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Balanced Scorecard for Circular Economy: A Methodology for Sustainable Organizational Transformation

Alejandro M. Martín-Gómez * [ID], **María Pineda-Ganfornina, María Jesús Ávila-Gutiérrez** [ID]**, Alejandro Agote-Garrido** [ID] **and Juan Ramón Lama-Ruiz** [ID]

Design Engineering Department, Higher Polytechnic School, University of Seville, 41011 Seville, Spain; mavila@us.es (M.J.Á.-G.); aagote@us.es (A.A.-G.); jrlama@us.es (J.R.L.-R.)
* Correspondence: ammartin@us.es

Abstract: The integration of circular economy (CE) principles within organizational strategies has become imperative for companies committed to sustainability and resource efficiency. This study explores the adoption of CE principles and the role of the balanced scorecard (BSC) as a facilitative tool. By contextualizing the significance of CE adoption, this paper reviews existing BSC models that incorporate sustainability aspects and evaluates software solutions for BSC implementation. Subsequently, a novel methodological framework was proposed. As a novelty, the strategic analysis included the use of a SWOT analysis. Once the situation was identified, BS 8001:2017 was used to define strategic objectives oriented towards the principles of a CE. Moreover, the proposed objectives were prioritized using the analytic network process tool. After completing the organizational and strategic analyses, the UNE 66175:2003 norm was incorporated to decide on the most appropriate indicators for each objective. Finally, to illustrate the proposed framework, a theoretical detailed case study was developed within the context of an industry specializing in the design and manufacturing of plastic packaging. The developed BSC was implemented using the selected software. This study demonstrated the convenience of establishing a methodology to guide decision making in the development and monitoring of the BSC.

Keywords: balanced scorecard (BSC); circular economy (CE); corporate sustainability; strategic management; methodological framework

1. Introduction

The imperative adoption of circular economy (CE) principles within organizational strategies has brought sustainability and resource efficiency into the spotlight for companies across various sectors. Thus, the concept of a CE has emerged as a framework built on three principles, driven by design: eliminating waste and pollution, circulating products and materials (at their highest value), and regenerating nature [1]. However, translating a CE into organizational practices has not been a straightforward task. Until recent years, there was a lack of authoritative guidance on CE principles, strategies, implementation, and monitoring. In response to this, in 2017, the British Standards Institution published the first practical framework and guide for corporations on implementing CE principles, known as BS 8001:2017 "Framework for implementing the principles of a CE in organizations" [2]. This standard aims to integrate CE principles with the business management practices of organizations. However, the standard stipulates that it is organizations themselves who are responsible for defining their strategic objectives and appropriate indicators [3].

However, integrating these CE principles into the operational fabric of small- and medium-sized enterprises (SMEs) presents a particularly challenging dilemma. In this context, the balanced scorecard (BSC) has emerged as a powerful strategic management tool [4]. Its ability lies in clarifying and translating the organizational mission and strategy of a company, enabling communication, strategic alignment, and organizational learning.

Furthermore, it is characterized by its versatility and its ability to adapt to various kinds of organizations. One of the most significant contributions of the BSC is its focus on improving business results and making the best use of available resources [5]. Therefore, the BSC enables organizations to enhance their performance by linking the various parts of the organization and its members, in a concerted effort aimed at increasing the aims of the corporation [6]. Nevertheless, despite the numerous advantages associated with the BSC in enhancing organizational performance, its integration into SMEs poses a formidable challenge [7]. SMEs, characterized by their unique attributes, including limited resources, informal organizational structures, and a predominant focus on short-term survival, may initially seem less compatible with the structured and formalized processes typically associated with the BSC [8].

This study has the following aims: (a) to analyze the advantages and disadvantages of using the BSC to incorporate the principles of a CE into SMEs; (b) to develop and propose a methodological framework based on the standard BS 8001:2007 that guides the effective implementation of CE principles based on the incorporation of the BSC in the context of SMEs; and (c) to illustrate the implementation of this framework through a specific case study.

This paper offers three main contributions to the field of strategic management and corporate sustainability. Firstly, it establishes the current situation of companies in incorporating a CE into their strategic management. Secondly, it develops a methodological framework based on the BSC to implement the principles of a CE into SMEs. Finally, through a case study based on the plastic packaging industry, it demonstrates the applicability of this methodology in an industrial context.

The article is organized as follows: (1) the Introduction Section presents the research problem and contextualizes the study; (2) the Background Section provides a literature review on the current developments in the CE and the BSC, establishing the theoretical framework of the study; (3) the Methodology Section describes the methodological approach adopted for implementing a CE into SMEs through the BSC; (4) the Case Study Section details the application of the framework in the plastic industry, offering a practical analysis of its implementation and results; and (5) the Conclusions Section presents the conclusions, implications, and recommendations for future research and industrial applications.

2. Background

In this section, a review is provided of the key concepts considered in this study. The aim was to identify the benefits of integrating CE principles into business management, as well as the challenges faced by SMEs. Additionally, this section examines the advantages and disadvantages of using the BSC and the existing approaches of the BSC for incorporating sustainability and CE principles. Furthermore, it compares software tools for implementing the BSC into SMEs.

2.1. Circular Economy and Business Management

The concept of a CE represents a paradigm shift in business management [9]. This concept emerged to transform the traditional linear model based on "produce, use, and dispose" into a more sustainable and regenerative approach [10]. A CE focuses on the creation of closed production systems. In fact, the resources are used efficiently, and waste is minimized and continuously recycled [11]. The implementation of a CE in companies is aimed beyond reducing the environmental impact and improving sustainability, because it drives innovation and competitiveness in the market [12]. By considering these principles as operational strategies, organizations can proactively face challenges such as resource depletion and market fluctuations. This allows businesses to discover new opportunities for growth and value creation [13].

