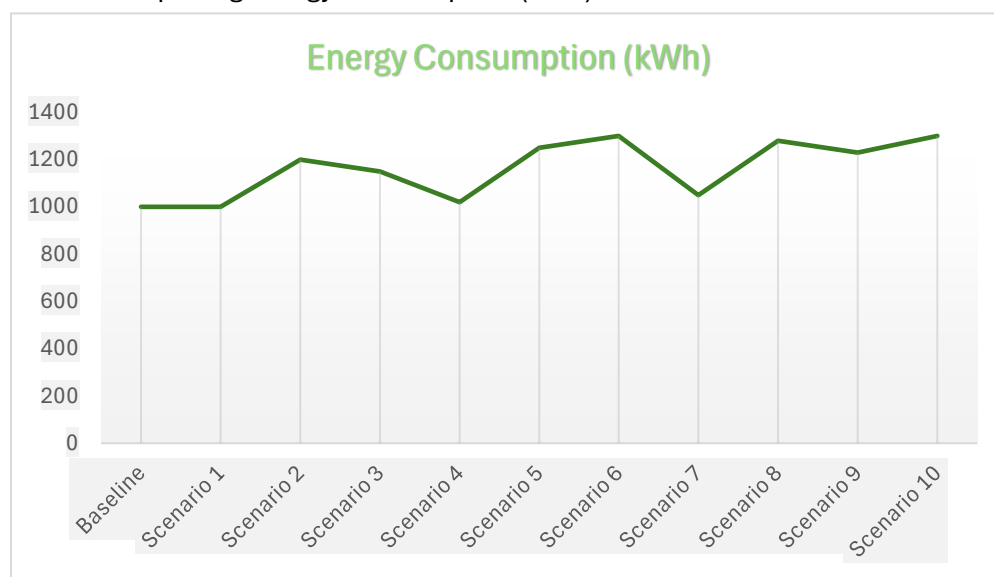
increase these scenarios use for procedures such as evaporating and drying the processed products.

2. Moderate emissions: Characterized by moderate quantity or balanced operational parameters increase emissions incrementally (scenario 1, 4 and 7). In all of these scenarios, slight rises in production could lead to greater emissions.
3. Baseline emissions: scenario 2 is the baseline with moderate values for all parameters. CO₂ emissions are 60 kgeq. That baseline serves as a reference point for comparison of emissions effects. Improved production parameters with generally increased commissions come from higher operational inputs.
4. Peak – harmful emissions: scenario 10 combines high quantity with increased humidity to produce highest CO₂ emissions of 73kgeq. It shows how high production levels can be environmentally harmful and how emission reduction strategies can be useful as production scales up. Harmful emissions release in the industry’s processes needs to be minimized to align with sustainable integration goals, ensuring environmentally friendly practices while maintaining operational efficiency and long-term viability.
5. Lower emissions with optimal efficiency: scenario 4 has a higher maturity and quantity level but records the lowest emissions at 51kgeq. That results in the conclusion that optimizing parameters like maturity and possible operation efficiency could mitigate emissions even at relatively high production inputs. The industry is effectively minimizing its environmental impact, indicating a commitment to sustainable practices and responsible resource management.

Outcomes for the "Energy Consumption (kWh)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 1000 kWh
2. **Scenario 2:** 1200 kWh
3. **Scenario 3:** 1150 kWh
4. **Scenario 4:** 1020 kWh
5. **Scenario 5:** 1250 kWh
6. **Scenario 6:** 1300 kWh
7. **Scenario 7:** 1050 kWh
8. **Scenario 8:** 1280 kWh
9. **Scenario 9:** 1230 kWh
10. **Scenario 10:** 1300 kWh

Chart 13 depicting Energy Consumption (kWh) Across Different Scenarios



Commentary on "Energy Consumption (kWh)" Index Outcomes:

The "Energy Consumption (kWh)" index evaluates the energy used in citrus processing, offering insights into both operational efficiency and sustainability. Monitoring this index is crucial for identifying areas to improve energy use and environmental impact.

1. **Baseline Comparison** Scenario 1 sets the baseline at 1000 kWh, serving as a reference point for evaluating other scenarios' energy efficiency under different operational conditions.
2. **High Consumption:** Scenarios 6 and 10 reached 1300 kWh, showing that higher production leads to increased energy use, suggesting possible inefficiencies.
3. **Efficient Use:** Scenarios 4 (1020 kWh) and 7 (1050 kWh) maintained lower energy use, indicating more effective management under specific conditions. While high energy

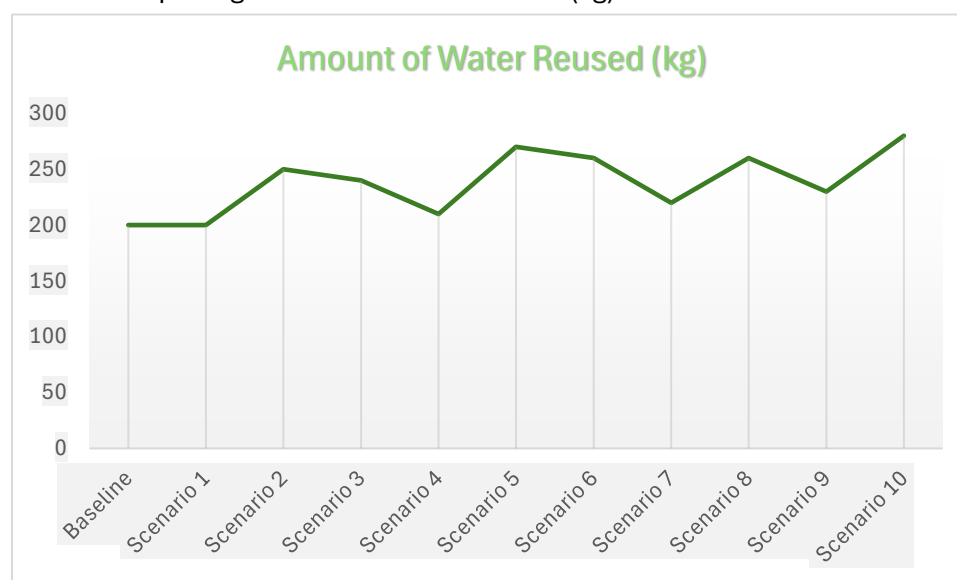
consumption often aligns with increased production, as seen in Scenarios 5 and 8, it doesn't always mean efficiency. This suggests a need to optimize energy use to avoid waste, aligning with sustainable practices.

4. A review of high-consumption scenarios should address inefficiencies in Scenarios 6 and 10 to improve energy management and efficient practices used in scenarios 4 and 7 should be applied to achieve energy savings.

Outcomes for the "Amount of Water Reused (kg)" index across the 10 scenarios are as follows:

1. **Scenario 1:** 200 kg
2. **Scenario 2:** 250 kg
3. **Scenario 3:** 240 kg
4. **Scenario 4:** 210 kg
5. **Scenario 5:** 270 kg
6. **Scenario 6:** 260 kg
7. **Scenario 7:** 220 kg
8. **Scenario 8:** 260 kg
9. **Scenario 9:** 230 kg
10. **Scenario 10:** 280 kg

Chart 14 depicting Amount of Water Reused (kg) Across Different Scenarios



Commentary on "Amount of Water Reused (kg)" Index Outcomes:

This index measures the volume of water recycled and reused in the company's industrial

operations in kilograms. This index is fundamental for assessing the water management practices and the sustainability commitment of the company.

1. Higher water reuse and increased maturity and quantity: increase the quantity and maturity of oranges in scenarios 2, 5, 8 and 10 generally increase the reuse of water. Higher amount of water reused indicated that the company makes a remarkable effort to align with sustainable regulations and integrate circular activities while processing its products.
2. Incremental increases: scenarios with moderate increases in quantity or balanced operational parameters (scenarios 1, 4 and 5) show steady, incremental improvements in water reuse. Such outcomes suggest that even modest improvement of operation parameters could affect water management practices, and thus demonstrate the scalability of water reuse initiatives.
3. Baseline water reuse: scenario 1 records 200kg of water reused at the baseline with moderate values for all parameters. This is a baseline against which to compare the effect of enriched production parameters and water used, most scenarios achieving higher reuse volumes than this baseline.
4. Peak water reuse: scenario 10 combining high quantity with optimal maturity and humidity conditions, achieves the maximum water use volume at 280kg. This situation demonstrates that optimal conditions have a compound effect on maximizing water use and that significant gains can result when several favorable conditions are combined.
5. Consistent water reuse: the high values in general for all scenarios between 200kg – 280kg represent the consistent water reuse commitment. That consistency indicates that the company has implemented water management practices enabling high water recycling rates in all production conditions.

4.2.6. Social sector KPI results

Employee Satisfaction (%) Actual Outcomes Across the 10 different scenarios are as follows:

1. **Scenario 1:** 78%
2. **Scenario 2:** 76%
3. **Scenario 3:** 72%
4. **Scenario 4:** 74%
5. **Scenario 5:** 73%
6. **Scenario 6:** 77%
7. **Scenario 7:** 71%
8. **Scenario 8:** 76%
9. **Scenario 9:** 72%
10. **Scenario 10:** 75%

Chart 15 depicting Employee Satisfaction (%) Across Different Scenarios



Commentary on "Employee Satisfaction (%)" Index Outcomes:

This index shows the satisfaction score the company makes across the different scenarios, indicating if each scenario can provide the appropriate conditions for the best possible satisfaction levels.

1. **High Scores Reflecting Positive Employee Engagement:** Scenarios 1 (78%) and 6 (77%) show the highest levels of employee satisfaction. These scores indicate that employees in these

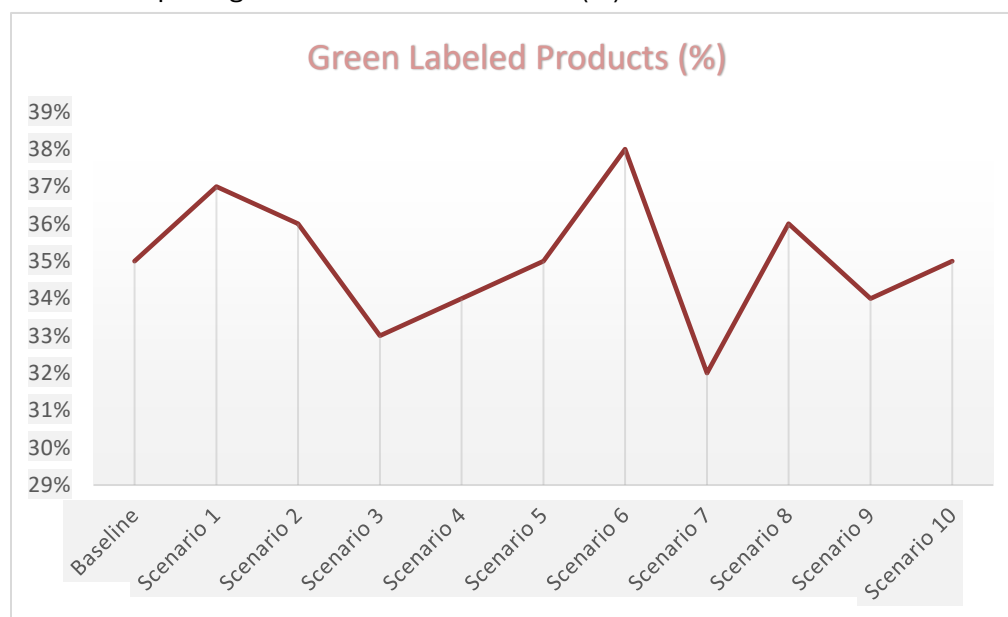
scenarios likely experience favorable working conditions and morale. This could be due to manageable workloads, efficient processes, or a balanced workplace culture.

2. **Optimal Scores with Increased Operational Efficiency:** Scenario 10 scores a solid 75%, demonstrating a slightly lower, but still strong employee satisfaction level. In this scenario, stable working conditions likely create an optimal environment where employees feel supported and valued.
3. **Moderate or Baseline Scores with Increased Workloads:** Scenarios 3 (72%), 5 (73%) and 9 (72%) fall slightly below the highest satisfaction scores but still reflect a positive work culture. These scenarios may involve moderate increases in workload or operational complexity that slightly affect employee morale.
4. **Impact of Higher Production on Lower Scores:** Scenarios 3 (72%) and 7 (71%) have the lowest scores, which may be attributed to increased production demands or more challenging work environments. These scenarios likely involve more intense operational conditions, resulting in reduced employee satisfaction compared to other scenarios.

