IOSR Journal of Business and Management (IOSR-JBM)
e-ISSN:2278-487X, p-ISSN: 2319-7668. Volume 26, Issue 10. Ser. 4 (October. 2024), PP 24-32
www.iosrjournals.org

Strategic Choice And Responsible Innovation: Integrating Approaches To Foster Sustainable Business Development

Leydiana De Sousa Pereira[1], Natália Macedo Baião[2]
(Department Of Business Administration / Universidade Federal De Minas Gerais, Brazil)
(Department, Of Management Engineering / Universidade Federal De Minas Gerais, Brazil)

Abstract:
The study focuses on addressing businesses' growing need to integrate sustainability into their decision-making processes, given the recognized worldwide environmental impacts derived from industrial and technological growth. The study proposes a decision-support artifact that aligns with the Sustainable Development Goals (SDGs). In light of the principles of Design Science Research (DSR), it combines the Strategic Choice Approach (SCA), which helps manage uncertainties, with Responsible Innovation (RI) principles to guide the socially and environmentally conscious innovation process. As another novel, this artifact adopted the Borda voting system to select the best sustainable development courses of action. Data from a Brazilian solar energy company were considered to demonstrate the artifact's application. Our results deliver a decision-making support artifact whose results serve as inputs for strategic planning for the business. These artifacts highlight the importance of collaborations for decision-making within the scope of sustainable development. This paper proposes a novel and holistic approach that recognizes peculiar aspects of managerial commitment to advancing sustainability within a business context, contributing to the literature. Managers also can apply this decision artifact to improve sustainability performance.

Keyword*: Strategic Choice Approach, Responsible Innovation, Strategic Planning, Sustainable Development. Decision artifact.*

Date of Submission: 26-09-2024 Date of Acceptance: 06-10-2024

I. Introduction

The first decades of the 21st century is characterized by rapid and multifaceted economic progress alongside unprecedented technological growth (Monteiro *et al.*, 2024). However, these accelerated advances have brought significant environmental consequences. The expansion of industrial activities and increased consumption of natural resources have intensified ecological degradation on a global scale, leading to harmful events such as climate change, pollution, sea level change, biodiversity loss, and a growing scarcity of essential resources like water and minerals (Dogan *et al.*, 2024). These impacts threaten ecological balance and impose economic and social challenges on organizations and governments.

Society, increasingly aware of the negative consequences of the current development model, demands solutions that integrate technological innovation with environmental responsibility. In this context, sustainable development is no longer just an ethical and environmental priority but also a strategic opportunity for organizations. Consequently, organizations need adaptable management approaches to navigate the uncertainty, complexity, and conflicting stakeholder interests (Adomako and Tran, 2022; Kogetsidis, 2024; Packard and Bylund, 2024). Success in today's competitive landscape requires new skills and knowledge (Shute and Becker, 2010) and the ability to transition from a traditional to a circular economic model (Bertoglio and Bertoglio, 2024; Pan *et al.*, 2024).

Managing complex systems requires fine-tuning control mechanisms, considering environmental factors, detailed planning, optimal methods and technologies, proactive management, and timely adaptation to operational changes (Celone *et al.*, 2022). Thus, this research proposes an integrated decision-support artifact based on the Strategic Choice Approach (SCA) to promote sustainability in organizations within the Sustainable Development Goals (SDGs). SCA, a problem structuring methods (PSMs), is distinguished by its ability to manage uncertainties (Phahlamohlaka and Friend, 2004). Its flexible process fosters collaborative learning (Friend and Hickling, 2005). In addition, the Borda voting system was integrated into the artifact to align stakeholders' preferences better, replacing the traditional arithmetic mean in SCA. The Borda system ensures that all stakeholder' opinions are considered in the decision-making process, promoting a more balanced outcome (Panja *et al.*, 2020).

The intense search for innovation often disregards ethical and social responsibility aspects, highlighting the importance of Responsible Innovation (RI) (Imaz and Eizagirre, 2020; Jarmai and Vogel-Pöschl, 2020). RI covers the entire innovation process, ensuring new products do not harm public health and new production processes do not pollute the environment (Imaz and Eizagirre, 2020). Von Schomberg (2015) postulated that RI

is fully achieved when stakeholders collaborate and become mutually responsive. Governments, industries, universities, and research institutes must create collaborative networks fostering value co-creation and knowledge exchange (Monteiro *et al.*, 2024). These networks drive sustainable practices, innovation, and efficiency, contributing to a resilient business ecosystem. RI principles are integrated into the proposed decision artifact, promoting a conscious and responsible approach.

This research is innovative within the literature, offering a theoretical advancement by aligning SCA with the voting system and the fundamentals of IR. In practical terms, the artifact can act as an auxiliary, self-instructional, yet robust mechanism, guiding more efficient decision-making processes.

II. Theoretical Background

Sustainable development and responsible innovation (RI): concepts and interconnections

In September 2015, the United Nations adopted the 2030 Development Agenda entitled "Transforming our world: the 2030 Agenda for Sustainable Development", and since then, sustainability has become a focal point for both public and private institutions. This agenda outlines 17 SDGs with 169 targets, structured around five pillars (5Ps)—people, planet, prosperity, peace, and partnership (Monteiro *et al.*, 2024). In the same year, the European Commission developed the European Union action plan for the circular economy, aiming for a transition to a less linear economy, where products, materials, and resources are kept in the system as long as possible, and waste generation is minimized (Beheshti *et al.*, 2023; Genovese and Pansera, 2021).