A CE offers multiple benefits beyond mere resource conservation. However, many companies, especially SMEs with fewer resources for business management, experience

serious difficulties in implementing CE principles in their companies [14], primarily due to a lack of technical skills [15]. Another barrier that SMEs face in implementing a CE is the collection and management of business and operational data, as they lack an integrated framework that enables decision making [16]. Therefore, multiple studies have focused on establishing programs, guidelines, and frameworks as innovation developments to progress towards circular transition [17–20]. These studies have also emphasized the need to establish the transition at various levels of analysis (micro, meso, and macro) [21].

The standard BS 8001:2017 outlines significant opportunities to improve the sustainability and efficiency of organizations at both the macro and micro levels [2]. At the macro level, adopting circular models permits a greater resilience in economic systems, but also mitigates the risks associated with the volatility of raw material prices [22]. This, in turn, contributes to economic growth, the preservation of natural capital, and the mitigation of climate change. At the micro level, organizations benefit from cost savings due to the reuse and better management of resources. Additionally, the adoption of a circular model promotes an improvement in customer relationships through more service-oriented business models [23]. However, the standard is a guideline and, therefore, does not define all the aspects of the incorporation of CE principles into companies; rather, it indicates that the organizations themselves will be responsible for defining their strategic objectives and associated indicators [3].

2.2. Balanced Scorecard for Circular Economy

The BSC has emerged as a transformative tool in the context of business management. It integrates strategic planning with operations and demonstrates a high correlation with improvements in organizational performance, both in the short and long term [24]. The BSC allows for structuring business thinking and provides a holistic view of the organization [25]. Moreover, nowadays, the adaptability of the BSC to various organizational dimensions and its ability to align the corporate mission with staff mobilization make it an indispensable tool in a competitive landscape [26]. Likewise, it guides the generation of value in the supply chain by directing change in a planned and controlled manner [27]. However, the practical development of the BSC presents challenges, requiring an integrated approach of teamwork and continuous learning [28].

The BSC can be implemented in organizations through three progressive levels: Levels A, B, and C [29]. Level A focuses on measurement and control. This allows for an improved understanding of the organizational situation, without significant changes in the management culture. Level B, promoted by top management, develops a management system based on strategy. This involves greater executive participation and a considerable impact on corporate culture. Level C aims to achieve an organization model and change management focused on aligning key people in the organization. This allows for a more flexible adaptation to changes, but requires meticulous planning of the change to align individual behavior with the defined strategic objectives [30,31].

The correct implementation of the BSC can provide the following advantages: (i) providing management with control in strategic dimensions; (ii) communicating the individual contribution of each employee; (iii) highlighting the benefits of investing in the development of competencies, information technologies, and customer relations; (iv) creating employee awareness that not all decisions yield immediate results; and (v) enabling the creation of opportunities for systematic learning, focusing on the critical success factors of the company [26]. However, there are several difficulties in implementing it, such as: (i) a lack of support from top management, (ii) little involvement from employees, and (iii) excessively long waiting times until the BSC is put into use [32]. In addition, a series of disadvantages have been identified as a consequence of applying the BSC: (i) the neglect of certain stakeholders, which is a common form of implementation failure; (ii) a non-existent cause-and-effect relationship; (iii) an external environment that is not integrated, as the BSC incorporates an insufficient number of external variables, under-

estimating the impact of the environment; and (iv) difficulty in establishing an adequate system of indicators [33].

In the realm of sustainability, specific BSCs have been developed that have evolved from the traditional BSC to enhance the integration of environmental, social, and economic aspects into the management and metrics of organizations [34–36]. These types of BSCs are organized in two ways: (i) the sustainability aspects are integrated within the four traditional perspectives, or (ii) a fifth sustainability perspective is added to the traditional BSC [37]. However, the literature indicates a lack of consensus in establishing a clear connection between a sustainable balanced scorecard (SBSC) architecture and the environmental performance outcomes [38]. Furthermore, although SBSC models have been developed in one way or another, no scorecard has been developed to date that is oriented according to the principles of a CE. However, there are few studies that delve into the use of the BSC for implementing CE principles in organizations [39]. Among them, it is worth highlighting the development of a methodology based on the BSC for implementing a CE in construction projects [40,41]. Other proposals for frameworks similar to the BSC for a CE in construction waste management suggest the use of a Monte Carlo simulation [42].

2.3. Applications to Implement the BSC

Selecting an appropriate tool for the implementation of the BSC is a critical aspect of its incorporation within an organization. The selected tool must be sufficiently flexible to facilitate alignment between the company's strategy and its organizational culture [43]. Moreover, its adaptability and ease of use are essential to avoid resistance from employees and management, which could lead to failure in the BSC implementation. The chosen tool should serve as an effective means of communication, providing guidance towards achieving specific objectives [44]. Depending on the level of BSC implementation, different software solutions are required. For Level A, a spreadsheet and a simple database that integrate with the organization's information system may suffice [45]. For Levels B and C, an application that combines an enterprise resource planning (ERP) system with a database is recommended, thus optimizing the use and performance of the BSC. Several software developers offer applications with similar features. Table 1 presents a comparison of four main tools, evaluating aspects such as a collaborative approach, an interactive and intuitive interface, availability in Spanish, and the price [46,47].

Table 1. Comparison of applications for the implementation of the BSC.