Green-Labeled Products (%) Actual Outcomes across 10 different scenarios are as follows:

1. **Scenario 1:** 37%
2. **Scenario 2:** 36%
3. **Scenario 3:** 33%
4. **Scenario 4:** 34%
5. **Scenario 5:** 35%
6. **Scenario 6:** 38%
7. **Scenario 7:** 32%
8. **Scenario 8:** 36%
9. **Scenario 9:** 34%
10. **Scenario 10:** 35%

Chart 16 depicting Green – Labeled Products (%) Across Different Scenarios



Commentary on "Green-Labeled Products (%)" Index Outcomes:

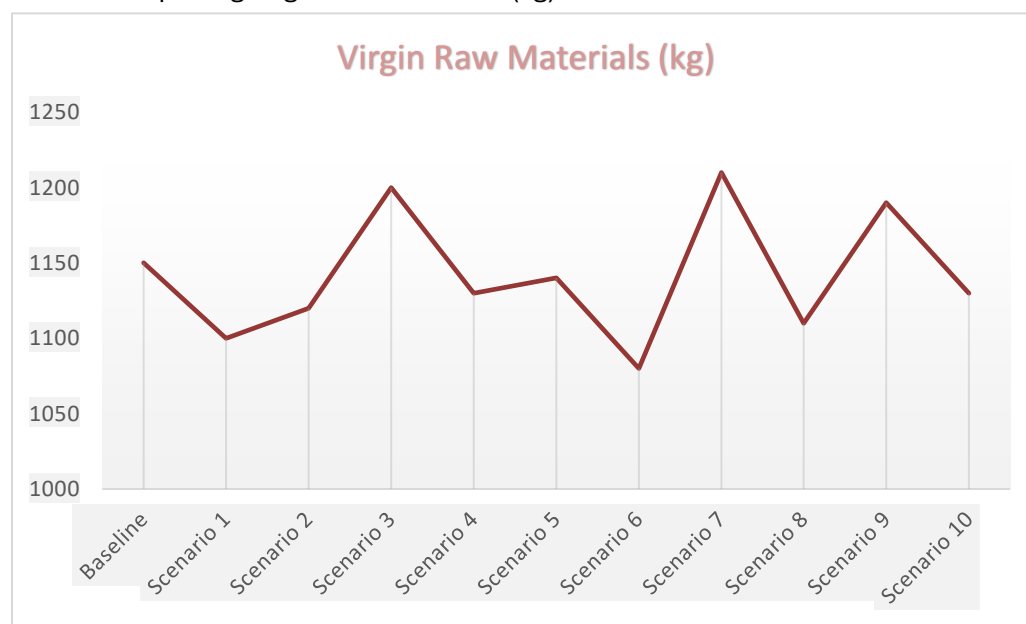
The "Green – labeled products (%)" index measures the total amount of green – labeled products used by the citrus processing operation over a specific period. This index, like many others, is crucial for assessing the operational efficiency and the environmental impact of the production process.

1. High scores reflecting sustainability commitment: scenario 6 has the highest percentage of green labeled products (38%). That shows the company values environmental practices and is working towards sustainability through environmentally friendly methods of production.
2. Optimal scores with increased eco – consciousness: Scenario 1 (37%) Also shows an optimal scored indicating a strong commitment to produce product with eco-labels. This demonstrates how the company has embedded sustainability strategies and its activities.
3. Moderate or baseline scores with lower focus and green products: scenarios 5 (35%), and 10 (35%), Are slightly above baseline and indicate that sustainability practices are in place, but more eco-labeled products could be added.
4. Consistent maintenance of sustainability practices: in most scenarios percentages of green labeled products remain close to the baseline of 35% not suggesting steady implementation of eco labeling practices. This reflects a consistent sustainability strategy across different operational conditions.
5. Effect of increased production and lower scores: Scenarios 7 (32%) and 3 (33%), have lower percentages which may be due to increased production complexity or a focus on scaling up operations, which slightly less emphasizes eco-friendly product labeling.

Virgin Raw Materials (kg) Actual Outcomes Across the 10 different scenarios are as follows:

1. **Scenario 1:** 1,100 kg
2. **Scenario 2:** 1,120 kg
3. **Scenario 3:** 1,200 kg
4. **Scenario 4:** 1,130 kg
5. **Scenario 5:** 1,140 kg
6. **Scenario 6:** 1,080 kg
7. **Scenario 7:** 1,210 kg
8. **Scenario 8:** 1,110 kg
9. **Scenario 9:** 1,190 kg
10. **Scenario 10:** 1,130 kg

Chart 17 depicting Virgin Raw Materials (kg) Across Different Scenarios



Commentary on "Virgin Raw Materials (kg)" Index Outcomes:

The virgin raw material index monitors the consumption of non-recycled raw materials in manufacturing processes. It underscores the organization's dependence on newly extracted resources, consequently influencing cost-effectiveness and sustainability practices.

1. **High material use:** High scores of virgin raw material usage represented in Scenarios 3 with 1,200 kg, 7 with 1,210 kg and 9 with 1,190 kg. This means those scenarios use new, non-recycled materials more, perhaps because of higher production demands or lower recycling efficiency.

2. Optimal scores with efficient use of materials: Scenario 6 (1,080 kg) demonstrates the best use of raw materials and indicates that recycling and resource management are in place. This probably involves optimized production processes that avoid new materials.
3. Moderate or baseline Scores with balanced Production: Scenarios 1 (1,100 kg), 4 (1,130 kg), and 5 (1,140 kg) are around Baseline and reflect a balanced material usage approach. These scenarios are not the most efficient but show reasonably sustainable practices.
4. Impact of Increased Production on Higher Material Usage: Higher raw Material Usage in Scenarios 3 and 7 suggests Higher dependence on virgin materials due to Increased Production. This gives an opportunity to improve recycling and reduce material consumption as production expands.

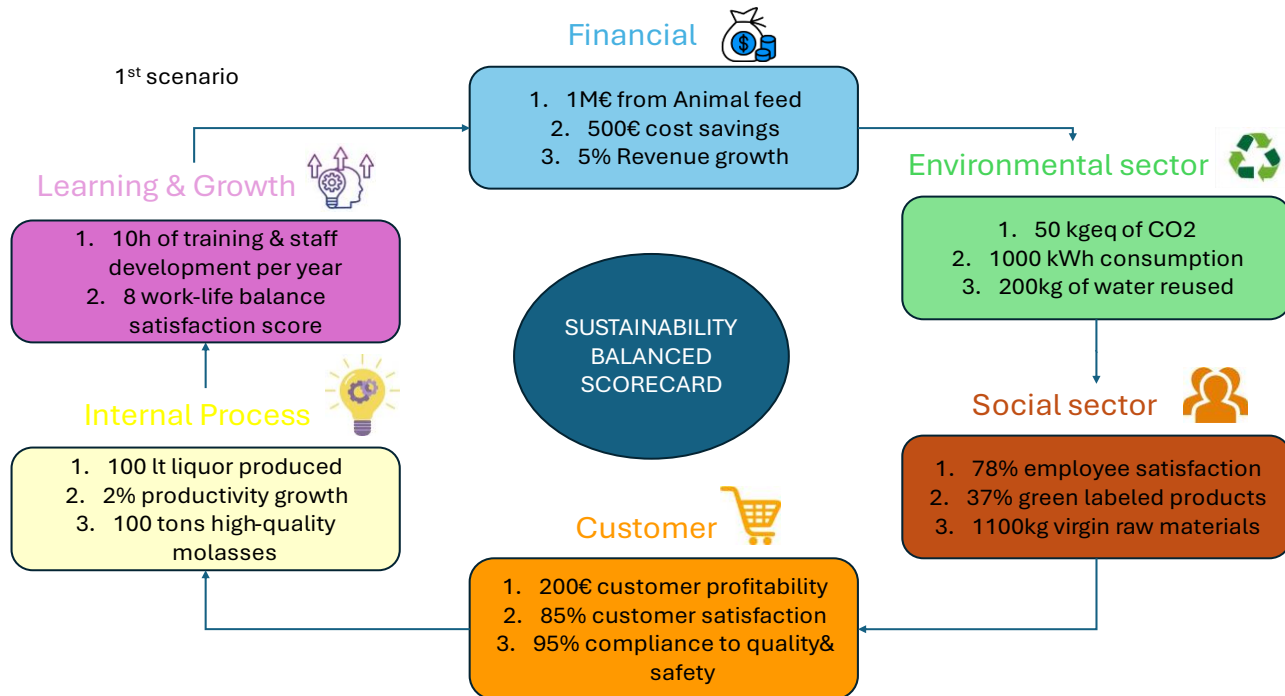
4.3. SBSC and SWOT analysis presentation for each case scenario

This section will present the sustainability balanced scorecards made for each case scenario. The SBSC were made following the research findings on how balanced scorecard templates should be structured to include sustainability practices in each pillar. There are 5 pillars that make up the sustainability balanced scorecard, the financial, internal process, customer, learning & growth and the sustainability pillar. The sustainability pillar consists of two sectors the environmental and social sector. To present each scenario's effect on the industry's performance, each scorecard is followed by a SWOT analysis representing the strengths, weaknesses, opportunities and threats opposed in the scenario. To enhance the objectivity and rigor of the SWOT analysis, a quantitative normalization process has been conducted. Each factor in the SWOT analysis was assigned a weight and rating based on its relative importance, resulting in a quantitative score that highlights the most impactful strengths, weaknesses, opportunities, and threats for this scenario.

4.3.1. First case scenario BSC and SWOT analysis

The first scenario demonstrates solid financial performance and commitment to product quality and customer satisfaction. There is however room for innovation in reducing energy consumption and raw material usage beyond conventional methods. Exploring other resources and optimizing internal processes positions the company as a sustainability leader. Efficiency and the green practices will result in a more flexible and resilient business model that can adapt to a changing market. Most results presented in the SBSC of the first scenario show the baseline of each KPI, so there should be improvements mainly regarding the financial, internal process and environmental pillars. The SWOT analysis indicates strengths and opportunities for the social and customer pillars, while there is potential for further enhancement because of potential threats from competitive pressures and resource costs. The normalization scores reinforce the qualitative analysis by quantitatively highlighting that [mention the top one or two strengths/opportunities and threats/weaknesses]. This process confirms that the key areas to focus on are [briefly mention any significant strengths or opportunities] while also addressing [mention the most critical weaknesses or threats]. This quantitative approach ensures that strategic priorities are based on a balanced and data-driven assessment.

Template 1: Scenario 1 Balanced Scorecard



Template 2: Scenario 1 SWOT analysis



Table 5: Normalized SWOT analysis of first case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1. High product quality (95%)	0.4	5	2.0
	2. Green labeled products (37%)	0.3	4	1.2
	3. High customer satisfaction (85%)	0.3	4	1.2
	Total strengths	1		4.4
Weaknesses	1. High baseline energy consumption (1000kWh)	0.3	3	0.9
	2. Work – life balance (score 8)	0.3	4	1.2
	3. Water reuse (200kg)	0.4	3	1.2
	Total weaknesses	1		3.3
Opportunities	1. Low CO2 emissions (50 kgeq)	0.4	5	2.0
	2. Improving employee satisfaction (78%)	0.3	4	1.2
	3. Low virgin raw material consumption (1100kg)	0.3	4	1.2
	Total opportunities	1		4.4
Threats	1. Competitive pressure	0.5	4	2.0
	2. Threat to customer profitability	0.3	4	1.2
	3. Shifting virgin raw material prices	0.2	3	0.6
	Total threats	1		3.8

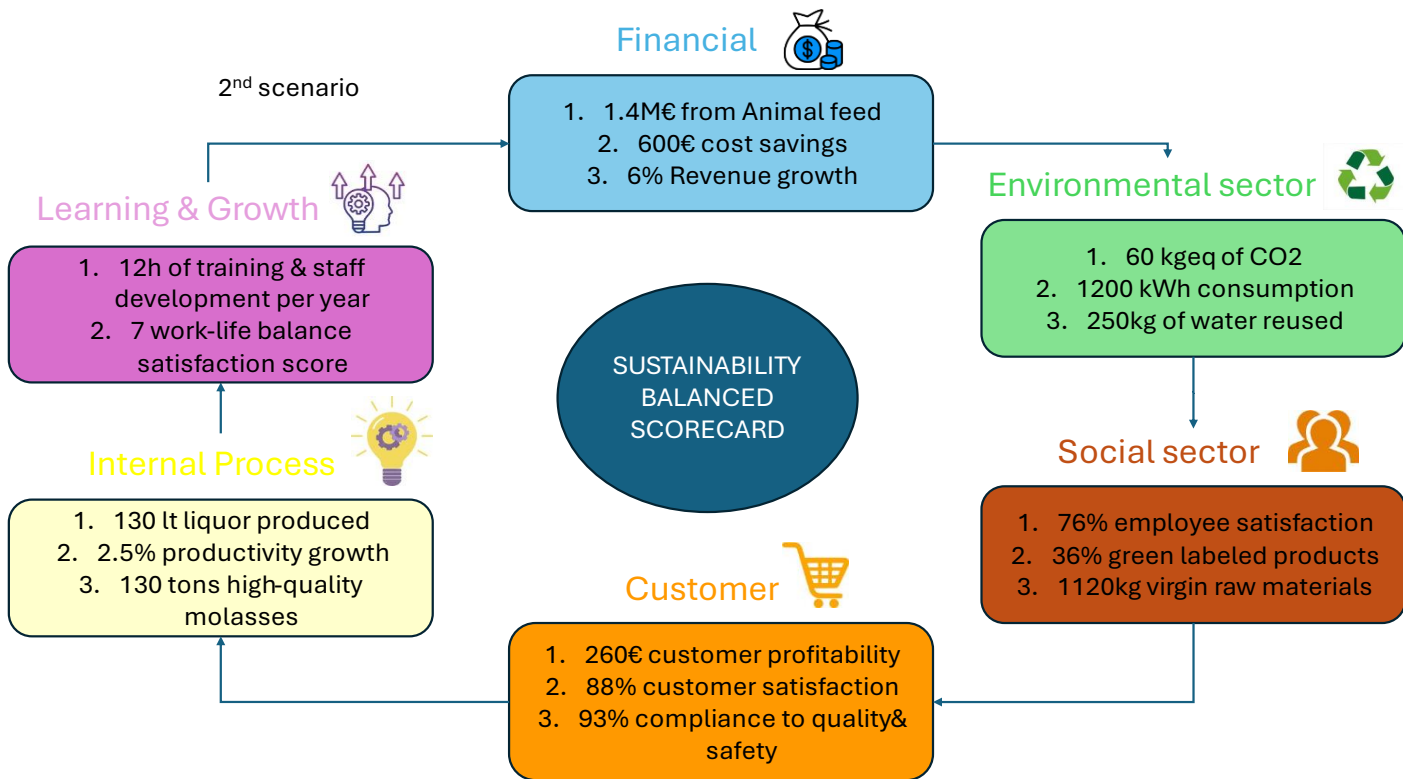
The normalization scores support the qualitative examination illustrating two higher strengths being high product quality and efficient use of renewable resources at low CO2 emissions, which are identified as best opportunities. Potential weaknesses and threats in Energy consumption are observed.