The SDGs are depicted as an effort towards "hybrid" or "transitional" governance, evolving into "principle-based" governance models (Nonet *et al.*, 2022) and adopting a "governance through goals" approach to address global sustainability challenges (Alodat *et al.*, 2024). Consequently, businesses and policymakers are particularly influenced by these shifts toward new and sustainable ways of conducting business and managing societal demands (Beretta *et al.*, 2024). While studies suggest that the transition to sustainable development models can occur naturally in Western market economies when appropriate economic incentives are in place, this process often overlooks critical factors. These include people's roles, class relations and power asymmetries, local communities, care, and social reproductive labor, and the significance of non-human nature (Genovese and Pansera, 2021).

Transitioning to sustainable development requires technological innovations, creative work, inventive practices, and networks to explore knowledge practices. In this context, RI drives the transformations needed for sustainable development, either unintentionally or deliberately (Pansera *et al.*, 2021). RI is based on interrelated behavioral principles: anticipation, reflexivity, inclusion, and responsiveness. Anticipation involves questioning what is known, what is probable, and what is possible in the innovation process (Imaz and Eizagirre, 2020; Jarmai and Vogel-Pöschl, 2020) to identify the implications of the innovation being developed, minimizing risks and uncertainties while articulating different perspectives (Stilgoe *et al.*, 2013). Reflexivity refers to assigning role responsibilities and moral implications. Thus, in the innovation process, one must "be aware of the limits of knowledge and recognize that a particular framing of an issue may not be universally accepted" (Stilgoe *et al.*, 2013, p. 1571). Inclusion, aiming at collective management, involves engaging various stakeholders and the public throughout the innovation process (Jarmai and Vogel-Pöschl, 2020). Responsiveness refers to the ability to react to uncertain events (Imaz and Eizagirre, 2020; Stilgoe *et al.*, 2013).

Strategic approaches: foundations and trends

Organizations operate in increasingly dynamic and complex environments, facing multiple destabilizing forces (Kunc and O'Brien, 2019). In this context, strategic management becomes essential, characterized by theories, tools, and methods designed to help managers think, plan, and act effectively to enhance organizational performance and efficiency (Gunn and Williams, 2007). One of the essential skills for organizational management is the creative ability to approach problems, aiming to achieve a sustainable competitive advantage. This is because the rigidity of some traditional methods and tools for strategic analysis proves a partial view of the problem, given their limited ability to focus on design, implementation, or monitoring strategies (Beretta *et al.*, 2024; Kunc and O'Brien, 2019).

In the scenario of qualitative research methodologies, there has been an evolution beyond data collection techniques, allowing advances in the understanding of managerial phenomena, being innovative in bringing multifocal research to obtain an in-depth view of the behaviors, values, attitudes, and motivations of actors (Pita *et al.*, 2008). Since the 1970s, the need for a systemic view of organizational challenges has led to Soft Operational Research (OR) focusing on PSMs (Richardson, 2021). PSMs moved away from the functionalism of traditional OR, shifting management science towards interpretivism and recognizing subjective elements in social realities (Kogetsidis, 2024). These methods became effective by facilitating learning, collaboration, and stakeholder agreements (Mingers and Rosenhead 2004).

In addition to the SCA, PSMs portfolio includes Strategic Options Development and Analysis (SODA), which uses cognitive mapping; Value-Focused Thinking (VFT), which is based on structuring a decision

according to the decision maker's core values; and Soft Systems Methodology (SSM), which seeks to understand the problem situation in light of a comparative structure between the ideal and the desired outcomes. However, some traditional tools continue to be widely used, especially in a supportive manner. As an example it can be pointed out, the SWOT matrix—an analysis of an organization's strengths, weaknesses, opportunities, threats, and benchmarking—is a process of analyzing competitors (Berisha Qehaja *et al.*, 2017; Pereira *et al.*, 2021). Another tool is design thinking, which stands out in this context due to its flexibility and dynamism. The design thinking process begins with research and empathetic engagement with those affected by the product, service, or experience. By understanding their needs, alternatives are developed, tested, and critically assessed for improvements before implementation.

Interactive modes of Strategic Choice Approach (SCA)

The SCA stands out by incorporating action to mitigate uncertainties and producing a recommendation plan covering present and future perspectives as outcomes (Friend and Hickling 2005). Its versatility allows adaptation to both informal, quick decisions and complex scenarios with divergent opinions (Friend and Hickling 2005). Structurally, SCA follows an open and flexible process that enhances participants' understanding of the problem, fostering stakeholder cooperation and reducing conflict zones (Pereira and Morais, 2020). Rather than directly solving problematic, SCA manages decision-making by structuring issues and defining scenarios (Mingers and Rosenhead 2004).

The SCA operates a cyclical process emphasizing learning throughout its implementation. The cycle consists of four complementary modes: shaping (which defines the inputs to structure the problem), designing (which explores opportunities in the problem), comparing (which evaluates possible actions based on specific criteria), and choosing (which establishes an agreement on preferences by proposing present and future action plans) (Friend and Hickling, 2005).

The shaping mode focuses on understanding the decision problem to be analyzed. To this end, 'decision areas' are identified that represent opportunities for exploring the situation under investigation (Lami and Todella, 2023). These 'decision areas' are connected by links that indicate their influence on each other and form a 'decision graph.' This graph supports defining the problem's focus, as it is recommended to consider only three or four decision areas per cycle. If the problem has more than four possible areas, these should be prioritized based on stakeholders' preferences (Friend and Hickling, 2005).