	Corporater	ClearPoint Strategy	Spider Impact	BSC Designer
Collaborative approach	✓	✓	✓	
Report generator	✓	✓		✓
Intuitive interface		✓	✓	
Data import from Excel			✓	✓
Alert configuration			✓	✓
Devices	Web Android/iOS	Web Android/iOS	Web Windows Android/iOS	Web Windows
Availability in different languages		✓		✓
Price (10 users)	Customized quotation	800 USD/month	1000 USD/month	600 USD/month
Free trial	✓ (For companies only)	✓ (For companies only)	✓ (For companies only)	✓
Other highlights	Meeting support Automatic and manual data collection Process workflow	Project manager Creation of customized graphics	Any panel can be exported in PDF, Excel, PowerPoint, Word, etc. Automatic creation of strategic maps from data	Organizational structure viewer BSC models already designed to be used as a model

3. Methodology

Based on the identification of the advantages and disadvantages of the use of the BSC, the methodology proposed in this work for the implementation of the BSC into companies from the principles of a CE is detailed below. The proposed methodology is divided into three fundamental phases: (i) a preliminary analysis of the organization, (ii) the design of the BSC, and (iii) the implementation of the BSC.

The preliminary analysis phase is divided into three parts, as shown in Figure 1: (i) an analysis of the organization, (ii) a strategic analysis, and (iii) identifying issues prior to the design of the BSC. The analysis of the organization identifies the mission, vision, and values [48]. This includes the value proposition, the product portfolio, and the production process [49]. In this methodology, the strategy to be defined must be oriented towards the principles of a CE. To implement the circular model, the guide of BS 8001:2017 can be used. In addition, the proposed objectives are prioritized using the analytic network process (ANP) tool so that at least two strategic objectives are obtained for each perspective of the BSC [50]. The ANP tool has been identified as a useful tool for stablishing strategic objectives in a BSC context [51], and it allows for the generation of strategic maps to communicate the aims [52]. Finally, once the strategy analysis is defined, a general questionnaire adapted from the one proposed by Amo Baraybar is carried out. This questionnaire synthesizes the previous information and clarifies other aspects [45].

Figure 1. Procedure for pre-analysis.

After the organizational and strategic analyses are completed and the preliminary issues for the implementation of the BSC are resolved, the formal design phase begins, as depicted in Figure 2. In this second phase, it is necessary to decide which indicators are the most appropriate for each objective (selection stage in accordance with UNE 66175:2003). A proposal of indicators for each objective is then made, specifying their type. The standard proposes the following steps: (i) the selection and naming of the concept to be evaluated, (ii) formula calculation, (iii) the definition of the form of representation, (iv) the definition of responsibilities, and (v) the definition of objective thresholds. Once the indicators that will form part of the BSC are defined, they are characterized, concluding the process with the final stage. This stage involves the selection and implementation of the BSC in the most suitable application.
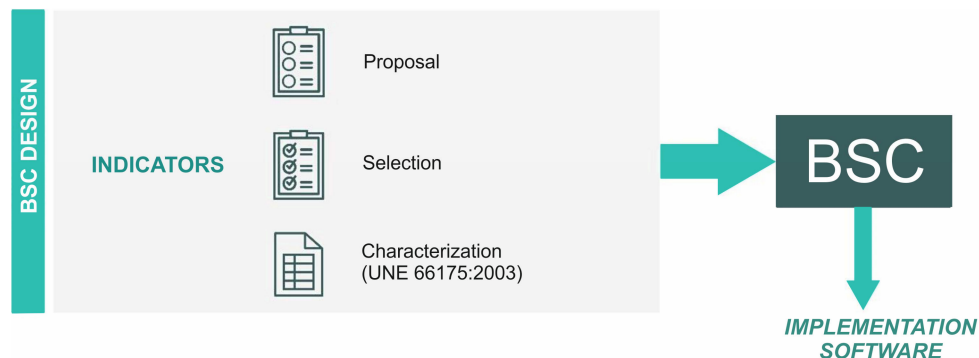
Figure 2. Procedure for the design and implementation of the BSC.

The proposed methodology presents a unique approach by integrating the BSC with CE principles. The innovation lies in the customized application of the BSC framework for specific CE objectives. This involves adapting traditional perspectives to emphasize sustainable resource management and circular processes. Additionally, the use of performance indicators that align strategic objectives with CE principles fills a gap in the current literature. This methodology aids organizations in transitioning towards sustainability and offers a novel tool for measuring and managing their progress in a CE context.

4. Case Study

4.1. Strategic Analysis

The case study used to implement the proposed methodology was based on a fictional SME dedicated to the production and distribution of plastic bottles. These bottles, designed to hold both liquid and solid products, were manufactured using advanced injection and blow-molding techniques [53]. The company was characterized by its flexibility and customer orientation, participating from the initial design to the production of the mold and the final manufacturing. Furthermore, the company was committed to quality, using raw materials that ensured durability and strength in its products.

Before formulating the strategy and understanding the situation of the company, a SWOT analysis was conducted, as shown in Table 2. This tool helped to establish the strategies to ensure the viability of the new project being proposed.

Table 2. SWOT analysis.

Internal Analysis	External Analysis
Weaknesses Lack of sustainable management system. No use of recycled raw materials. Archaic information systems.	**Threats** Imported packaging with bad press about plastics. European legislation on the reduction in the consumption of plastic packaging. New substitute materials.
Strengths Quality of products—experience. Satisfied workers. Tailor-made packaging.	**Opportunities** Competition without sustainable management. Improvements to the image of the plastics industry by implementing environmentally friendly processes. European project for the CE in the plastics industry.

After completing the analysis, a strategy was defined to enhance the strengths, overcome the weaknesses, control the threats, and take advantage of the opportunities. The proposed objective of the company was to make its economic, social, and environmental activities more sustainable by implementing CE principles. The application of the recommendations of BS 8001:2017 allowed these objectives to be achieved. According to the standard, it is recommended to obtain a vision of the maturity level of an organization with respect to the CE before establishing a strategy [2]. In this case, the starting point was a level of immaturity. Therefore, the CE implementation process proposed needed

to be addressed from its first step. For the case study, this guide was adapted, tailoring the phases to the scope of the present project. For each stage, a series of questions and proposals were established to help resolve related issues.