This process also confirms the strength of product quality and the potential to reduce CO2 emissions even more, both of which will improve sustainability and market position. It would also be prudent to focus on energy consumption and prepare for competitive pressure simultaneously as important risk mitigants.

4.3.2. Second case scenario SBSC and SWOT analysis

In this second scenario, the results demonstrate a balanced approach to resource utilization, productivity, and sustainability. While there's noticeable financial improvement with increased revenue from animal feed and cost savings, the scenario reveals areas for growth, particularly in energy efficiency and resource management. The balanced scorecard (template 3) shows each KPI result based on the control variables used in this scenario with high humidity of oranges and temperature. The scenario overall has results ranging close to baseline which is expected due to similar control variable usage. At the next template (template 4), the SWOT analysis suggests threats opposing employee satisfaction which is below baseline and should be addressed immediately.

Template 3: Scenario 2 Balanced Scorecard



Template 4: Scenario 2 SWOT analysis



Table 6: Normalized SWOT analysis of second case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1.High product safety (93%)	0.4	4	1.2
	2.130 liters of liquor produced	0.3	4	1.2
	3.1.4M€ of animal feed	0.3	4	1.2
	Total strengths	1		3.6
Weaknesses	1.High energy consumption (1200kWh)	0.3	4	1.2
	2.Work – life balance (score 7)	0.4	5	2.0
	3.1120kg of virgin raw materials	0.3	4	1.2
	Total weaknesses	1		4,4

Opportunities	1.Water reuse (250 kg)	0.4	4	1.6
	2.By – product income	0.3	4	1.2
	3.Baseline CO2 emissions (60kgeq)	0.3	3	0.9
	Total opportunities	1		3.7
Threats	1.Reduction of green labeled products (36%)	0.3	3	0.9
	2.Moderate customer profitability of 260€	0.3	4	1.2
	3.Decreased employee satisfaction (76%)	0.4	3	1.3
	Total threats	1		3.3

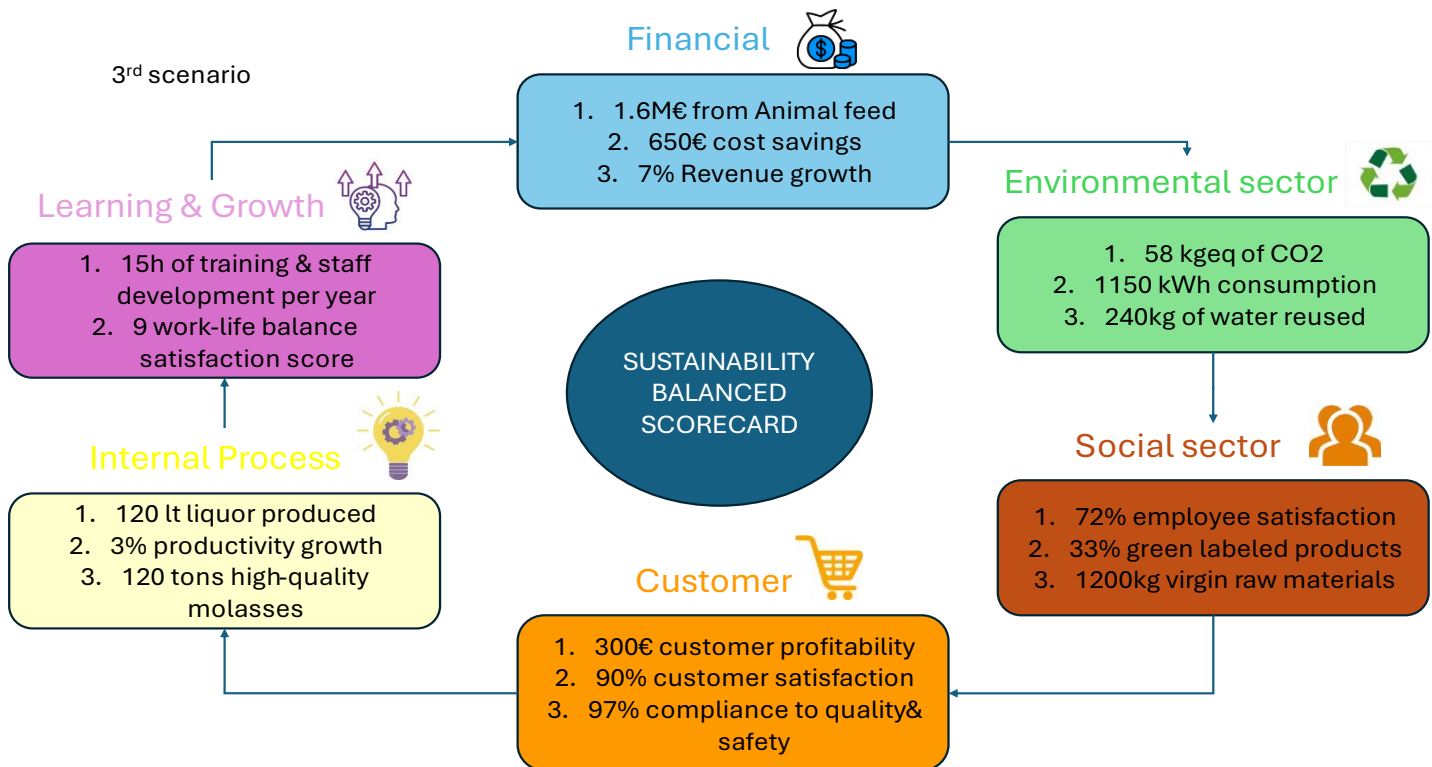
The normalization scores for the second scenario confirm that production of 130 liters of liquor and reuse of water are the top strengths and opportunities, respectively. On the other hand, work-life balance and the reduction of green-labelled products are the most significant weaknesses and threats.

These results suggest that the company should continue to capitalize on its strong production capabilities while focusing on improving work-life balance and ensuring that green-labelled products meet environmental standards to mitigate threats.

4.3.3. Third case scenario SBSC and SWOT analysis

The third case scenario uses similar control variables to the second but with a significant difference in the quantity of oranges used. In the first template of this scenario (template 5), the results of the KPIs are presented based on the use of each control variable. The third case scenario only uses 17,5 oranges which mainly reflects on the low production of liquor and high-quality molasses. This scenario though, has high customer satisfaction which means that even though less oranges were used their quality was high, a fact that is also depicted in the high percentage of compliance to safety & quality. Some threats that are pointed out at the SWOT analysis (template 6) are the high consumptions of virgin raw materials and energy, which can lead to increased operational costs and reduced sustainability.

Template 5: Scenario 3 Balanced Scorecard



Template 6: Scenario 3 SWOT analysis

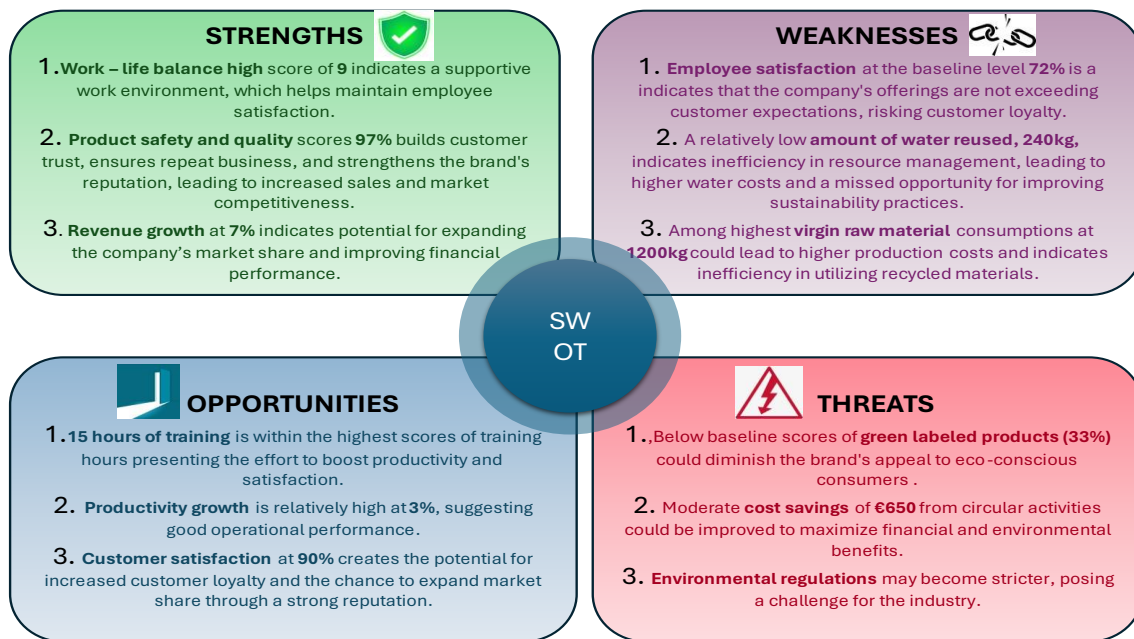


Table 7: Normalized SWOT analysis of third case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1. High product quality (97%)	0.3	4	1.2
	2. Increased revenue growth (7%)	0.4	5	2.0
	3. Score of 9 for work – life balance	0.3	4	1.2
	Total strengths	1		4.4
Weaknesses	1. Low employee satisfaction (72%)	0.4	5	2.0
	2. Moderate amount of water reused (240kg)	0.3	4	1.2
	3. High virgin raw material use (1200kg)	0.3	5	1.5
	Total weaknesses	1		4,7
Opportunities	1. 15 hours of training	0.4	4	1.6
	2. Productivity growth (3%)	0.4	4	1.6
	3. Customer satisfaction (90%)	0.3	3	0.9
	Total opportunities	1		4.1

Threats	1. Below baseline green labeled products (33%)	0.4	5	2.0
	2. Cost savings	0.3	4	1.2
	3. Strict environmental regulations	0.3	3	0.9
	Total threats	1		4.1

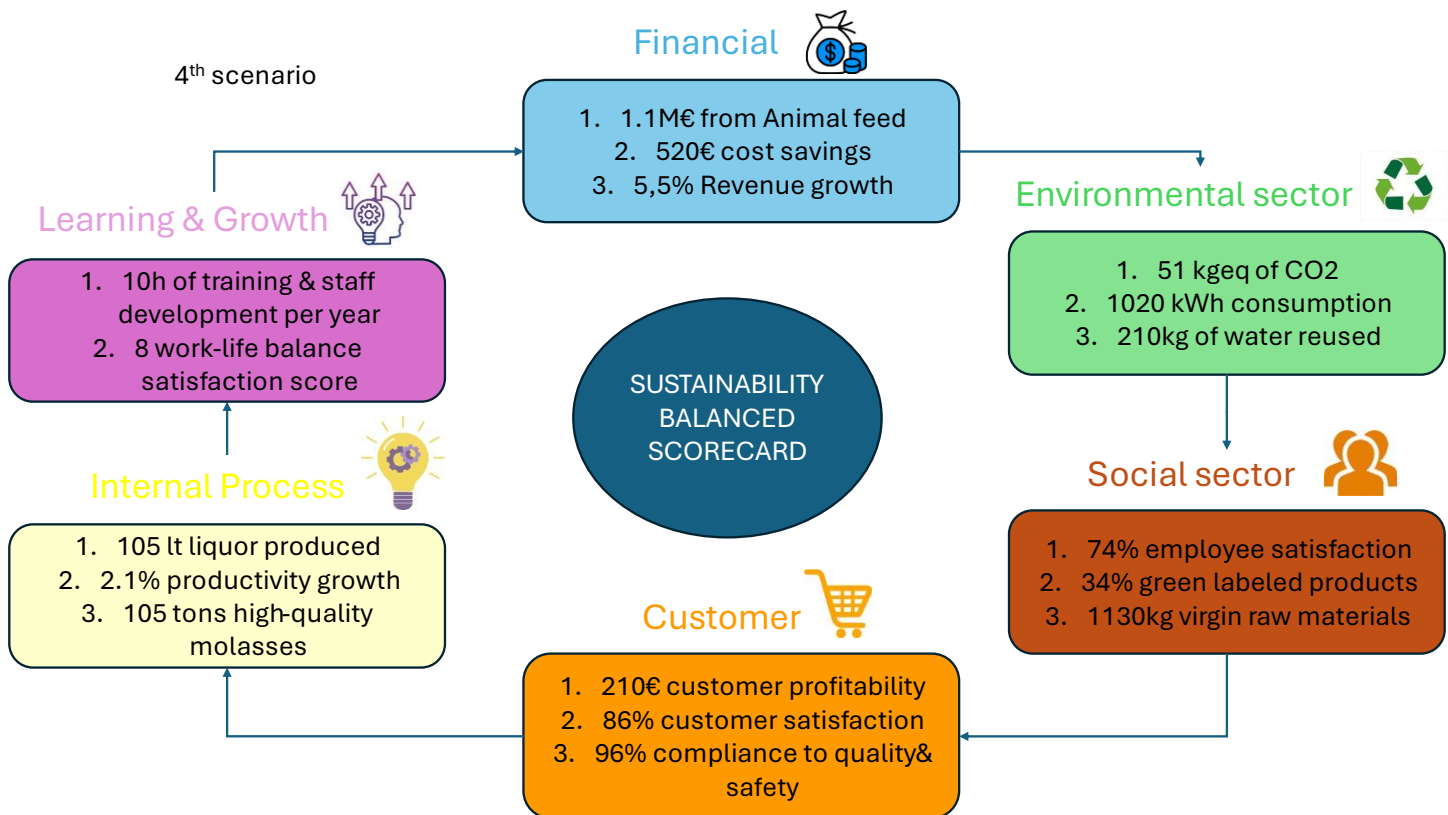
The normalization scores for the third scenario reveal that work-life balance and training opportunities are the top strengths and opportunities, respectively. On the other hand, high virgin raw material consumption and the low proportion of green-labeled products are the most pressing weaknesses and threats.