The designing mode aims to identify 'decision options' that represent 'courses of action' for each decision area. In this mode, combinations are suggested, and the compatibility of decision options is verified by considering the decision graph. To this end, a 'decision scheme' is developed to visualize all viable decision options, resulting in a tree-like structure (Friend and Hickling, 2005). The comparing mode defines the 'comparison areas' as key aspects for evaluating decision options or schemes. The evaluations can be based on advantage attributes or simplified numerical scales. The main objective is to select a targeted, limited list of options for further action (Pereira and Morais, 2020).

The choosing mode identifies 'uncertainty areas', which are factors that cause difficulties or conflicts in the decision-making process. The focus is to propose 'exploratory actions' to mitigate doubts based on the limited list outlined in the comparing mode. SCA considers three types of uncertainties (Friend and Hickling, 2005):

- Uncertainties about the working environment (UE) consist of personal doubts or stakeholder disagreements regarding external circumstances or trends. Therefore, they require analytical intervention, such as research, forecasting, or modeling.
- Uncertainties about guiding values (UV) consist of doubts or disagreements regarding the values that should influence them, especially when evaluating course of action across different comparison areas. Therefore, they require political actions, such as defining objectives and consulting stakeholders.
- Uncertainties about related choices (UR) consist of doubts about considering future projections. Thus, they require some form of negotiation or collaborative proposals because their aspects go beyond the limits of the current decision.

This choosing mode delivers a 'commitment package' by including a time perspective. This outcome is an incremental and structural plan containing the decision schemes and actions to address uncertainties in "present" and "future" projections (Friend and Hickling, 2005).

Borda rule: a collaborative solution to align stakeholders

Voting systems assist group members in making collective decisions (Naamani-Dery *et al.*, 2015). Jean-Charles Borda introduced the Borda method in 1971, an ordinal multicriteria evaluation approach that assesses alternatives against defined criteria. It is often considered a consensus-based voting system (Panja *et al.*, 2020).

The Borda procedure assumes that each stakeholder established a total order of preferences ranked in "n" items. These preferences are converted into descending order of 1: {n, n - 1, n - 2, …}. Each value is assigned exclusively to one item. In other words, no two items can be equally preferred. Finally, the items are ranked

according to their total scores. The Borda winner is the item with the highest aggregate score, as shown in Equation 1.

$$max_j \sum_i q_j^i \quad (1)$$

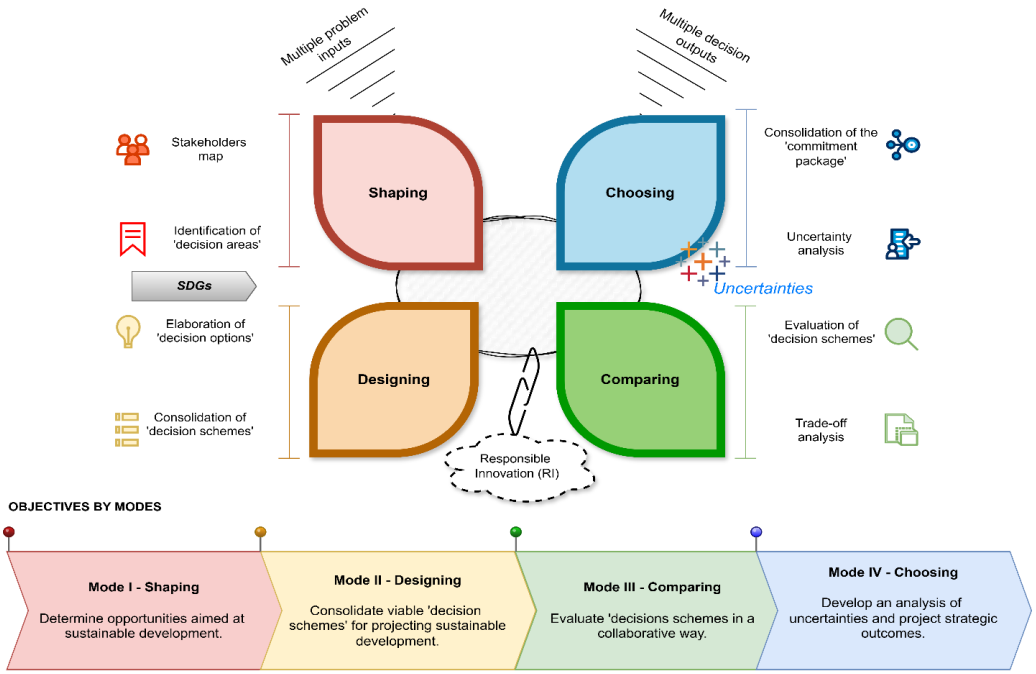
Where: q^i_j represents the score stakeholder "*i*" assigns to alternative "*j*".

The Borda method is recognized by collecting more information from the stakeholder since, unlike the pluralist voting system, it does not indicate only the winning item. According to Panja *et al.*, 2020, the Borda method is commonly used in music competitions, sports awards, voting in research institutions, and even political elections, such as in Slovenia (Fraenkel and Grofman, 2014) and adaptively in Ireland (Emerson, 2007). However, one of the main criticisms of the Borda method is its susceptibility to strategic voting. For example, a stakeholder, acting alone or in collusion, can rank a strong item lower than it is genuinely evaluated (Panja *et al.*, 2020).