- Stage 1: the application framework. Has a future vision for a more circular and sustainable mode of operation been defined? Are the benefits and opportunities of applying a CE understood? How are these communicated to the organization? What systems relate to the vision and objectives of the CE?
- Stage 2: the scope. How is the CE intended to influence the system? What assumptions are being made? What problems could arise, and could there be unintended consequences of any proposed action?
- Stage 3: the determination of the objectives and a strategic map. In Table 3, strategic objectives are proposed for the four perspectives of the BSC (financial, customer, internal processes, and learning and growth) considering the three dimensions of sustainability (economic, social, and environmental).

Table 3. Strategic objectives of the company for sustainability.

	Economic	**Social**	**Environmental**
P1 Finance	E1 Increasing profitability. E2 Generating a greater number of sales.	S1 Increasing productivity through better communication between management and the workers.	En1 Enabling long-term sustainability through recycling and the implementation of reverse-logistics processes.
P2 Customers	E3 Increasing the level of customer satisfaction. E4 Improving customer service and after-sales service.	S2 Improving the vision of customers. S3 Raising customer awareness of the need to be sustainable and the benefits of implementing a CE.	En2 Including recycled material in the manufacture of products. En3 Creating prototype solutions with biodegradable plastics.
P3 Internal process	E5 Increasing the efficiency of the production process. E6 Shortening development times for new products.	S4 Promoting responsible behavior among workers. S5 Reducing the number of occupational accidents.	En4 Reducing waste. En5 Consuming renewable energies. En6 Promoting eco-design.
P4 Training and growth	E7 Establishing economic incentives for personnel for productivity gains.	S6 Promoting a sustainable corporate culture. S7 Increasing the level of employee satisfaction.	En7 Raising staff awareness of the need to implement circular and environmentally friendly principles.

The colors in the table represent the different categories of strategic objectives: economic (yellow), social (red), and environmental (green).

The objectives presented were derived from the literature analysis conducted. Each one was selected to ensure that it was relevant, measurable, and applicable to the context of the organization [54]. After selection, the list of objectives underwent a prioritization process. This allowed for the creation of a strategic map based on quantitative criteria, rather than solely on experience. For this, the ANP tool was used [51,52]. It allowed the most significant objectives and the relationships between them to be identified [55]. First, the strategic objectives were identified as alternatives in the decision problem. The perspectives corresponded to the criteria. These were grouped into two components that were related to each other. After this, the relationships between the elements of the network were established through the influence matrix or inter-factorial domination matrix, as shown in Table 4. This matrix revealed the relationships between perspectives, objectives, and both groups.

The next step involved assigning priorities among elements that showed influences in the inter-factorial matrix. The influences were assigned values ranging from 1 to 9, depending on whether they presented equal importance or extreme importance, respectively, and the reciprocity was such that if Aij = x, then Aji = 1/x, where $1/9 \leq x \leq 9$.

Table 4. Interfactorial domination matrix.

		Perspectives				Objectives																						
		P1	P2	P3	P4	E1	E2	E3	E4	E5	E6	E7	S1	S2	S3	S4	S5	S6	S7	En1	En2	En3	En4	En5	En6	En7
Persp.	P1	0	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
	P2	0	0	1	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0
	P3	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	1	1	1	0
	P4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1
Objectives	E1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	E2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	E3	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	E4	0	1	0	0	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
	E5	0	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	E6	0	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	E7	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	S1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1
	S2	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0
	S3	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0
	S4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1
	S5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	S6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1
	S7	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	1
	En1	1	0	0	0	1	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0
	En2	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0
	En3	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0
	En4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	En5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	En6	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0	0	1	0	1	1	1	1	0	0	1
	En7	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	1	0	1	0

The colors in the table represent the different categories of strategic objectives: economic (yellow), social (red), and environmental (green).

In the case study, the following assumptions were made: (i) The perspectives relate in the following manner: the financial perspective influences the customer perspective, the customer perspective influences the internal processes perspective, and the internal processes perspective influences the learning and growth perspective. Each perspective will receive influence from the previous ones, although the immediately superior one will have greater importance, as shown in Table 5; (ii) the objectives influence the perspective in which they are framed equally; (iii) the perspectives only influence the objectives they encompass; and (iv) the influences between objectives are determined by developing 21 matrices, 1 for each proposed objective. Table 6, for example, represents the matrix for the objective En7. These tables answer the question: "To achieve objective x, does objective i or objective j have more influence?".

Table 5. Paired comparison matrix on perspectives.

Influence on P2		P1
	P1	1

Influence on P3		P1	P2
	P1	1	1/9
	P2	9	1

Influence on P4		P1	P2	P3
	P1	1	1/3	1/9
	P2	3	1	1/5
	P3	9	5	1

CR = 2.81%

Table 6. Paired comparison matrix on the A7 target.

En7 (CR = 8.01%)	E7	S1	S4	S6	S7	En4	En5	En6
E7	1	0.333	0.333	0.333	1	0.2	0.2	0.2
S1	3	1	0.2	0,2	1	0.2	0.2	0.2
S4	3	5	1	1	3	1	1	1
S6	3	5	1	1	3	3	3	3
S7	1	1	0.333	0.333	1	0.2	0.2	0.2
En4	5	5	1	0.333	5	1	1	3
En5	5	5	1	0.333	5	1	1	3
En6	5	5	1	0.333	5	0.333	0.333	1

The consistency of the pairwise comparison matrices (CR) was calculated to ensure that the assignment of influences was coherent (less than 5% for matrices with n = 3; less than 9% for matrices with n = 4; and less than 10% for matrices with n $\geq$ 5). Finally, the weight vector of each element in the matrix was calculated. By placing the obtained weights in the influence matrix, the original supermatrix was obtained, as shown in Table 7.