These results indicate that the company's strengths in work-life balance and training initiatives are pivotal to maintaining productivity and employee satisfaction. However, resource consumption and improving the environmental profile (green-labeled products) should be immediate priorities to enhance operational sustainability and mitigate external threats.

4.3.4. Fourth case scenario

This scenario's performance is moderate, as most indices show results only slightly exceeding the baseline. For the balanced scorecard results there was high use of oranges with high maturity. Even though the highest quantity of oranges (25) was used, this scenario has low energy consumption and CO2 emissions showing the industry's effort to enhance its reputation as an eco – friendly brand and use sustainable ways of managing their processes. The SWOT analysis (template 8) highlighted that the financial pillar of this scenario is underperforming and requires improvement, as the key financial indicators, such as revenue growth and cost savings, show low incomes which can reduce profitability.

Template 7: Scenario 4 Balanced Scorecard



Template 8: Scenario 4 SWOT analysis



Table 8: Normalized SWOT analysis of fourth case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1.Lowest CO2 emissions (51kgeq)	0.4	5	2.0
	2.Lowest energy consumption (1020kWh)	0.4	5	2.0
	3.Product safety & quality (96%)	0.2	4	0.8
	Total strengths	1		4.8
Weaknesses	1.Productivity growth at 2.1%	0.3	4	1.2
	2.86% customer satisfaction	0.3	4	1.2
	3.Water reuse (210kg)	0.4	3	1.2
	Total weaknesses	1		3,6
Opportunities	1.10h of training	0.3	4	1.2

	2.Strong work-life balance (8)	0.3	4	1.2
	3.Low virgin raw material consumption (1130kg)	0.4	4	1.6
	Total opportunities	1		3.8
Threats	1.Close to baseline revenue from animal feed (1.1M€)	0.4	5	2.0
	2.Threat to customer profitability (210€)	0.3	4	1.2
	3.Low cost savings (520€)	0.3	4	1.2
	Total threats	1		4.4

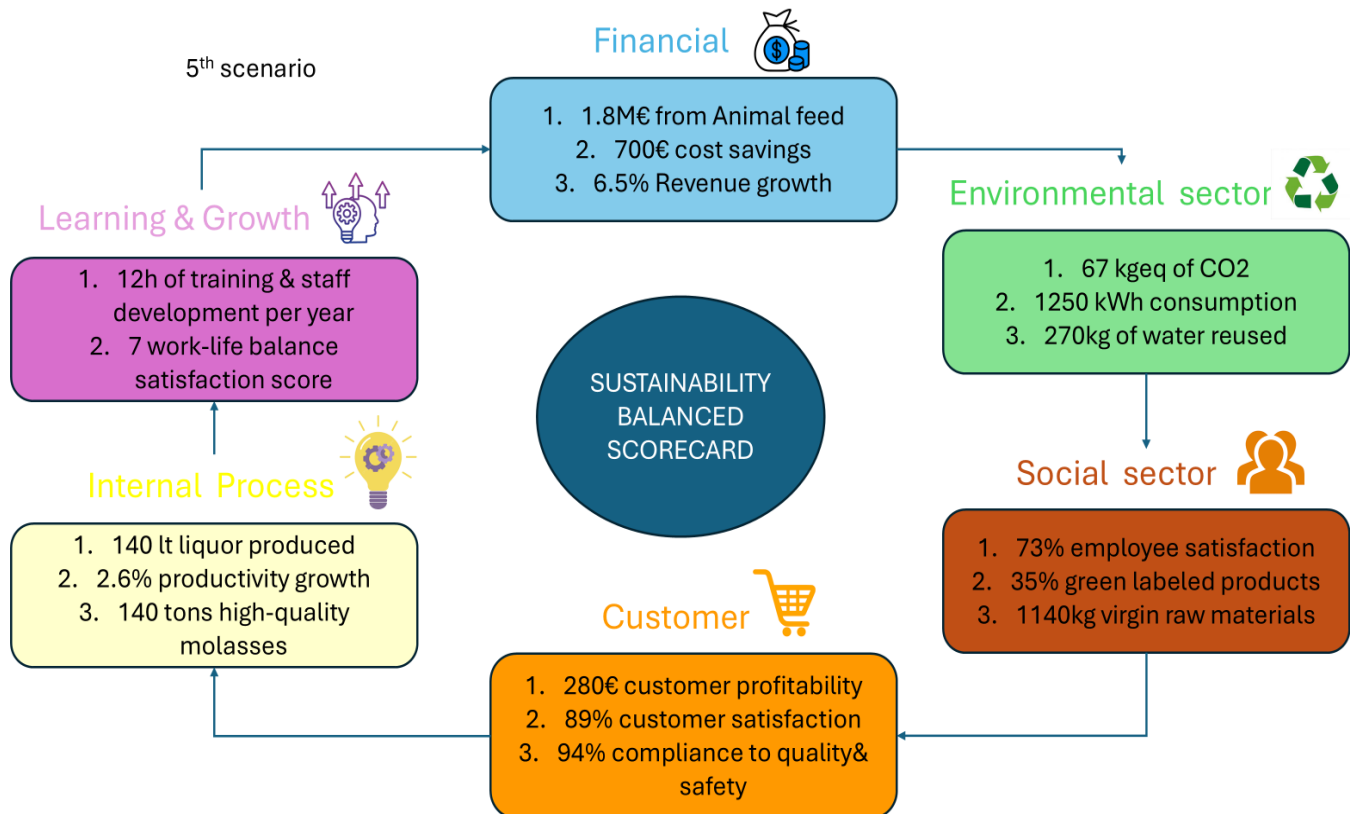
The normalization scores for the fourth scenario show that low CO2 emissions and work-life balance are the most critical strengths and opportunities, respectively. On the other hand, low revenue from animal feed and productivity growth are the top concerns among weaknesses and threats.

These results suggest that the company's commitment to sustainability and work-life balance are key advantages that can be leveraged. However, improving revenue generation from by-products and addressing productivity inefficiencies are essential to enhancing long-term profitability and operational efficiency.

4.3.5. Fifth case scenario SBSC and SWOT analysis

This scenario generally presents a positive outlook, but its performance remains standard without demonstrating any particularly outstanding results. The balance scorecard (template 9) shows results based on the use of 15 oranges with high maturity and humidity. Due to this usage, there was a high amount of water reused, high production of molasses and by – products which is also presented on the good performance of the financial indicators. The 10th template where the SWOT analysis is shown, points out that the environmental and social sector did not exceed the sustainability standards and should be improved.

Template 9: Scenario 5 Balanced Scorecard



Template 10: Scenario 5 SWOT analysis



Table 9: Normalized SWOT analysis of fifth case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1.High cost savings (700€)	0.4	5	2.0
	2.140 tons of high-quality molasses	0.2	4	0.8
	3.1.8M€ revenue from animal feed	0.4	5	2.0
	Total strengths	1		4.8
Weaknesses	1.Energy consumption (1250kWh)	0.5	5	2.5
	2.Work – life balance (score 7)	0.3	4	1.2

	3.CO2 emissions (67kgeq)	0.2	3	0.8
	Total weaknesses	1		4,3
Opportunities	1.Liquor production (140 liters)	0.3	4	1.2
	2.Revenue growth (6,5%)	0.4	5	2.0
	3.Water reuse (270kg)	0.3	5	1.5
	Total opportunities	1		4.7
Threats	1. Product quality (94%)	0.3	5	1.5
	2. Reduced customer satisfaction (89%)	0.4	4	1.6
	3. Rising virgin raw material costs	0.3	4	1.2
	Total threats	1		4.3

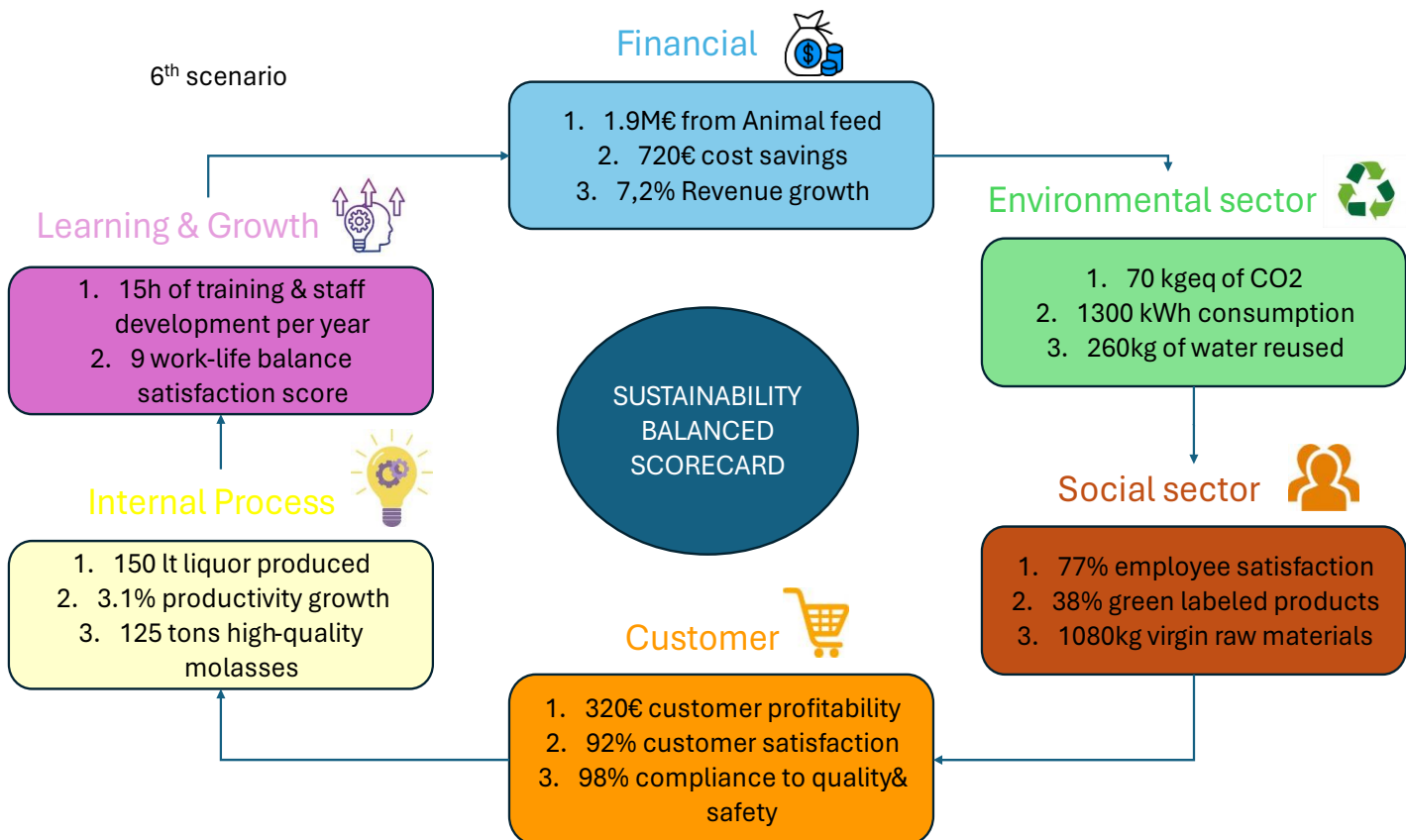
The normalization scores for the fifth scenario emphasize that cost savings and revenue growth are the most critical strengths and opportunities, respectively. On the other hand, energy consumption and rising raw material costs are the most significant weaknesses and threats.

These results indicate that the company should prioritize controlling energy consumption and material costs while capitalizing on cost-saving measures and growth opportunities in new markets. Addressing these high-impact areas will enhance both financial performance and operational efficiency.

4.3.6. Sixth case scenario SBSC and SWOT analysis

This scenario stands out as the most successful, consistently achieving high results across the majority of KPIs. The KPI results are presented in the balanced scorecard template (template 11). Since this scenario is the most optimal in terms of KPI performance, it can be inferred that the control variables applied in this case are the most effective. Therefore, the combination of high quantity and humidity of oranges with relatively low rates of temperature and maturity of oranges is highly recommended as the ideal approach for the research, offering a balanced and efficient strategy for achieving the best outcomes across all indices. Through SWOT analysis (template 12) it is shown that high CO2 emissions and energy consumption rates pose a threat by increasing the risk of regulatory penalties and damaging the company's reputation. This scenario's key strengths include high revenue growth and exceptional product quality, reflecting strong financial health and market competitiveness. Opportunities lie in efficient resource utilization, such as high-water reuse and low virgin raw material consumption, which enhance sustainability and cost-effectiveness.