III. Decision Artifact Procedures

This section describes the proposed decision artifact flows, including the research procedures following the DSR methodology (Hevner *et al.*, 2024; Peffers *et al.*, 2020). This artifact is consolidated within the problem-centered direction and is organized based on SCA modes, as shown in Figure 1.

Figure 1. Decision artifact flows



Source: Authors, 2024.

The following subsections present each artifact mode regarding inputs, actions, and outcomes.

Mode I – Shaping

The organization, recognizing its context, must first identify a set of opportunities ('decision areas') related to sustainable development, which can be explored to enhance competitiveness and promote balanced growth. The integrated SWOT matrix can contribute to this phase, identifying internal and external business factors (Pereira *et al.*, 2021). As a starting point, it is suggested that the 17 SDGs be considered potential 'decision areas' and that the focus be narrowed to five or six SDGs aligned with the business profile. It is crucial to consult the stakeholder network, using tools like brainstorming, to connect decisions with broader interests.

Organizations may not always be aware of their critical stakeholders, but for sustainable development, they should build a network connecting primary and secondary actors (Pereira *et al.*, 2021). Thus, a "stakeholder map" is recommended to identify the parties and understand their needs and expectations (Mitchell *et al.*, 1997). Knowledge and resource networks play a critical role in business evolution. The inclusion of "new voices in the

governance of science and innovation" (Owen *et al.*, 2013, p. 1571) through RI enhances the legitimacy of the process and its outcomes while also increasing the diversity of perspectives (Jarmai and Vogel-Pöschl, 2019).

After the initial filtering of 'decision areas,' it is necessary to establish their interconnections, indicating influence relationships. At this moment, defining the problem's focus is also necessary to carry out the process. The SCA principles recommend prioritizing only three or four decision areas, forming an focused 'decision graph' to avoid excessive complexity.

Mode 2- Designing

From the 'decision graph,' stakeholders must develop 'decision options.' In the proposed artifact, these 'decision options' can be seen as the actions aimed at achieving the selected SDGs. Actions can range from traditional ones, as noted by Geissdoerfer (2017)—such as cycling, extension, intensification, and dematerializing resource flows—to more innovative approaches, including the integration of emerging technologies, focusing on relationships rather than transactions, and fostering circular business models adapted to local needs. RI principles are evident as a contribution to this mode stage since a change process disconnected from the top level may not produce the desired results.

Sustainable development actions often require cultural changes and concern for creating business value (Beheshti *et al.*, 2023). Design thinking is recommended as a supporting mechanism in this mode due to the creative approach to generating ideas based on the stakeholder's needs. In summary, sustainable development can be integrated into a business in three stages: strategic proactivity – efficiency, where sustainability increases the current competitive advantage (through costs or differentiation) to maximize shareholder value; strategic proactivity – innovation, where sustainability is fully integrated into the core business and becomes a source of competitive advantage; and sustainable corporation, where the organization is fully integrated with its environment, promoting positive impacts at all levels of the system (Beretta *et al.*, 2024).

It is recommended that at least two options per 'decision area' with no maximum limit be established. However, significant differences between the established options and their feasibility for the business should be considered. Subsequently, combinations between the 'decision options' should be established. A decision tree is developed to identify the start/end and their interrelations (Pereira and Morais, 2020). This analysis may reveal impossible or non-viable paths. Valid paths are then characterized as 'decision scheme.'

Mode 3 – Comparing

This mode evaluates the 'decision scheme' identified in Mode II. First, the 'comparison areas' are defined as evaluation criteria to compare the effects and implications of each 'decision scheme.' These 'comparison areas' must be holistic, considering the diversity of stakeholders (Pankov *et al.*, 2021). Evaluations can be based on qualitative or quantitative data, with four to five 'comparison areas' considered optimal for balance. Based on the RI foundations, its pillars—anticipation, reflexivity, inclusion, and responsiveness (Jarmai and Vogel-Pöschl, 2020)—can be framed as one or more 'comparison areas.'

Once the 'comparison areas' have been defined, it is necessary to establish mechanisms for evaluating the 'decision schemes.' This means determining whether the evaluation will be conducted solely by the business or include one or more stakeholders. In cases with a single evaluation, the result is expressed directly. However, when multiple evaluations are involved, it becomes necessary to combine them. Thus, unlike an arithmetic mean, the artifact proposes using the Borda voting system, which balances stakeholders' opinions by considering all assigned rankings, not just a single winning option. This ensures that even a stakeholder's least preferred alternatives have influence in determining the final ranking, balancing divergent opinions and minimizing the effects of outliers, resulting in a decision more representative of consensus (Burka *et al.*, 2022).

Through the Borda system, the stakeholders can assign a differentiation of importance to the 'comparison areas', as the outcome will be the ranking of 'decision schemes' by their preference. The objective of this procedure is not to exclude 'decision schemes' but to obtain a consolidated ranking highlighting the most prioritized courses—those remaining at the top of the ranking. This facilitates knowledge acquisition and generates business value (Monteiro *et al.*, 2024).

Mode 4 – Choosing

This mode focuses on consolidating results, which does not necessarily represent an ideal solution but rather the integration of inputs to develop a strategic plan that respects the business's specific characteristics, culture, and resources (Adomako and Tran, 2022). To achieve organizational sustainability, it is necessary to acquire knowledge, manage changes, integrate processes, and collaborate in the value chain, all while ensuring stakeholders' engagement (Vilochani *et al.*, 2024).