The final step was the calculation of a limit supermatrix. This was obtained by multiplying the weighted supermatrix by itself until the weights of a column were repeated throughout the entire matrix. In the case study, it was necessary to multiply 31 times. This matrix determines the global priority of the elements of the network and the final decision problem [56]. Table 7 presents the objectives ordered from highest to lowest according to their weight obtained from the limit supermatrix.

Having completed the original supermatrix, it was transformed into a weighted supermatrix, a stochastic matrix where the sum of each column must equal 1. In the case study, it was assumed that the perspectives and objectives influenced in the same way, as shown in Table 8.

Table 7. Original supermatrix.

		Perspectives				Objectives																				
		P1	P2	P3	P4	E1	E2	E3	E4	E5	E6	E7	S1	S2	S3	S4	S5	S6	S7	En1	En2	En3	En4	En5	En6	En7
Persp.	P1	0.00	1.00	0.10	0.07	1.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
	P2	0.00	0.00	0.90	0.18	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00
	P3	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Objectives	E1	0.25	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E2	0.25	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E3	0.00	0.17	0.00	0.00	0.10	0.15	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E4	0.00	0.17	0.00	0.00	0.10	0.15	0.32	0.00	0.00	0.00	0.05	0.00	0.55	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E5	0.00	0.00	0.14	0.00	0.04	0.05	0.09	0.08	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00
	E6	0.00	0.00	0.14	0.00	0.04	0.05	0.08	0.08	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E7	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.31	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	S1	0.25	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.06	0.07	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	S2	0.00	0.17	0.00	0.00	0.10	0.15	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.12	0.09	0.00	0.50	0.00	0.00
	S3	0.00	0.17	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.07	0.00	0.00	0.00	0.00
	S4	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.02	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.15
	S5	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	S6	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.34	0.41	0.14	0.33	0.50	0.35	0.25
	S7	0.00	0.00	0.00	0.25	0.02	0.02	0.06	0.36	0.50	0.50	0.02	0.83	0.05	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	En1	0.25	0.00	0.00	0.00	0.32	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.03	0.08	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
	En2	0.00	0.17	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.00	0.00	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.10	0.00
	En3	0.00	0.17	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00
	En4	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
	En5	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
	En6	0.00	0.00	0.14	0.00	0.00	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.00	0.00	0.07	0.00	0.14	0.48	0.69	0.07	0.00	0.00	0.13
	En7	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.67	0.00	0.34	0.12	0.38	0.00	0.00	0.31	0.00	0.45	0.00

The colors in the table represent the different categories of strategic objectives: economic (yellow), social (red), and environmental (green).

Table 8. Weighted supermatrix.

		Perspectives				Objectives																					
		P1	P2	P3	P4	E1	E2	E3	E4	E5	E6	E7	S1	S2	S3	S4	S5	S6	S7	En1	En2	En3	En4	En5	En6	En7
Persp.	**P1**	0.00	0.50	0.05	0.04	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00
	P2	0.00	0.00	0.45	0.09	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00
	P3	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.00
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Objectives	**E1**	0.25	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E2	0.25	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E3	0.00	0.08	0.00	0.00	0.05	0.07	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E4	0.00	0.08	0.00	0.00	0.05	0.07	0.16	0.00	0.00	0.00	0.03	0.00	0.27	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E5	0.00	0.00	0.07	0.00	0.02	0.02	0.05	0.04	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
	E6	0.00	0.00	0.07	0.00	0.02	0.02	0.04	0.04	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	E7	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.15	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	S1	0.25	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.03	0.04	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	S2	0.00	0.08	0.00	0.00	0.05	0.07	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.00	0.25	0.00	0.00
	S3	0.00	0.08	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.03	0.00	0.00	0.00	0.00
	S4	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.08
	S5	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	S6	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.17	0.20	0.07	0.16	0.25	0.17	0.12
	S7	0.00	0.00	0.00	0.13	0.01	0.01	0.03	0.18	0.25	0.25	0.01	0.42	0.02	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	En1	0.25	0.00	0.00	0.00	0.16	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.02	0.04	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
	En2	0.00	0.08	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.05	0.04	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.05	0.00
	En3	0.00	0.08	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.04	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
	En4	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
	En5	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
	En6	0.00	0.00	0.07	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.04	0.00	0.00	0.03	0.00	0.07	0.24	0.35	0.03	0.00	0.00	0.06
	En7	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.33	0.00	0.17	0.06	0.19	0.00	0.00	0.16	0.00	0.22	0.00

The colors in the table represent the different categories of strategic objectives: economic (yellow), social (red), and environmental (green).

Table 9. Weights obtained from the limit supermatrix.

	Weight	Perspectives	Objectives
✓	0.055	Finance	E1
✓	0.053	Finance	En1
✓	0.047	T&G	En7
	0.047	Finance	E2
	0.046	Finance	S1
✓	0.045	T&G	S7
	0.041	T&G	S6
✓	0.032	Customers	E3
✓	0.026	Customers	E4
✓	0.025	IP	En6
	0.023	Customers	S2
✓	0.017	IP	E5
	0.015	T&G	E7
	0.015	IP	S4
	0.014	Customers	En2
	0.013	IP	E6
	0.013	IP	En5
	0.013	IP	En4
	0.012	Customers	En3
	0.012	Customers	S3
	0.011	IP	S5

The colors in the table represent the different categories of strategic objectives: economic (yellow), social (red), and environmental (green).

For the development of the strategic map, the two objectives with the highest weight from each perspective were selected. These are presented in Table 10. Additionally, specific strategies that would be followed for each perspective were included.

Table 10. Strategies and objectives of the company.