Template 11: Scenario 6 Balanced Scorecard



Template 12: Scenario 6 SWOT analysis



Table 10: Normalized SWOT analysis of sixth case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1.Highest revenue from animal feed (1.9M€)	0.4	5	2.0
	2.Highest cost savings (700€)	0.3	5	1.5
	3.Highest customer profitability (320€)	0.3	5	1.5
	Total strengths	1		5
Weaknesses	1.Energy consumption (1300kWh)	0.5	5	2.5
	2.High-quality molasses produced (125kg)	0.3	4	1.2
	3.Water reuse (260kg)	0.2	4	0.8

	Total weaknesses	1		4,5
Opportunities	1.Revenue growth at 7.2%	0.4	5	2.0
	2.Liquor produced (150liters)	0.3	4	1.2
	3.Green labeling (38%)	0.3	5	1.5
	Total opportunities	1		4.7
Threats	1.CO2 emissions (70kgeq)	0.4	5	2.0
	2.Threat by environmental regulations	0.3	4	1.2
	3.Employee satisfaction (77%)	0.3	2	0.6
	Total threats	1		3.8

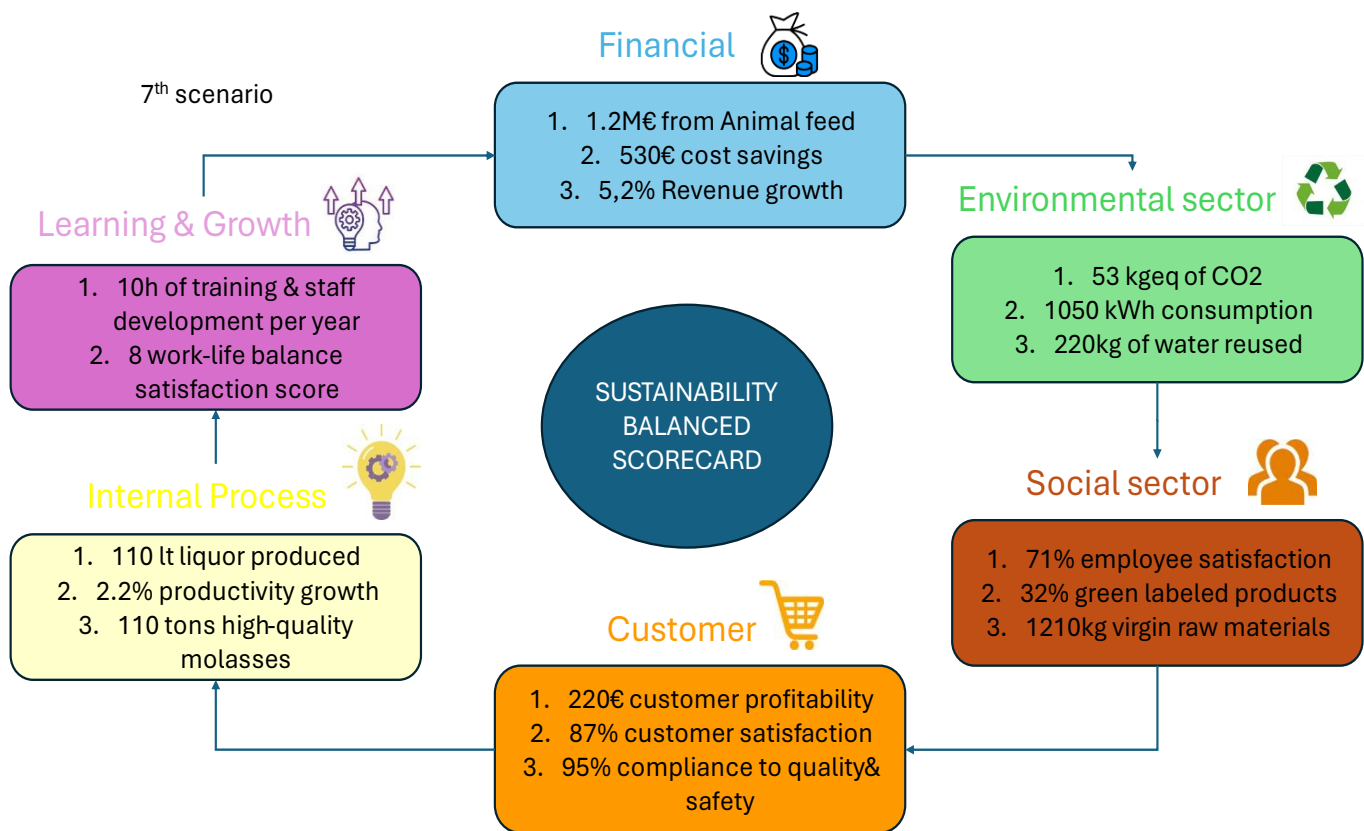
The normalization for the sixth scenario shows that customer profitability and revenue growth are the most significant strengths and opportunities, respectively. On the other hand, energy consumption and CO2 emissions are the most pressing weaknesses and threats.

These results suggest that the company should focus on optimizing energy use and reducing emissions to address sustainability and regulatory risks while leveraging growth opportunities in customer profitability and green labeling.

4.3.7. Seventh case scenario SBSC and SWOT analysis

The seventh scenario demonstrates a moderate performance with notable strengths, such as high revenue growth and excellent productivity. The balanced scorecard (template 13) is based on the variables used in this scenario which include 22 oranges with average rate of humidity and maturity. It is important to note the outcomes of CO2 emissions and energy consumption are within desired levels, so it is presented as strength. Conversely, the indicators of the financial pillar, green-labelled products and employee satisfaction percentages are opposed as threats and should be taken under careful consideration to be improved. The opportunities and threat of this specific scenario can be found in the SWOT analysis presented at template 14.

Template 13: Scenario 7 Balanced Scorecard



Template 14: Scenario 7 SWOT analysis



Table 11: Normalized SWOT analysis of seventh case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1. Energy consumption (1050kWh)	0.4	5	2.0
	2. CO2 emissions (53kgeq)	0.3	5	1.5
	3. Work-life balance score of 8	0.3	4	1.2
	Total strengths	1		4.7
Weaknesses	1. Low productivity growth (2.2%)	0.4	5	2.0
	2. Employee satisfaction (71%)	0.3	4	1.2
	3. Green labeled products (32%)	0.3	4	1.2
	Total weaknesses	1		4.4

Opportunities	1.Baseline product safety (95%)	0.4	4	1.6
	2.High quality molasses (110kg)	0.3	4	1.2
	3.10h of training & development	0.3	4	1.2
	Total opportunities	1		4
Threats	1.Customer profitability (220€)	0.5	4	2.0
	2.Low cost savings from circular activity (530€)	0.3	4	1.2
	3.Increased use of virgin raw materials (1210kg)	0.3	4	1.2
	Total threats	1		4.4

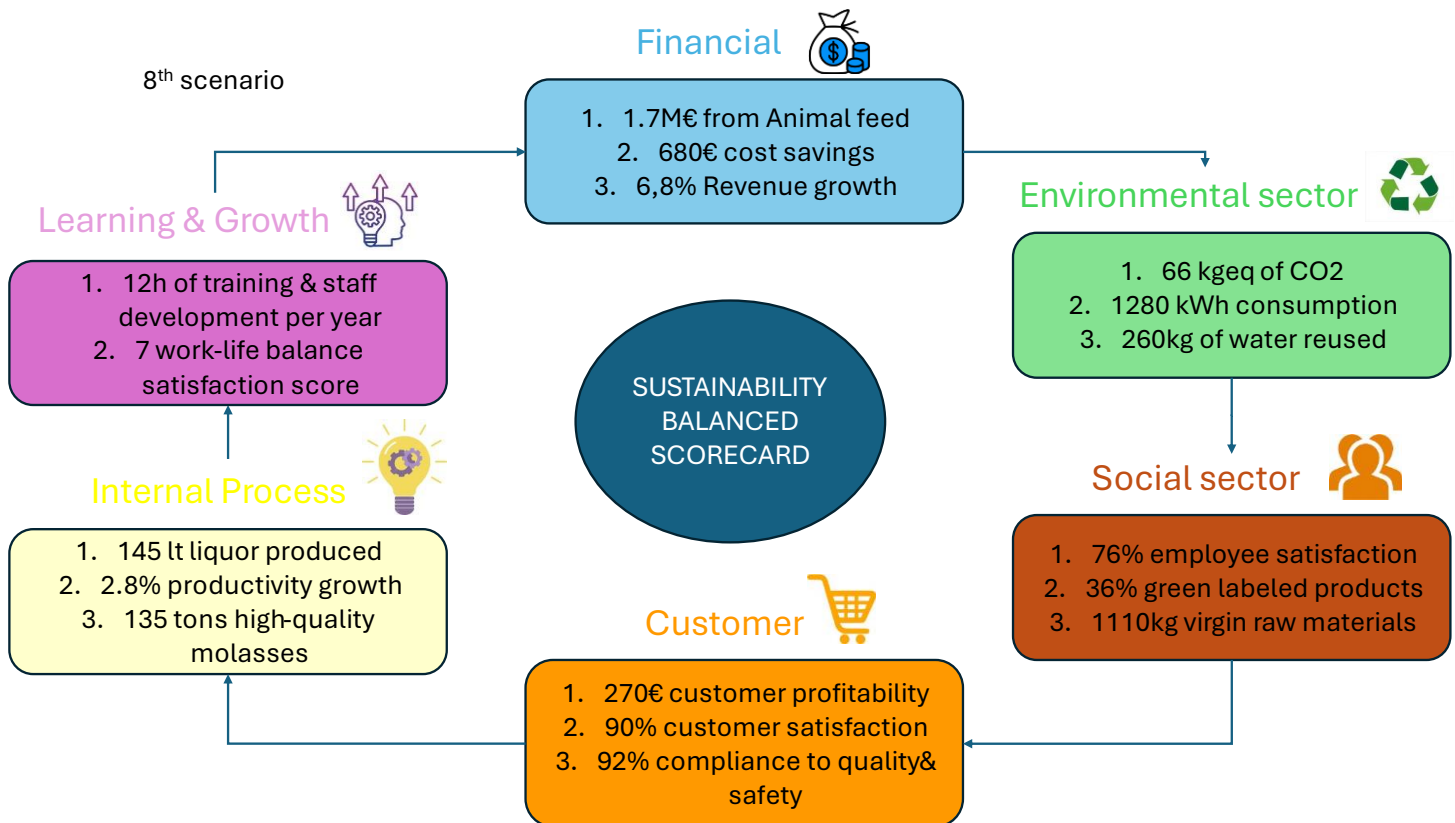
The normalization of the sixth scenario emphasizes that energy consumption and product safety are the most important strengths and opportunities, respectively. On the other hand, low productivity growth and customer profitability are the most significant weaknesses and threats.

These results indicate that the company should focus on improving operational efficiency and customer profitability while leveraging its strengths in energy efficiency and product safety to maintain its competitive edge.

4.3.8. Eighth case scenario SBSC and SWOT analysis

The eighth case scenario has a relatively high performance since most indicators performed above the suggested baseline levels. This scenario's strong performance ranks it as second optimal scenario alongside case scenario number nine that follows. With moderate scores of temperatures, humidity, quantity and maturity the balanced scorecard is presented in template 15 where the result of each indicator is shown. With the analysis conducted for the SWOT (template 16), it was indicated that the financial key performance indicators are within target results reflecting strong profitability and effective cost management. Compliance with safety & quality and work – life balance score indicators have scored low, potentially causing the company to fall behind competitors that are more actively improving their eco-friendly initiatives.