Initially, this mode requires investigating uncertainties. Considering the prioritized 'decision schemes' from Mode III, it is essential to reflect on their challenges: what barriers might these courses face? Are they technical obstacles? Political? Conflicts of interest among stakeholders? These reflections will allow identify the

'uncertainty areas' in the situation under analysis. Subsequently, the decision artifact encourages identifying change proposals to address the current state of doubt within the 'uncertainty areas,' characterizing them as 'exploration options.'

To prioritize 'exploration actions,' three key aspects can be considered: cost (monetary adjustment or opportunity cost), delay (the time required to explore the option), and gain (the expected confidence by reducing uncertainty). This allows for selecting the most important actions for immediate execution. Based on the 'decision schemes' prioritized in Mode III and the uncertain 'exploration options' ranked in Mode IV, a compromise package can be proposed, directing actions into present and future phases.

IV. Decision Artifact Application: Illustrative Case

Case description

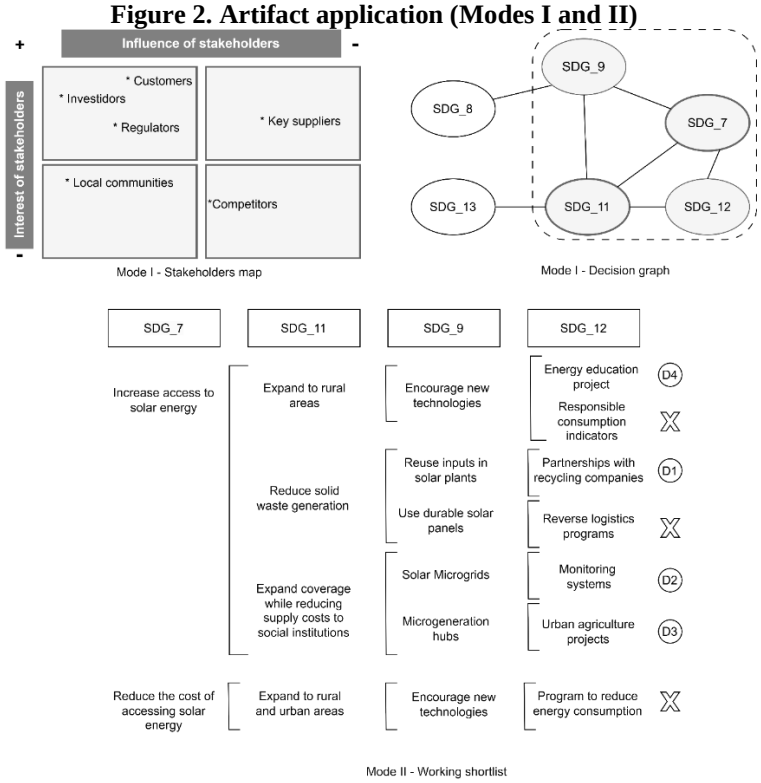
Company A (fictitious name) has been operating for nearly 15 years in the Brazilian renewable energy sector. Specializing in solar energy, the company is a pioneer in democratizing access to renewable power through its "subscription solar energy" model. This innovative approach allows individuals and businesses to benefit from solar energy without needing to purchase or install solar panels, providing a cost-effective and sustainable energy solution.

Company A nowadays is committed to SDG 7, which aims to ensure access to affordable, reliable, and clean energy for all. Currently, this company integrates several ESG practices into operations, including the use of carbon credits, participation in social initiatives, and maintaining internal policies that promote corporate transparency and integrity. Despite these achievements, Company A faces growing competition within the renewable energy sector, requiring continuous adaptations to maintain its market leadership. Company A is involved in establishing a strategic plan for the next four years to address these challenges, focusing on enhancing its competitive capacity and reinforcing its commitment to sustainability.

Development of decision artifact procedures

Considering Company A's current circumstances, the first artifact mode requires identifying the 'decision areas,' specifically the SDGs, to be explored in the strategic plan. To begin, it is necessary to consolidate the network. If the company lacks clear stakeholder recognition, building a stakeholder map is recommended to identify levels of influence and interest. In this case, only the first quartile (customers, investors, and regulators) was considered due to their relevance to Company A and its primary strategic interests. Regarding Mode II, 'decision options' are established for each SDG, and using the design thinking tool can enhance this process. Figure 2 shows the results of Modes I and II.

Figure 2. Artifact application (Modes I and II)



Source: Authors, 2024.

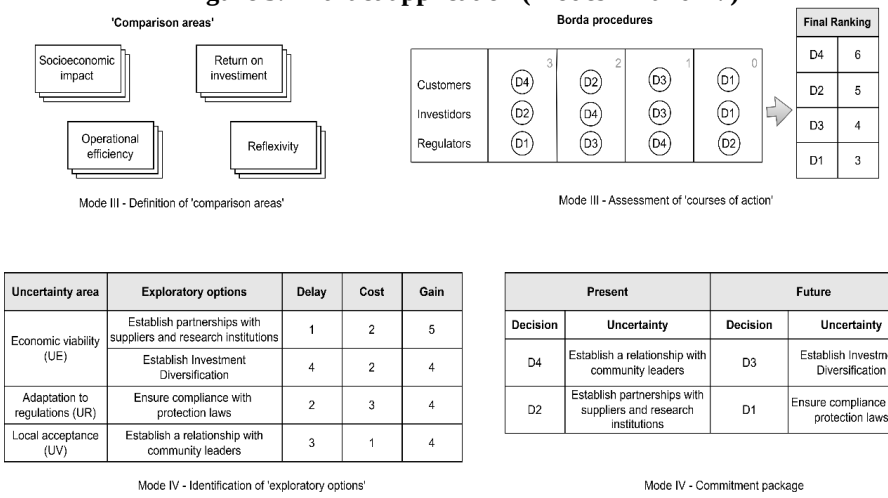
According to Figure 2, six possible SDGs were identified, and, in line with the company's profile, four SDGs were chosen to continue their exploration in artifact flows, according to the 'decision graph.' In sequence, "SDG_7" and "SDG_11" were prioritized based on stakeholders' preferences. This does not mean that "SGDs 8" and "13" are irrelevant, but the artifact indicates that specific focuses are necessary for effective development. Therefore, these two themes were disregarded for Company A's short action plans.