	Strategy	Objectives
P1 Finance	Sustainable revenue growth.	E1 Increasing profitability. En1 Enabling long-term sustainability through recycling and the implementation of reverse-logistics processes.
P2 Customers	Achieving customer intimacy; providing the consumer with what they need.	E3 Increasing the level of customer satisfaction. E4 Improving customer service and after-sales service.
P3 Internal process	Producing sustainably and efficiently.	E5 Increasing the efficiency of the production process. En6 Promoting eco-design.
P4 Training and growth	Improving competencies related to sustainability and improving the work environment.	S7 Increasing the level of employee satisfaction. En7 Raising staff awareness of the need to implement circular and environmentally friendly principles.

4.2. Pre-Design Issues of the BSC

This phase consisted of two main stages. In the first stage, the questionnaire proposed by Amo Baraybar was administered. The answers to the formulated questions provided a general overview of the organization, which enabled the design of the BSC and its subsequent implementation [57]. The questionnaire is composed of 42 questions, which are divided into 7 areas: (i) objectives of the BSC; (ii) activity, business, and environment; (iii) strategy; (iv) organization; (v) processes; (vi) information systems; and (vii) people. The second stage involved identifying the success factors that would influence the company and establishing how the organization should prepare to address the inconveniences and prevent the implementation and monitoring of the BSC from failing [58].

4.3. Design of the BSC

The first stage of the design phase involved selecting indicators. Table 11 presents a proposal of indicators for each objective, allowing for the subsequent selection of these based on the following three criteria:

- For each objective, an inductor (leading) indicator and an outcome (lagging) indicator were included. If two outcome indicators were chosen, they were weighted based on how much information they contributed to the objective.
- Measurements that were already being conducted were prioritized over those that required additional actions.
- The selection of indicators whose information was easy to obtain was prioritized.

Table 11. Internal process indicator proposal.

Perspective	Objective	Indicator	Type
P1 Finance	E1 Increasing profitability.	Sales growth	Result
		Cost reduction	Result
		Company profitability	Result
	En1 Enabling long-term sustainability through recycling and the implementation of reverse-logistics processes.	Costs derived from reverse-logistics processes	Result
		Quantity of packaging returned to recyclers	Result
		Quantity of recycled raw materials purchased per year	Result
P2 Customers	E3 Increasing the level of customer satisfaction.	New customers through referrals	Result
		Number of complaints	Inducer
		Customer satisfaction	Result
		Abandonment rate	Result
	E4 Improving customer service and after-sales service.	Time to process an order	Inducer
		Delivery time	Inducer
		Rate of requests fulfilled on time	Result
P3 Internal Process	E5 Increasing the efficiency of the production process.	Performance efficiency	Result
		Machine utilization rate	Result
		Annual energy savings	Result
		Reduction in production waste	Result
		Production delays	Inducer
	En6 Promoting eco-design.	Sustainable designs developed	Inducer
		Hours dedicated to R&D&i on eco-design	Inducer
		Recycled material used in production	Result
P4 Training and growth	S7 Increasing the level of employee satisfaction.	Complaints received	Inducer
		Suggestions implemented	Inducer
		Employee satisfaction	Result
		Absenteeism rate	Result
	En7 Raising staff awareness of the need to implement circular and environmentally friendly principles.	Sustainability awareness campaigns	Inducer
		Employees awarded for their commitment to the circular economy	Result

Upon defining the indicators to be used, the final design of the BSC could be presented. Table 12 shows the chosen indicators associated with each strategic objective and their respective coordinator. For the selection of indicators, there are numerous studies focused on their evaluation, providing detailed analyses of their applicability and reliability [59,60]. The focus of this work, however, was centered on the development of the methodology, not considering within its scope the in-depth determination of which indicator is the most suitable for each objective.

Table 12. BSC indicators and coordinators.

Code	Objective	Coordinator	Indicator
F01	Increasing profitability	Administrative manager	F01-1 Company profitability
			F01-2 Sales growth
F02	Enabling long-term sustainability through recycling and the implementation of reverse-logistics processes	Quality manager	F02-1 Quantity of packaging returned to recyclers
		Sales manager	F02-2 Quantity of recycled raw materials purchased per year
C01	Increasing the level of customer satisfaction	Marketing and sales manager	C01-1 Number of complaints
			C01-2 Customer satisfaction
C02	Improving customer service and after-sales service		C02-1 Time to process an order
			C02-2 Rate of requests fulfilled on time
IP01	Increasing the efficiency of the production process	Production manager	IP01-1 Reduction in production waste
			IP01-2 Production delays
IP02	Promoting eco-design		IP02-1 Recycled material used in production
		Design and prototyping manager	IP02-2 Hours dedicated to R&D&i on eco-design
TG01	Increasing the level of employee satisfaction	Human resources manager	TG01-1 Suggestions implemented
			TG01-2 Employee satisfaction
TG02	Raising staff awareness of the need to implement circular and environmentally friendly principles		TG02-1 Sustainability awareness campaigns
			TG02-2 Employees awarded for their commitment to circular economy

Next, each indicator was characterized by following the recommendations of the UNE 66175:2003 standard [61]. Additionally, the actions that the organization needed to take to achieve the proposed objectives are included. Although this characterization was carried out for the sixteen selected indicators, as an example, the template proposed in this methodology is shown, completed for the indicator IP02-1, "Recycled material used in production" (Table 13).

Table 13. Characterization of the IP02-1 indicator.