Template 15: Scenario 8 Balanced Scorecard



Template 16: Scenario 8 SWOT analysis



Table 12: Normalized SWOT analysis of eighth case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1.145 liters of liquor produced	0.4	5	2.0
	2.135 tons of high quality molasses produced	0.3	4	1.2
	3.High customer satisfaction (90%)	0.3	4	1.2
	Total strengths	1		4.4
Weaknesses	1.High energy consumption (1280kWh)	0.4	5	2.0
	2.Work – life balance (score 7)	0.3	4	1.2

	3.Product safety at 92%	0.4	3	1.2
	Total weaknesses	1		4,4
Opportunities	1.Revenue growth (6.8%)	0.4	5	2.0
	2.12h of training	0.3	4	1.2
	3.Green labeling (36%)	0.3	4	1.2
	Total opportunities	1		4.4
Threats	1.CO2 emissions (66kgeq)	0.4	5	2.0
	2.High energy consumption (1280kWh)	0.3	5	1.5
	3.Assessment of average working environment threats	0.3	4	1.2
	Total threats	1		4.7

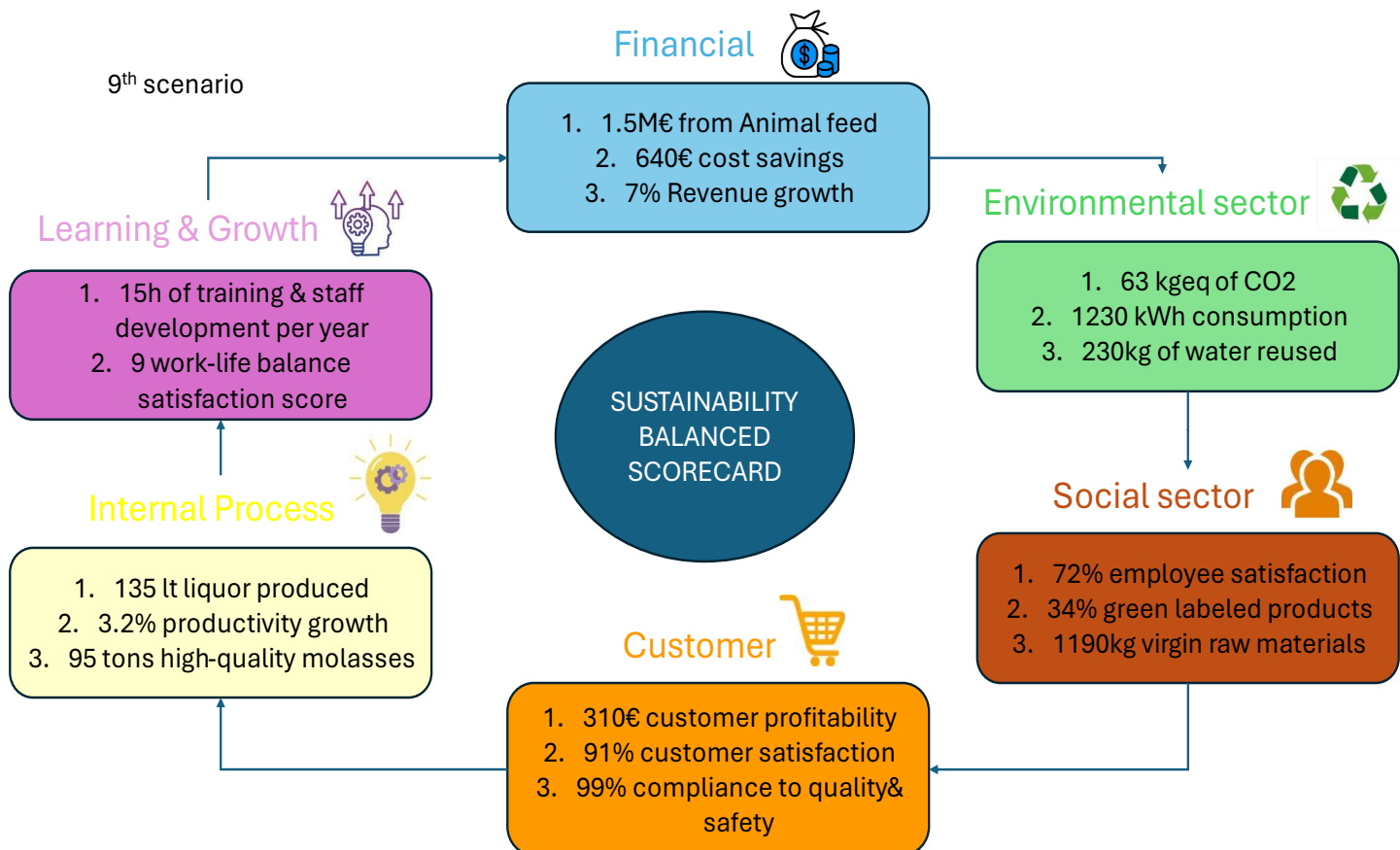
The normalization results for the eighth scenario indicate that liquor production and revenue growth are the most significant strengths and opportunities, respectively. On the other hand, energy consumption and CO2 emissions are the most pressing weaknesses and threats.

These results suggest that the company should focus on addressing energy inefficiencies and reducing emissions to comply with regulations and improve sustainability. Simultaneously, leveraging the liquor production and revenue growth potential will strengthen the company's profitability and competitive positioning.

4.3.9. Ninth case scenario SBSC and SWOT analysis

Case scenario number nine is the second optimal scenario following the sixth. Both optimal scenarios, despite having different sets of control variables, demonstrated effective outcomes due to the way these variables were applied within the industry. The variable combination in Scenario 9 as presented in template 17 also proved to be successful, showcasing a strong and favorable performance, slightly less optimal than scenario 6. This suggests that both combinations have the potential to be beneficial. SWOT analysis (template 18) suggests weaknesses and threats in the environmental and social sectors leading to potential risks to the company's reputation, compliance with regulations, and long-term sustainability goals.

Template 17: Scenario 9 Balanced Scorecard



Template 18: Scenario 9 SWOT analysis



Table 13: Normalized SWOT analysis of ninth case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	1.Revenue growth (7%)	0.4	5	2.0
	2.Productivity growth (3.2%)	0.3	4	1.2
	3.High customer satisfaction (91%)	0.3	4	1.2
	Total strengths	1		4.4
Weaknesses	1.Employee satisfaction (72%)	0.3	4	1.2
	2.Work – quality molasses below baseline (95kg)	0.4	5	2.0
	3.Water reuse (230kg)	0.3	4	1.2

	Total weaknesses	1		4.4
Opportunities	1. Cost savings (640€)	0.4	5	2.0
	2. 135 liters of liquor produced	0.3	4	1.2
	3. Revenue from animal feed at 1.5M€	0.3	3	0.9
	Total opportunities	1		4.1
Threats	1. Energy consumption (1230kWh)	0.4	4	1.6
	2. CO2 emissions (63kgeq)	0.3	4	1.2
	3. Virgin raw material increasing costs (1190kg)	0.3	3	0.9
	Total threats	1		3.7

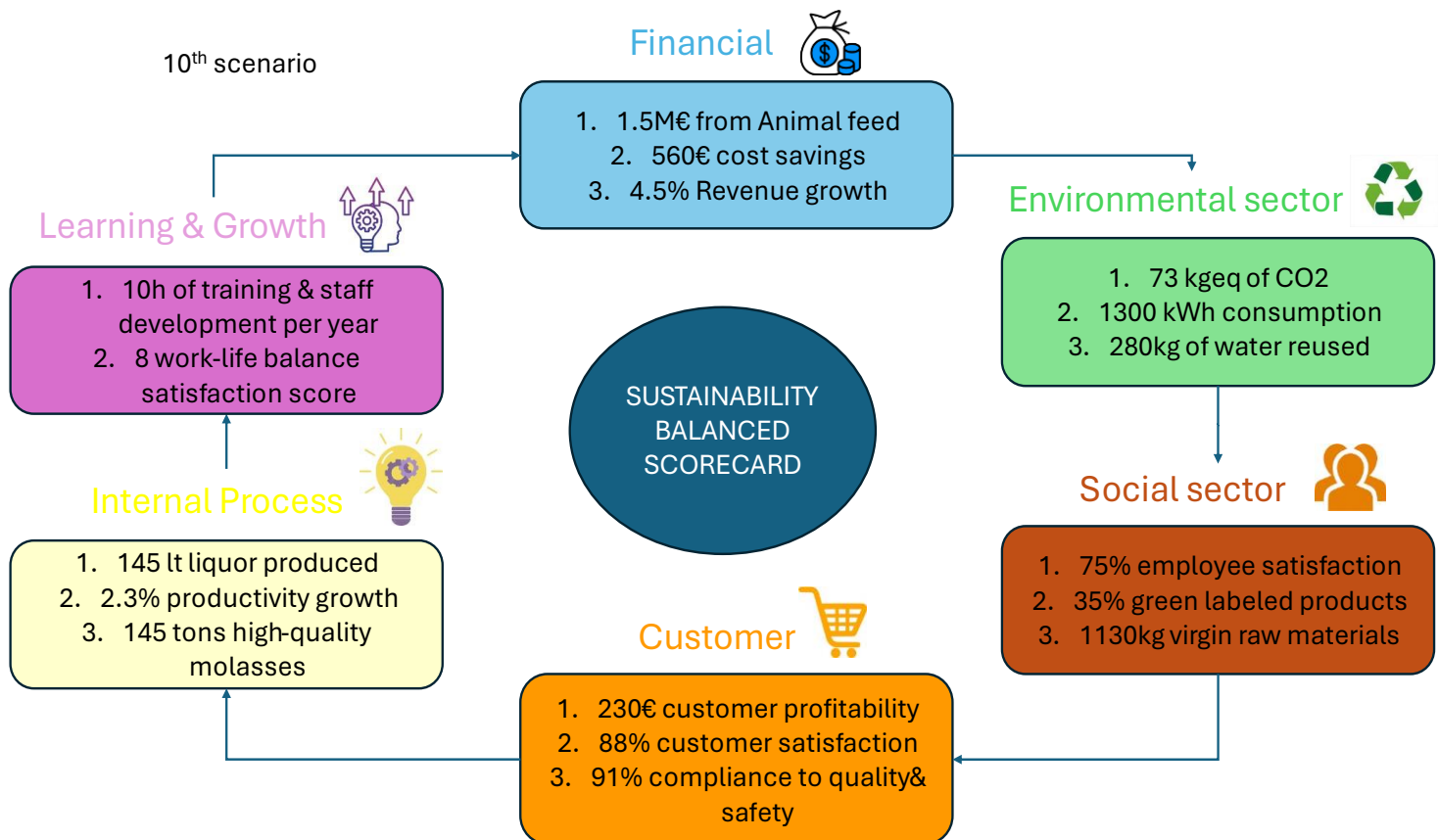
The normalization results for the ninth scenario show that revenue growth and cost savings are the most important strengths and opportunities, respectively. On the other hand, energy consumption and CO2 emissions are the most pressing weaknesses and threats.

These results suggest that the company should focus on addressing energy inefficiencies and reducing emissions to maintain regulatory compliance and improve sustainability. Leveraging revenue growth and cost savings will further enhance financial performance and operational resilience.

4.3.10. Tenth case scenario SBSC and SWOT analysis

The last scenario has a relatively bad performance because of the below baseline rate that some indicators scored. The control variable combination suggested in this scenario includes high humidity and moderate scores for the rest of the variables. Each KPI is presented in the balanced scorecard below (template 19) showcasing which pillars exceeded the desired outcomes or not. While analyzing the effects this scenario had in the industry a SWOT analysis is made (template 20) suggesting that the first indicator that has to be improved is revenue growth to ensure the company's long-term financial stability, competitiveness, and ability to invest in innovation, sustainability, and expansion. Furthermore, indicators like CO2 emissions, energy consumption and compliance to safety & quality should be improved to enhance environmental sustainability and maintain high standards that meet customer expectations and regulatory requirements.

Template 19: Scenario 10 Balanced Scorecard



Template 20: Scenario 10 SWOT analysis



Table 14: Normalized SWOT analysis of tenth case scenario

Category	Factors	Weight	Rating (1 – 5)	Score (weight *rating)
Strengths	4. Water reused (280kg)	0.4	5	2.0
	5. High quality molasses (145kg)	0.3	4	1.2
	6. High customer satisfaction (88%)	0.3	4	1.2
	Total strengths	1		4.4
Weaknesses	4. High baseline energy consumption (1300kWh)	0.4	5	2.0
	5. Revenue growth below baseline (4.5%)	0.3	5	1.5

	6. CO2 emissions (73kgeq)	0.3	4	1.2
	Total weaknesses	1		4,7
Opportunities	7. Green labeling expands (35%)	0.4	4	1.6
	8. Improving employee satisfaction (75%)	0.3	4	1.2
	9. Low virgin raw material consumption (1130kg)	0.3	4	1.2
	Total opportunities	1		4
Threats	10. Customer satisfaction (88%) risk	0.4	4	1.6
	11. Regulatory restrictions on CO2 emissions	0.3	4	1.2
	12. Productivity growth (2.3%)	0.3	4	1.2
	Total threats	1		3.8

The normalization results for the tenth scenario indicate that water reuse and green labeling are the most critical strengths and opportunities, respectively. Meanwhile, energy consumption and customer satisfaction risks are the most pressing weaknesses and threats.

These results suggest that the company should focus on reducing energy consumption and enhancing customer satisfaction to stay competitive. Leveraging strengths in water reuse and green labeling will position the company as a leader in sustainability.

4.4. Detailed analysis of the scenario outcomes

First case scenario analysis

The first case scenario mostly presents the baseline of each scenario (except from scenarios). This means that its performance is generally lower than most scenarios results. The baseline is used to represent a benchmark in order to indicate which scenario exceeded it or not. Scenarios that are under the baseline indicate lower performance rates and should be considered so that the control variable set chosen have to be reconsidered. This scenario's control variables were set at 20 °C, using 22,5 oranges, the pH of the oranges is 1 and they had 70% humidity. This combination gives a moderate performance to the industry's strategy. The KPIs that were chosen to not be baseline numbers were employee satisfaction, green labeled products, amount of virgin raw materials produced and CO2 emissions. These KPIs outperformed the baseline rates and made a significant impact on the social and environmental sector's performance.

More specifically, the financial sector of this scenario made 1M€ revenue from animal feed, 5% revenue growth and 500€ cost savings indicating that the amount of oranges used in relation to the rest of the variables made a respectful amount of by products such as high-quality molasses, animal feed and orange liquor resulting in a relatively good performance of this pillar. The learning and growth sector had KPIs in relatively high scores, for a baseline scenario, since many scenarios after this will result in lower rates of training and staff development (which is currently on 10 hours) and work – life balance (currently at a score of 8). The customer and internal process pillar also performed well making acceptable rates on important KPIs such as costumer satisfaction, and profitability, amount of molasses and liquor produced and product growth. Finally, the sustainability pillar had such performance that exceeded the expectations of the baseline in several KPIs like the ones mentioned above.

From the SWOT analysis the main strengths, weaknesses, opportunities and threats were found in order to enhance the strategic management of the industry and focus in areas that should be improved. The strengths and opportunities of this scenario focus on the KPIs that were below the average scores the rest of the scenarios had. These strengths include the outperformance of the social and environmental sectors indicating commitment to reducing its carbon footprint to attract environmentally conscious consumers and improve brand image.