In sequence, "decision options" were identified for each of the four decision areas. Note that the decision tree structure assembly follows the stakeholder preference criteria. As represented in Figure 2, these combinations of 'decision options' enable seven different 'decision schemes,' which represents the logical and complementary blend of decision options. However, based on Company A's strategic profile and technical and operational capacity, only four 'decision schemes' were considered viable, identified as "D_1, D_2, D_3 and D_4".

In the artifact flow, after identifying the 'decision schemes,' they were analyzed using criteria ("comparison areas") such as socioeconomic impact, return on investment, operational efficiency, and reflexivity. These criteria further shaped stakeholder preferences gathered during a brainstorming session. These criteria enable stakeholder preferences to be collected during a brainstorming session. This Brainstorming session was conducted by the analyst (research author) based on the question, which evaluative elements are decisive for Company A's stock portfolio, aiming at its sustainable competitive advantage in the face of the SDGs? Note that the criteria "return on investment" and "Operational efficiency" can, if desired, take on a quantitative perspective. In other words, they can use real or predictive values. However, in this application scenario, all criteria were based on a five-point Likert scale, ranging from extreme to irrelevant impact.

According to the proposed artifact, the Borda method was also used in Mode III to rank the 'decision schemes.' Each stakeholder is assigned points based on their preferences, as shown in Figure 3. For customers, priorities included reaching rural areas, creating energy education projects, and offering jobs, with less emphasis on urban agriculture and recycling. Investors valued innovation through solar microgrids and monitoring systems, ensuring a return on investment. Regulators focused on reducing solid waste through partnerships with recycling companies.

Figure 3. Artifact application (Modes III and IV)



Uncertainty area	Exploratory options	Delay	Cost	Gain
Economic viability (UE)	Establish partnerships with suppliers and research institutions	1	2	5
	Establish Investment Diversification	4	2	4
Adaptation to regulations (UR)	Ensure compliance with protection laws	2	3	4
Local acceptance (UV)	Establish a relationship with community leaders	3	1	4

Mode IV - Identification of 'exploratory options'

Present		Future	
Decision	Uncertainty	Decision	Uncertainty
D4	Establish a relationship with community leaders	D3	Establish Investment Diversification
D2	Establish partnerships with suppliers and research institutions	D1	Ensure compliance with protection laws

Mode IV - Commitment package

Source: Authors, 2024

Explaining the Borda Procedure, consider that item D_4 received three points from customers, two from investors, and one from regulators, totaling 6 points. After applying the Borda protocol, the final ranking of 'decision schemes' was established as $D_4 \rightarrow D_2 \rightarrow D_3 \rightarrow D_1$. In sequence, Mode 4 enables stakeholders to reflect on potential obstacles, identifying 'uncertainty areas' such as economic viability (UE), adaptation to regulations (UR), and local acceptance (UV), categorized by SCA methodology. Also, stakeholders define 'exploration options' as shown in Figure 3. In other words, it consists of analyzing how these obstacles can be overcome. However, there may be some actions that, although interesting, are not entirely attractive due to the low return. Therefore, an analysis of the options' cost, delay, and gain is recommended, as pointed out by Friend (2005). With these assessments, it was possible to set goals for the present and those that will remain for the future, with due uncertainties.

V. Conclusion

This research proposes a decision artifact that allows structuring decisions about sustainability holistically and democratically. The combination of SCA with the concepts of RI and the Borda system allowed

a robust decision-making procedure, while maintaining flexibility and the ability to stimulate collaboration, essential elements in this context. The application in a real Brazilian company demonstrated the potential of the proposed artifact. In addition to the theoretical advances in decision-process and sustainability literature, the artifact acts as a self-instructional mechanism for managers. One limitation is the projection of conflicts between stakeholders, which can be minimized by including the principles of the expert system.

Acknowledgment

This work was carried out with the support of the Pró-Reitoria de Pesquisa da Universidade Federal de Minas Gerais – Brazil (PRPq/UFMG), PRPq – 029/2023, with financing code 30563*58.