Code IP02-1	Indicator Recycled material used in production	Type	Result
		Perspective	Internal processes
		Strategic objective	Promoting eco-design
		Responsible	Responsible for production
Definition		Amount of recycled raw material used in packaging production	
Frequency		Quarterly	
Calculation rule		(kg of recycled raw material used in production/kg of total raw material)100	
Target		≥40%	
		20–39%	
		≤19%	
Source of information		Production data	
Coordinator responsible for the information		Production manager	
Necessary actions		Record the weights of raw material used in production	

4.4. Implementation and Simulation of the BSC

The company proposed in the case study had a matrix organization, so the BSC Designer software provided a suitable structure to facilitate the implementation of the BSC. As an application specialized in this method, it greatly facilitated data entry, as well as the visualization and monitoring of these data [62]. Although its use requires training, it is worthwhile to train the responsible parties, as the software significantly streamlines strategy management. In the design, the data were entered according to the chosen frequency for each indicator over a two-year period to simulate medium-term functioning. Figure 3 shows the screen with the KPIs (key performance indicators) of the organization. The software set strategic objectives for each perspective, within which the indicators were found. This screen offered the most information, as it allowed for the visualization of the performance of the indicator and its progress, the latest data entered, and whether they were up to date. It was easy to graphically identify the type of indicator (performance indicators in green and outcome indicators in grey) and whether its performance was adequate through a traffic light system.
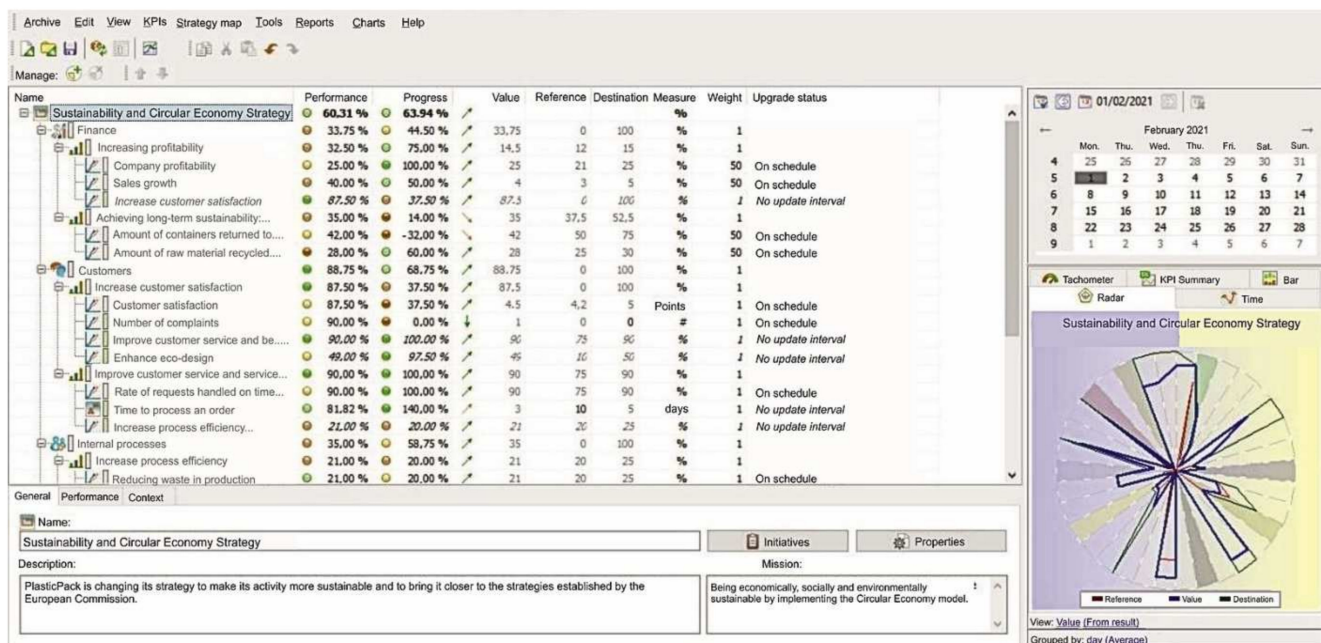
Figure 3. Organization's KPI screen in BSC Designer software.

The software was selected using the weighted technical value (WTV) criterion, as shown in Table 14. In comparison with the other software tools evaluated in Table 1, BSC Designer stood out for its data import capability from Excel and its alert configuration. These features enable the agile and proactive management of performance indicators. Unlike other tools, BSC Designer allows for a greater flexibility in data management, facilitating a quick and effective response. Additionally, its availability on multiple platforms and support in Spanish make it accessible to a wide range of users. These features, combined with its specialized focus on the BSC method and its ability to facilitate data entry and visualization, determined its selection for the study.

$$WTV_i = \frac{\sum_{j=1}^{n} p_{ij} \cdot g_j}{P_{max} \cdot \sum_{j=1}^{n} g_j} \tag{1}$$

Table 14. Weighted technical value (WTV) calculation table.

Criteria	Weights	Corporater		ClearPoint Strategy		Spider Impact		BSC Designer	
	g_j	p_{1j}	$p_{1j} \cdot g_j$	p_{2j}	$p_{2j} \cdot g_j$	p_{3j}	$p_{3j} \cdot g_j$	p_{4j}	$p_{4j} \cdot g_j$
Collaborative approach	0.05	5	0.25	5	0.25	5	0.25	1	0.05
Report generator	0.10	5	0.50	5	0.50	1	0.10	5	0.50
Intuitive interface	0.15	1	0.15	1	0.15	1	0.15	3	0.45
Data import from Excel	0.20	1	0.2	1	0.2	5	1.00	5	1.00
Alert configuration	0.10	1	0.10	1	0.10	5	0.50	5	0.50
Price	0.20	2	0.40	2	0.40	1	0.2	4	0.8
Availability in different languages	0.20	1	0.20	5	1.00	1	0.20	5	1.00
Summations	1	1.80		2.60		2.40		4.30	
	WTVi	0.36		0.52		0.48		**0.86**	