Even though most indices of this scenario and more specifically of the sectors mentioned have a relatively good performance, there is room for improvement and changes should be evaluated because competitive pressures, the risk of reduced customer profitability, high energy consumption, and limited water reuse highlight areas that need efficiency improvements to maintain high standards and establish its brand name as an environmentally responsible company.

Second case scenario analysis

This scenario has a slightly better performance than the first one making it even more competitive and promising for future growth. The variables chosen for this scenario include 20 oranges, oranges with a pH rate of 1, 75% humidity and 21 °C for the temperature. In comparison to the previous scenario there are no significant changes on the rates used on the current scenario's variable combination but still make a better combination reflecting a better strategic performance for Aspis. There are no KPIs that stand out in this scenario when compared both to the baseline and the rest of the scenarios. This represents a moderate strategic management performance of this specific scenario.

When analyzing this scenario's SBSC it can be noted that the financial pillar has a slight increase in each performance indicator that it consists of. Revenue from animal feed has a notable increase that most probably is affected by the higher temperature used for the drying and heat evaporation process which produces a larger amount of by products even though the number of oranges used is a bit lower than the oranges used for the previous scenario. The significant amount of liquor produced and income by animal feed present an opportunity for the industry indicating the opportunity to diversify income streams. The environmental and social sector of this scenario have the complete opposite image in comparison to the first scenario. This scenario has increased energy consumption and CO₂ emissions with a larger amount of water being reused. Also, the social sector has indices with worse performance since employee satisfaction has decreased 2%, green labeled products have dropped by 1% and 1120kg of virgin raw materials have been used highlighting the immediate need of enhancement for this sector to foster employee well-being, meet environmental standards, and reduce reliance on non-recycled materials, ensuring sustainable and responsible business practices. The rest of the pillars did not have a significant difference that should be pointed out since the variations of each KPI resulted in very similar strategic performance for the industry.

The SWOT analysis strengths emphasize cost-saving measures and high product quality compliance, indicating efficient utilization of resources. Opportunities focus on enhancing eco-labeling, employee development, and energy-efficient technologies, presenting potential for market expansion, workforce improvement, and operational cost reductions.

The deficiencies identified in this SWOT analysis underscore inefficiencies, exemplified by a constrained water reuse capacity of 250 kg, a work-life balance metric of 7, and elevated energy consumption levels at 1200 kWh, thereby signaling prospective domains for operational enhancement. The threats are predominantly centered around regulatory exigencies aimed at diminishing CO₂ emissions, the potential escalation of competition within the sustainability domain, and the variability of raw material costs that could adversely affect both cost efficiency and profitability. These facets delineate susceptibilities that may necessitate strategic initiatives to optimize resource allocation, ensure regulatory adherence, and sustain competitive advantage within the industry.

Third case scenario analysis

The next scenario generated presents a more favorable outcome for most indices in relation to the previous scenarios examined. This scenario should be considered by the industry among the optimal scenarios driven by this research. It has used 17,5 oranges, significantly less than the previous scenarios, which had pH rate at 2. The rest of the control variables did not have an important difference from their previous ones with 21 °C temperature and 75% humidity. The changes made from the control variables have been analyzed and presented in the sustainability balanced scorecards and SWOTs of this scenario. KPI rates that should be noted are the increase of revenue growth and decrease of virgin raw materials used for this scenario. These changes indicate an improvement in financial performance and a shift towards more sustainable resource management, demonstrating the scenario's efficiency and potential for long-term viability.

Looking at the financial pillar each KPI shows marked enhancement. Revenue from animal feed has shown the biggest increased followed by the revenue growth index. This increase suggests that even though the amount of oranges used is lower, the pH rate which made oranges that needed less processing and the appropriate temperature balance the difference and even resulted in heightened revenues. The next pillar that showcased enhancement is the learning and growth, where many hours of training were dedicated so that employers can better understand the processes and learn new techniques that will help them through their

work and the balance between their work and personal life has the optimal rate of 9 meaning that they were able to manage better their obligations and contribute their time correctly in order to have the time to relax and recharge, enhancing their efficiency and motivation in the long run. In the sustainability pillar some indices had better performance and others appeared to have decreased. More specifically, the environmental aspect has a good overall performance with low energy consumption and subsequently low CO₂ emissions produced with 240kg of water reused. The social aspect on the other hand did not perform this good. The green labeled products and employee satisfaction were aligned with the baseline level and virgin raw materials was way over the specified baseline amount and should be addressed immediately because it could lead to higher production costs and indicates inefficiency in utilizing recycled materials.

The SWOT analysis defines strengths and opportunities to improve operational efficiency, product quality, workforce skills. The higher work-life balance metric indicates a productive environment. Parallel to this high product safety and quality standard, we build customer trust and position ourselves competitively in the market. Increasing revenue and productivity indicates financial growth potential. Such opportunities include developing the workforce through the allocation of training hours and achieving a customer satisfaction rate of 90%, opening up avenues for market share expansion. These indicate a trajectory towards robust operational performance and sustainable growth.

The weaknesses and threats of this scenario center around efficiency and sustainability challenges. High energy consumption at 1150kWh increases operational costs, and the large use of virgin raw materials at 1200 kg suggests inefficiency in recycling. Baseline employee satisfaction at 72% indicates room for improvement in workforce engagement. Threats like stricter environmental regulations and potential issues with cost savings emphasize the need for more efficient practices and adaptability to external pressures.

Fourth case scenario analysis

Case scenario analysis number four has a moderate performance with no enhancement in its performance indicators. The results of this analysis are similar to those of the first case scenario. The control variables that were used consist of 25 oranges processed at 19 °C, with pH rate of 3 and 70% humidity. The amount of oranges and rate of pH are control variables that exceeded the previous rates used. This means that this particular combination of control variables did not work out well for the strategic performance of the industry. In this scenario the indices were slightly above the baseline levels leading to these moderate results.

In the financial pillar the indices depicted have not increased in relation to the 2nd and 3rd case scenarios. This indicates that even though the industry managed to maintain its results over the baseline level it didn't perform an increase. All indices of the internal process and the customer pillars showed a decrease as well. This decrease can be explained by the set of control variables used for the procedures that make the by products Aspis sells. Using the highest amount of oranges that are more mature and contain less humidity to be processed on a lower temperature has inefficiencies in extraction, reduced quality of end products, and increased energy consumption. The internal process and customer have results lower than the third but slightly higher than the second scenario. More mature oranges and compliance to quality standards make flavorful products so well performed percentage of customer satisfaction and profitability is expected. An aspect that performed better than expected based on the control variables chosen is the environmental. The energy consumption and CO₂ produced by processing the oranges was within lowest rates of all scenarios. This suggests that the process efficiency is well-managed, and the energy-saving measures are effectively implemented, leading to optimized resource utilization even with increased production input.

The strengths and opportunities delineated in this SWOT analysis emphasize sustainability, operational efficacy, and employee development. Minimal carbon dioxide emissions and reduced energy consumption signify a dedication to environmentally sustainable practices and economically efficient operations. Elevated standards of product safety and quality imply dependable production methodologies, whereas the potential to improve work-life balance underscores a commitment to employee welfare. Furthermore, sustaining virgin raw materials at fundamental levels offers the prospect for enhanced resource optimization, and the implementation of continuous training programs underscores the potential for the advancement of workforce competencies.

The identified vulnerabilities and risks linked to operational deficiencies and uncertainties. The productivity growth rate of 2.1% highlights sectors that necessitate enhancement. The customer satisfaction rate of 86% implies potential reductions in market share and consumer loyalty. The water reuse figure of 210 kg fails to align with established sustainability criteria, whereas inadequate revenue from animal feed coupled with limited cost efficiencies presents threats to overall financial viability.

Fifth case scenario analysis

The fifth case scenario analysis is a well performed scenario with indices that outpace the baseline and have high results. This scenario uses a low quantity of oranges, 15, with 75% humidity and pH level of 3. For the processing of such oranges 20 °C is used. The biggest difference between this and the previous scenarios is in the quantity of oranges. Less oranges than usual and high maturity are used in this scenario. KPIs with the best performance in this scenario are the revenue from animal feed, cost savings from circular activities, and the amount of water reused during the processing procedures.

Via the SBSC methodology the result of each KPI is presented and can be compared to the KPIs the rest of the scenarios have. For this scenario's financial pillar, the outcomes are highly favorable. Even though a not so high amount of oranges was used, the revenue growth and revenue from animal feed has increased. This is due to the large quantities of by products such as high-quality molasses (140 tons) and orange liquor produced (140 liters). Because of the good quality and high maturity of the oranges used, notable increases in the customer pillar have also been made. Customer satisfaction and profitability have high percentages creating a strong brand image for Aspis since more customers will prefer and become devoted to the brand's products. In the environmental pillar even though a respectful amount of water is being reused, the energy consumed and CO₂ produced is within high rates necessary for immediate decrease. The higher energy consumed could be due to higher humidity rate in oranges that are less than they usually are. The social aspect of the sustainability pillar has performed well but did not exceed the baseline rates a lot.

The strengths and opportunities suggested predominantly revolve around the proficient utilization of resources, economically viable operations, and prospective pathways for financial advancement. The considerable cost reductions and ample generation of premium molasses indicate robust internal efficiencies and sustainability initiatives. Furthermore, the notable revenue enhancement and efficient practices in water reuse underscore the organization's capacity to leverage sustainable opportunities. The extensive production of liquor further signifies a potential diversification in revenue streams, while the elevated revenue derived from animal feed exemplifies resource optimization, thereby positively impacting overall profitability.

The threats and weaknesses in this SWOT analysis highlight concerns about sustainability, operational efficiency, and potential market competition. High energy consumption and CO₂ emissions indicate areas that require improvement to meet stricter environmental standards. Additionally, while customer satisfaction

and product quality levels are decent, there's a risk of losing competitive advantage if rivals achieve better scores.

Sixth case scenario analysis

This case scenario's analysis presents the optimal solution proposed to the industry. This solution should be highly considered by the company's strategic management and effort should be made to maintain this high performance by continuously monitoring key indicators and implementing strategies to address potential weaknesses and threats as they emerge. The control variables used for this scenario are 22.5 oranges with 80% of humidity, pH rate of 1 processed at 18 °C. This control variable combination is the optimal selection the industry should make. By comparing these control variables to the rest of the scenarios it is showcased that the quantity of oranges should be maintained over 21 (optimally 22,5) but the temperature used and maturity of oranges has to be in lower rates. It is of outmost importance that this scenario uses the highest percent of humidity, indicating the significance of this control variable to the overall strategic performance of the industry.

The financial indicators performed the highest rates out of all scenarios resulting in very high rates of animal feed and growth revenue and cost savings through circular activity conducted by the industry's process. The quantity of oranges and temperature resulted in high amounts of by products increasing the financial performance. 15 hours of training and growth leads to employers that can better understand the processes and learn new techniques that will help them through their work and the balance between their work and personal life has the optimal rate of 9 meaning that they were able to manage better their obligations and contribute their time correctly in order to have the time to relax and recharge, enhancing their efficiency and motivation in the long run. The internal process and customer pillars have also developed an admirable image. The customer satisfaction level wasn't affected negatively by the low maturity of the oranges indicating that the high quality of products and the right procedures conducted in Aspis's processes had effective outcomes. In the sustainability pillar, the social sector has optimal amount of virgin raw materials use and high percentages in the rest of the indices which can also be explained by the well selected control variable combination. The only aspect that has a negative performance is the environmental because of high energy consumption and CO2 emissions.

The strengths and opportunities underscore robust financial performance, encompassing elevated customer profitability and efficient cost management, which collectively enhance the organization's growth potential. The significant revenue escalation and liquor manufacturing illustrate the possibility for market proliferation and augmented profitability. Moreover, the substantial prevalence of green labeling indicates an ability to engage a wider clientele interested in products that prioritize sustainability.

The identified vulnerabilities and potential hazards underscore apprehensions related to elevated energy consumption and CO2 emissions, which may lead to regulatory obstacles and environmental sanctions in the future. Furthermore, the comparatively diminished output of superior-grade molasses and the inadequate levels of water reclamation suggest inefficiencies within operational protocols. The necessity for enhanced employee satisfaction is also recognized as a prospective threat to the maintenance of a productive and committed workforce.

Seventh case scenario analysis

The next case scenario has a moderate overall performance with indicators in optimal rates though some are below baseline with need of enhancement. This scenario used 22,5 oranges with pH rate of 2, 70% humidity and 22 °C during the procedure processing. This control variable combination mainly reflects on the good performance of the environmental aspect with optimal outcomes of energy consumption and CO2 emissions production.

This scenario has its own SBSC representing the indicators for each pillar. In the financial pillar this index had no significant increase and performed worse than its previous two scenarios, with results most similar to the fourth case scenario. These results are slightly above baseline and should be refined. Since the fourth case scenario have similar results the explanation as to why both scenarios do not exceed to perform better can be found in the control variables. The only control variable these two scenarios have in common is the humidity percentage at 70%. This immediately indicates that in order to expect better results, the humidity rate should be refined. The learning & growth and internal processes aspects show results very close to baseline meaning that the chosen variables maintain a good and stable performance for the industry but should be enhanced via further investigation. The sector that has the best performance in this case scenario is the environmental. Optimal low energy consumption and CO2 emissions construct this scenario indicating that the pH humidity and temperature levels consume less energy during the processes that are used to make each by product that Aspis sells to the market.