References

[1]. Adomako, S. And Tran, M.D. (2022), "Environmental Collaboration, Responsible Innovation, And Firm Performance: The Moderating Role Of Stakeholder Pressure", Business Strategy And The Environment, Vol. 31, Pp. 1695-1704. Https://Doi.Org/10.1002/Bse.2977

[2]. Alodat, A.Y., Salleh, Z., Hashim, H.A. And Sulong, F. (2024), "Sustainability Disclosure And Firms' Performance In A Voluntary Environment", Measuring Business Excellence, Vol. 28 No. 1, Pp. 105-121. Https://Doi.Org/10.1108/Mbe-01-2023-0008

[3]. Beheshti, M., Mahdiraji, H.A. And Rocha-Lona, L.(2023), "Transitioning Drivers From Linear To Circular Economic Models: Evidence Of Entrepreneurship In Emerging Nations", Management Decision, V. Ahead-Of-Print

[4]. Beretta, V., Demartini, M.C. And Trucco, S. (2024), "From Sustainability To Financial Performance: The Role Of Sdg Disclosure", Measuring Business Excellence, Vol. Ahead-Of-Print. Https://Doi.Org/10.1108/Mbe-05-2024-0054

[5]. Berisha Qehaja, A., Kutllovci, E. And Shiroka Pula, J. (2017), "Strategic Management Tools And Techniques Usage: A Qualitative Review", Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis, Vol. 65 No. 2, Https://Ssrn.Com/Abstract=2982744

[6]. Bertoglio, O.; And Bertoglio, I. (2024). Well-Being In The Context Of Entrepreneurship: A Discussion From Economic, Psychological, And Subjective Dimensions. Iosr Journal Of Business And Management, Vol. 26 No. 7, Pp 61-73. Https://Doi.Org/10.9790/487x-2607016173

[7]. Burka, D., Puppe, C., Szepesváry, L. And Tasnádi, A. (2022), "Voting: A Machine Learning Approach", European Journal Of Operational Research, Vol. 229 No. 3, Pp. 1003-1017. Https://Doi.Org/10.1016/J.Ejor.2021.10.005

[8]. Celone, A., Cammarano, A., Caputo, M., And Michelino, F. (2022), "Is It Possible To Improve The International Business Action Towards The Sustainable Development Goals?". Critical Perspectives On International Business, Vol. 18 No 4, Pp. 488-517

[9]. Dogan E., Mohammed K.S., Khan Z. And Binsaeed R.H. (2024), "Analyzing The Nexus Between Environmental Sustainability And Clean Energy For The Usa", Environmental Science And Pollution Research, Vol. 31, Pp. 27789-27803. Https://Doi.Org/10.1007/S11356-024-32765-

[10]. Emerson, P. (2007). Designing An All-Inclusive Democracy: Consensual Voting Procedures For Use In Parliaments Councils And Committees, Berlin, Germany: Springer.

[11]. Fraenkel, J. And Grofman, B. (2014), "The Borda Count And Its Real-World Alternatives: Comparing Scoring Rules In Nauru And Slovenia", Australian Journal Of Political Science, Vol. 49, Pp. 186-205. Https://Doi.Org/10.1080/10361146.2014.900530

[12]. Friend, J. And Hickling, A. Planning Under Pressure: The Strategic Choice Approach. 3 Ed. Oxford: Pergamon, 2005.

[13]. Geissdoerfer, M., Savaget, P., Bocken, N.M. And Hultink, E.J. (2017), "The Circular Economy–A New Sustainability Paradigm?", Journal Of Cleaner Production, Vol. 143, Pp. 757-768. Https://Doi.Org/10.1016/J.Jclepro.2016.12.048

[14]. Gunn, R. And Williams, W. (2007). "Strategic Tools: An Empirical Investigation Into Strategy In Practice In The Uk", Strategic Change, Vol. 16, No. 5, Pp. 201-216, 2007. Https://Doi.Org/10.1002/Jsc.799

[15]. Hevner Et Al. (2024) "Transparency In Design Science Research". Decision Support Systems, Vol. 172, 114236. Https://Doi.Org/10.1016/J.Dss.2024.114236

[16]. Imaz, O., Eizagirre, A. (2020). "Responsible Innovation For Sustainable Development Goals In Business: An Agenda For Cooperative Firms". Sustainability, Vol. 12, Pp. 6948, 2020. Https://Doi.Org/10.3390/Su12176948

[17]. Jarmai, K. And Vogel-Pöschl, H. (2020). "Meaningful Collaboration For Responsible Innovation", Journal Of Responsible Innovation, Vol. 7 No. 1, Pp. 138-143. Https://Doi.Org/10.1080/23299460.2019.1633227

[18]. Kogetsidis, H. (2024). "Dealing With Complexity–The Contribution Of Problem Structuring Methods To Management Science", International Journal Of Organizational Analysis, Vol. 32 No. 2, Pp. 272-285. Https://Doi.Org/10.1108/Ijoa-01-2023-3562

[19]. Kunc, M. And O'brien, F.A. (2019). The Role Of Business Analytics In Supporting Strategy Processes: Opportunities And Limitations. Journal Of The Operational Research Society, Vol. 70 No. 6, Pp. 974-985, Https://Doi.Org/10.1080/01605682.2018.1475104.

[20]. Lami, I.M. And Todella, E. (2023). "A Multi-Methodological Combination Of The Strategic Choice Approach And The Analytic Network Process: From Facts To Values And Vice Versa". European Journal Of Operational Research, Vol. 307 No 2, Pp. 802-812

[21]. Mingers, J. And Rosenhead, J. (2004). "Problem Structuring Methods In Action". European Journal Of Operational Research, Vol. 152 No. 3, Pp. 530-554. Https://Doi.Org/10.1016/S0377-2217(03)00056-

[22]. Mitchell, R.K., Agle, B.R. And Wood, D.J. (1997). "Toward A Theory Of Stakeholder Identification And Salience: Defining The Principle Of The Who And What Really Counts", Academy Of Management Review, Pp. 853-886, 1997. Https://Doi.Org/10.2307/25924