When the indicators and values were entered, the BSC Designer software automatically updated the strategic map shown in Figure 4. As with the KPI viewer, the performance indicators are represented in green and the outcome indicators in grey. For each strategic objective, its performance in the action part and in the outcome part, its indicators, and the values they take are shown. The software allows for the use of different graphics, such as a traffic light system, a tachometer, or a percentage bar. This software enables the visualization of graphical representations of different indicators, strategic objectives, perspectives, or the entire BSC. Additionally, it has an alert screen that allows for the configuration of warnings if critical values are reached. Another feature is the ability to generate reports.
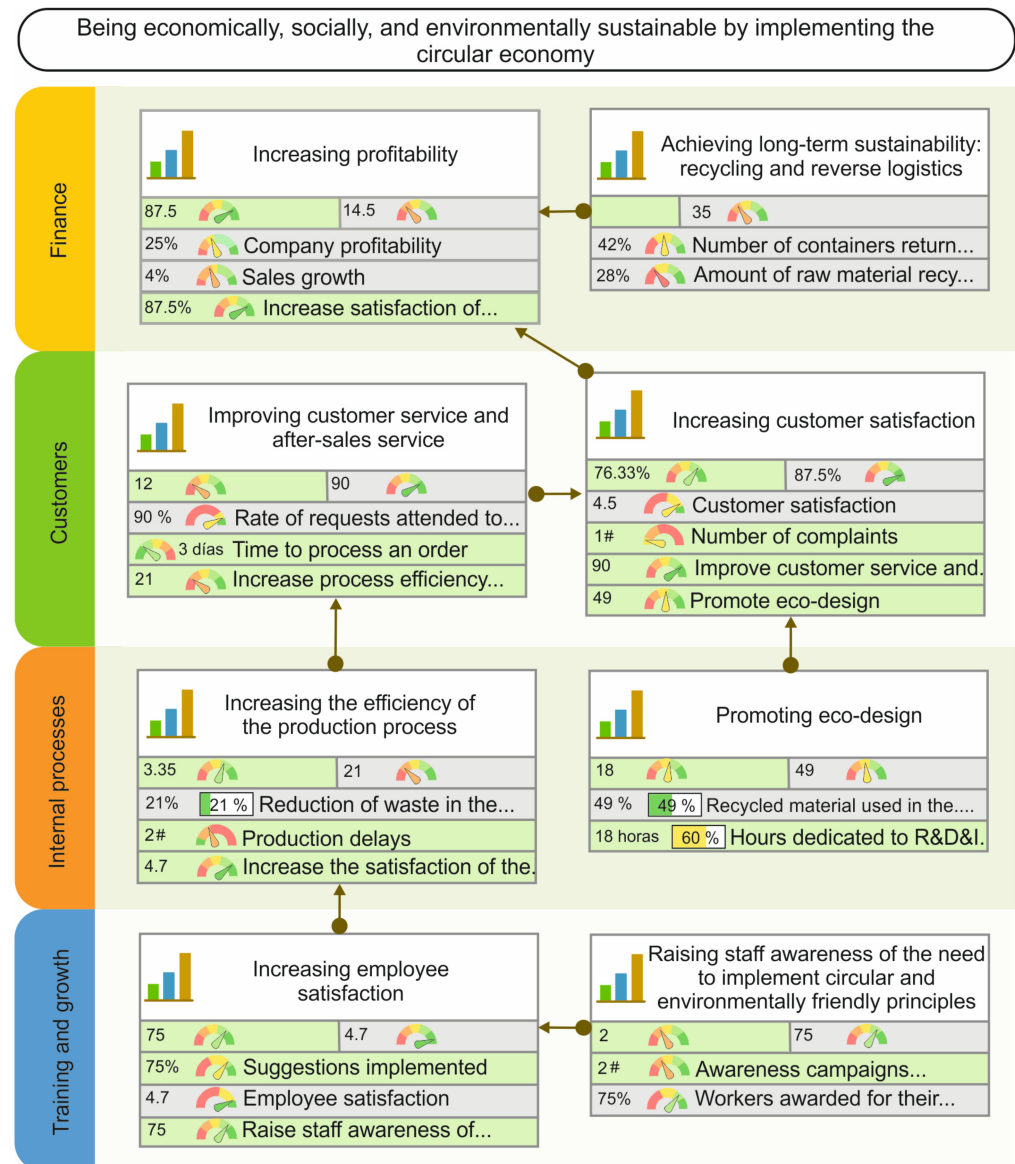
Figure 4. Strategic map of the organization using the BSC Designer software.

5. Conclusions

Firstly, (a) the developed study successfully explored the synergy between the principles of a CE and the BSC. It demonstrated their significant impact on strategic management and corporate sustainability. This analysis revealed how the integration of CE principles into the BSC can be effectively achieved without the need to add new dimensions to the BSC, thus providing a holistic view that improves both operational efficiency and environmental responsibility, in line with companies' sustainability objectives. Secondly, (b) a methodological framework was developed based on BS 8001:2007. It effectively guides the implementation of the BSC in a CE context. This framework guides the incorporation of sustainable practices into each of the traditional BSC perspectives and facilitates digitization. This enables efficient and adaptable strategic management for companies of any size.

Finally, (c) the proposed methodology was illustrated through a theoretical case study in the plastics industry. This case was fictitious and was designed to simulate realistic scenarios and challenges similar to those that an SME in this sector might face. Although theoretical, the case study served to demonstrate how the methodology for implementing the sustainable BSC can be adapted and applied in a real environment, providing practical

guidelines. As a future line, it is proposed to validate this methodology by applying it to a real industrial company. This will not only enable the effectiveness of the proposed methodology to be verified in a practical context, but it will also allow necessary corrections to be made, thus enriching the existing literature and offering a more robust guide for the practical implementation of the model in various industrial contexts.

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