There are both strengths and opportunities in this scenario: good resource management coupled with low energy use and CO2 emissions indicates a sustainability orientation of the company. A balanced work environment and training also improve employee satisfaction. Quality standards could certainly improve and the high-quality molasses and Product Safety could provide avenues to increase revenue and build a market presence.

The weaknesses and threats in this scenario highlight areas that require attention, such as low productivity growth and slightly below-baseline employee satisfaction, which could impact overall performance and morale. The low score in green-labeled products reflects a need for stronger sustainability practices. On the threat side, low customer profitability and limited cost savings pose financial risks, while high reliance on virgin raw materials could challenge long-term sustainability goals.

Eighth case scenario analysis

Scenario analysis for the eighth case presents a solid overall performance, with its KPIs consistently reaching high levels, though they don't achieve the very top scores. The strong overall performance of this scenario makes it a viable option for Aspis, ranking among the top scenarios alongside the third and ninth case, just after the optimal first scenario. It consists of 17,5 oranges with 75% humidity and their pH level is at 1. The temperature used to perform this scenario is at 19 °C which is low but has shown significant outcomes when used in previous scenarios. This scenario has control variables within their lowest levels and its outcomes are expected to be similar to those of the sixth and ninth case scenarios. The relatively small number of oranges used in relation to 75% humidity could result in threats like high energy consumption used to evaporate and dry the amount of water the oranges have.

The financial performance of this scenario shows that all three indicators have outperformed most of the other scenarios resulting in high revenue growth, revenue from animal feed and cost savings. This scenario

could be regarded as a viable option for the industry to incorporate into their processes. The internal process sector of the company has also been significantly enhanced by the control variable combination this scenario provides. Although a smaller quantity of oranges was used, they were processed efficiently, resulting in a substantial amount of high-quality molasses and orange liquor. The productivity rate is increased, which aligned with the high customer satisfaction can explain the good performance of the financial pillar. Similar to the fifth and sixth scenarios, the CO₂ emissions produced by high energy consumption should be addressed as a possible threat for the company and its performance as a sustainable company. The social sector of the sustainability pillar performs high with 76% employee satisfaction indicating a positive work environment and strong morale, while low virgin raw material consumption suggests efficient resource usage and a commitment to sustainability practices.

This scenario demonstrates exceptional proficiency in generating a substantial quantity of alcoholic beverages (145 liters) and high-quality molasses (135 tons), thereby illustrating effective utilization of by-products and robust operational efficiency. The level of customer satisfaction is notably elevated at 90%, reflecting dependable product quality. Prospects for advancement are apparent, marked by a 6.8% increase in revenue, the opportunity for enhanced employee training, and the expansion of environmentally sustainable labeling initiatives, which could potentially engage a broader demographic of environmentally aware consumers.

The identified deficiencies within the scenario encompass a substantial energy consumption level of 1280 kWh, signifying a lack of efficiency that warrants rectification to bolster sustainability efforts. The work-life balance metric, rated at 7, indicates a potential for enhancing employee wellness initiatives to sustain morale and optimize productivity. Furthermore, a product safety rating of 92%, although respectable, lags in comparison to alternative scenarios, highlighting an opportunity for quality enhancement. Regarding potential threats, CO₂ emissions quantified at 66 kgeq may precipitate regulatory complications should more stringent standards be enacted.

Nineth case scenario analysis

The ninth case scenario ranks as the second most effective, coming just after the optimal one (scenario 6). The KPI performance is increased and alongside the eighth scenario is suggested to the industry for its strategic management. An amount of 22,5 oranges is processed that have 65% humidity and pH level at 2. The temperature used is 21 °C. The humidity of the oranges is at its lowest rate possibly affecting the low performance of the financial pillar as it was suggested for scenarios four and seven. The amount of oranges and their pH level are expected to provide the company with larger amounts of by products which will be flavorful and preferred by customers.

The SBSC of this scenario has depicted the KPI performance of this case scenario. The financial pillar has stable and high revenue growth, it has also decreased in revenue from animal feed and cost savings from circular activities operated by the company. In the internal process pillar, there is an important downgrade because the high quality molasses production is below baseline leading to missed opportunities for revenue and underutilization of raw materials. The liquor produced remains stable and productivity growth has optimized performance. The overall image of this pillar remains good, but the decrease of molasses should be addressed as a threat and the industry will have to find ways to enhance it. The customer pillar demonstrates an exceptional level of performance. High compliance to safety and quality standards and customer satisfaction has resulted in strong customer profit margins. The good performance that the customer pillar

has should also be linked to the right maturity, humidity and quality of the oranges processed in this case scenario.

The advantages and prospects within this context underscore a robust financial infrastructure, with persistent growth and profitability emphasizing the operational efficiency. Evidently, customer satisfaction is markedly high, suggesting superior product quality and consumer loyalty. The cost-reduction strategies demonstrate significant potential for reinvestment into more sustainable methodologies, thereby bolstering long-term profitability. Furthermore, the judicious utilization of resources facilitates opportunities for the enlargement of production capacities and market penetration, thereby ensuring that the enterprise sustains its competitiveness and adaptability within a dynamic industry.

Tenth case scenario analysis

This scenario's analysis demonstrates a less favorable performance overall, with several areas requiring significant improvement to meet optimal standards. This last scenario used 20 oranges with 80% humidity and a pH level at 2. The temperature used for processing the oranges is 21 °C. High humidity percentages generally lead to increased energy consumption and subsequently to high rates of CO₂ emissions. This scenario's KPI performance should be taken under consideration so that the industry can address changes and enhancements necessary to increase its efficiency, sustainability, and overall profitability.

The SBSC created for this scenario depicts the moderate image of the financial pillar. For this pillar, revenue growth's decreased must be highlighted because it is 0,5% lower than baseline. This indicates slower progress in generating additional income, showing that the current strategies may not be as effective in expanding market share. The next pillar showcasing low performance for this scenario is the customer pillar, since all three indices that make it up rate within lowest levels. Bad performance of this aspect is highly aligned with relatively low compliance to product quality and suboptimal combination of control variables. This pH and humidity rate the oranges have might not be as flavorful and the temperature used to process them must have made a lower by product quality that were sold to the market. The next pillar that proves this is the internal process. A significant amount of orange liquor and high-quality molasses were produced, leading to increased processing costs for the oranges. However, this investment did not translate into the desired level of customer satisfaction. Additionally, the low productivity growth suggests inefficiencies in the production process, indicating that resources are not being utilized optimally to generate higher outputs. Finally, the sustainability performance of this scenario is also moderate with highly increased energy consumption and CO₂ gas emissions generated. This output was expected by the control variables chosen as the high humidity rate for an average amount of oranges and temperature demands higher energy consumed by each stage of orange processing in order to reach the baseline amount of revenues and by products.

The strengths inherent in this scenario imply a proficient utilization of resources alongside a pronounced emphasis on upholding product quality and fostering customer loyalty. The identified opportunities signify the potential for enhanced sustainability through diminished dependence on raw materials and the proliferation of environmentally conscious practices. Augmented employee satisfaction and deliberate initiatives in green labeling present avenues for bolstering workforce engagement and enhancing market positioning.

The identified weaknesses illuminate inefficiencies in energy utilization and present challenges in sustaining consistent revenue expansion, thereby indicating prospective domains for operational enhancement. The threats imply that, although customer satisfaction remains elevated, it is susceptible to variabilities, and the imposition of more stringent regulatory requirements concerning CO₂ emissions may introduce compliance

challenges. The comparatively modest rate of productivity advancement indicates potential obstacles in aligning with market exigencies.

5. Conclusion

In this thesis, we have demonstrated how sustainability can enhance the value of an organization's strategic management by employing the sustainability Balanced Scorecard (SBSC) framework within the context of Aspis's juice production sector.

The integration of the SBSC within the Aspis sector constitutes a pivotal strategic framework designed to synchronize sustainability objectives with operational and financial aspirations. The key findings of this investigation illustrate that the SBSC proficiently underscores areas necessitating enhancement, pinpoints potential opportunities, and guarantees a comprehensive approach to the achievement of lasting sustainability. Through the adoption of the SBSC, Aspis is enabled to systematically evaluate its environmental, social, and financial performance, thereby augmenting its capacity to respond effectively to market dynamics, regulatory obligations, and consumer anticipations.

The implementation of the SBSC is anticipated to assist Aspis in prioritizing ongoing improvement, thereby facilitating informed decision-making processes that result in enhanced resource efficiency, diminished environmental repercussions, and fortified stakeholder relations.

Through applying the SBSC framework, we assessed the influence of temperature, production volumes, and resource management on critical performance indicators, thereby revealing the strengths and limitations inherent in the company's approach to sustainable production. The results of this research indicated that sustainability transcends environmental considerations and constitutes a competitive advantage that can catalyze profitability, operational enhancements, and sustained growth. This comprehensive approach highlighted insights into how the company could refine its processes and objectives in alignment with sustainable practices, illustrating the compatibility of sustainability and corporate success. From such analysis, it became evident that including sustainability in the company's foundational strategies would enable Aspis to achieve greater competitiveness, resource efficiency, and the establishment of a resilient business model predicated on both environmental and financial performance.

With the SBSC incorporation to the industry's strategic management, significant conclusions have been made for each pillar. The financial performance of the industry indicates that the company's financial health is strongly influenced by the quantity and majority of processed oranges. Higher quantities and matured oranges consistently drove significant increases in revenue from animal feed and customer profitability. This demonstrates that optimizing these inputs directly improves the financial performance of the company and shows that production volume adjustments can bring significant economic benefits. Revenue growth reaches a point where it no longer increases significantly, even when production continues, or other factors change suggesting a possible market saturation point for my products like animal feed that should be closely monitored to avoid excess production and waste.

The internal process pillar became a driver of sustainability for the company. The highest amount of liquor produced was in scenarios with increased orange amounts suggesting the production can grow to meet increased demand. Nevertheless, this scalability also led to an increase in energy consumption highlighting the need for energy efficient technologies and the practices, especially during peak production periods. Good maturity and controlled temperature scenarios showed higher productivity growth. Maintaining optimal operating conditions may result in smoother workflows and the faster

processing. With this knowledge a space can tune its processes to get maximum output with minimum resource consumption.

Maintaining Product Safety and quality and customer satisfaction were consistent strengths in all scenarios and reflected the company's commitment to high standards even in challenging operational conditions. Results indicated that orange maturity boosted these KPI's, suggesting that quality raw materials are critical to customer loyalty and trust. That kind of high-quality performance suggests that despite the solid foundation in providing superior products, a space still has an opportunity to improve customer satisfaction by continuously monitoring and adjusting production parameters.

At the sustainability pillar, this research mentioned that the company reuses water and has high engagement in circular activities. Though, an important factor this research highlights is the need for improvement in managing CO2 emissions. Higher production volumes were related to increased emission and thus required Aspis to adopt greener technologies and process in order to reduce its carbon footprint. A consistent amount of water is reused across scenarios indicating that the company cares about water conservation. Aspis should expand its waste management and recycling activities to include all production steps.

The training & development and work life balance indices indicate that the company it's too healthy work environment. Higher production scenarios required additional training, so employees were prepared for more involved processes. Such proactive workforce development improves operational efficiency as well as employee morale and retention. Employee satisfaction is crucial for a long-term success because the facts productivity, quality and performance.

Out of the 10 scenarios analyzed, scenarios 3, 6 and 9 were the best. Scenario 6 is the most optimal scenario since almost all its indices have the highest scores, followed by scenario 3 and 9. These scenarios offered a balance between good financial performance, good operational efficiency, good product quality and good employment relations. Scenario 6 is the best example of operational excellence as it benefited the industry with high revenues and productivity growth, resulting in increased customer and employee satisfaction. The sector this scenario did not perform as good as expected is the environmental pillar since energy consumption and CO2 gas emissions were relatively high. This issue should be addressed by the industry by investigating which control variable or variables have to be altered to provide better results.

Scenario 3 and 9 the financial gains, productivity growth and environmental sustainability we're best balanced overall. Even with slightly higher CO2 emissions these scenarios showed significant cost savings from circular activities, suggesting that the company could cope with increased production without compromising sustainable practices.

These optimal scenarios show that Aspis has the potential to achieve long term success by integrating sustainability into every aspect of its operations. All three scenarios have similar results averagely using temperature at 18C – 21C, 20 oranges, the pH level should be 2 and the humidity rate within 70% - 85%. Sustainability investments in terms of energy use efficiency, waste management improvement and employee training bring about long-term environmental benefits as well as financial savings and productivity gains. The optimal scenarios also demonstrate that a targeted effort towards enhancing core processes such as resource utilization and circular activities can contribute to a significant cost

reduction and to a better product quality, critical for a good brand image and customer loyalty in today's market.

The company should optimize inputs such as the quantity of oranges processed but pH level, humidity percentage and the temperature should remain stable to achieve maximum financial and operational performance. Each control variable within the recommended rates positively affects revenue profitability and productivity. Increase production requires sustainable practices such as energy efficiency improvement and robust emission control measures. Continuous improvement of water reuse practices supports companies' sustainability goals. Employee training and the supportive work environment are important to maintain high productivity and quality standards while keeping the workforce motivated leads to operation success.

The thorough examination of the citrus processing enterprise within various contexts underscores the pivotal significance of strategic optimization in attaining balanced growth. Through the alignment of production resources with sustainable methodologies and the commitment to workforce advancement, the organization may increase its financial viability, operational efficacy, and ecological responsibility. This integrated strategy guarantees sustained prosperity and adaptability within a competitive industrial milieu.

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