[23]. Monteiro, A.P., Cepêda, C., Borges, A.P. And Vieira, E. (2024), "Does Csr Committee Presence, Stakeholder Engagement, Gender Equality (Sdg 5) And Firm Value Influence Esg Performance Reporting? An Eu Pre And During Covid-19 Analysis", Measuring Business Excellence, Vol. Ahead-Of-Print No. Ahead-Of-Print. Https://Doi.Org/10.1108/Mbe-03-2024-003

[24]. Naamani-Dery, L., Golan, I.,Kalech, M., And Rokach, L. (2015). "Preference Elicitation For Group Decisions Using The Borda Voting Rule". Group Decision And Negotiation, Vol. 24, Pp. 1015–1033. Https://Doi.Org/10.1007/S10726-015-9427-9

[25]. Nonet, A.-H.N.G., Gössling, T., Van Tulder, R. And Bryson, J.M. (2022), "Multi-Stakeholder Engagement For The Sustainable Development Goals: Strategic And Organizational Challenges For Principles-Based Approaches", Journal Of Business Ethics, Vol. 180, Pp. 945-957. Https://Doi.Org/10.1007/S10551-022-05192-

[26]. Pan, X.F.; Yuan, J.H.; Mangla, S.K.,Song, M.; Siranova, L.; Ferraris, A. (2024), "How Does Circular Economy Affect Firms' Innovation Performance? The Interaction Effect Of Open Innovation", Ieee Transactions On Engineering Management, Vol. 71, Pp. 11872-11883. Https://Doi.Org/10.1109/Tem.2023.332188

[27]. Panja, S., Bag, S., Hao, F. And Roy, B. (2020), "A Smart Contract System For Decentralized Borda Count Voting". Ieee Transactions On Engineering Management, Vol. 67 No. 4, Pp. 1323-1339. Https://Doi.Org/10.1109/Tem.2020.2986371
[28]. Pankov, S.,Velamuri, V.K. And Schneckenberg, D. (2021), Towards Sustainable Entrepreneurial Ecosystems: Examining The Effect Of Contextual Factors On Sustainable Entrepreneurial Activities In The Sharing Economy. Small Business Economics, Vol. 56, Pp. 1073-1095. Https://Doi.Org/10.1007/S11187-019-00255-5
[29]. Phahlamohlaka, J. And Friend, J. (2004), Community Planning For Rural Education In South Africa. European Journal Of Operational Research, Vol. 152 No 3, Pp. 684-695. Https://Doi.Org/10.1016/S0377-2217(03)00066-
[30]. Pansera, M., Genovese, A. And Ripa, M. (2021), Politicising Circular Economy: What Can We Learn From Responsible Innovation? Journal Of Responsible Innovation, Vol. 8 No. 3, Pp. 471-477. Https://Doi.Org/10.1080/23299460.2021.192331
[31]. Packard, M.D. And Bylund, P.L. (2024), Towards An Entrepreneurial Judgement Theory: Building The Cognitive Microfoundations Of Entrepreneurial Judgement. International Small Business Journal, In Press. Https://Doi.Org/10.1177/02662426241269772
[32]. Peffers, K., Tuunanen, T., Rothenberger, M.A., And Chatterjee, S. (2007), A Design Science Research Methodology For Information Systems Research, Journal Of Management Information Systems, Vol. 24 No. 3, Pp. 45-77. Https://Doi.Org/10.2753/Mis0742-1222240302
[33]. Pereira, L.S. And Morais, D.M. (2020). "The Strategic Choice Approach To The Maintenance Management Of A Water Distribution System", Urban Water Journal, Vol. 17, No. 1, Pp. 23-31. Https://Doi.Org/10.1080/1573062x.2020.1734945
[34]. Pereira, L., Pinto, M., Costa, R.L., Dias, Á. And Gonçalves, R. (2021). "The New Swot For A Sustainable World". Journal Of Open Innovation: Technology, Market, And Complexity, Vol. 7, No. 1, P. 18, Https://Doi.Org/10.3390/Joitmc7010018
[35]. Pita, Z., Cheong, F. And Corbitt, B. (2008). Approaches And Methodologies For Strategic Information Systems Planning: An Empirical Study In Australia. In: 19th Australasian Conference On Information Systems
[36]. Richardson, G.P. (2021), "Can Systems Thinking Be An Antidote To Extensive Evil?". Systems Research And Behavioral Science, Vol. 38 No 4, Pp. 401-412. Https://Doi.Org/10.1002/Sres.2677
[37]. Shute, V.J. And Becker B.J. (2010). Innovative Assessment For The 21st Century. New York, Ny: Springer-Verlag.
[38]. Stilgoe, J., Owen, R. And Macnaghten, P. (2013). "Developing A Framework For Responsible Innovation", Research Policy, Vol. 42, No. 9, Pp. 1568-1580. Https://Doi.Org/10.1016/J.Respol.2013.05.00
[39]. Vilochani, S., Mcaloone, T.C. And Pigosso, D.C.A. (2024). "Consolidation Of Management Practices For Sustainable Product Development: A Systematic Literature Review", Sustainable Production And Consumption, Vol. 45, Pp. 115-125. Https://Doi.Org/10.1016/J.Spc.2024.01.002.
[40]. Von Schomberg, R. (2015). Responsible Innovation. In: The New Paradigm For Science, Technology, And Innovation Policy Responsible Innovation: Neue Impulse Fur Die Technikfolgenabschatzung?, Edited By A. Bogner, M. Decker, And M. Sotoudeh, Pp. 47–71. Baden-Baden: Nomos Verlagsgesellschaft.