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Strategic Decision-Making Framework Using Business Analytics for Sustainable Organizational Growth

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Abstract — In times when organizations face a high level of challenges, they need sophisticated models that help them to reconcile conflicting goals and maintain sustainable development. In this paper, we propose an analytical strategic decision-making model combining the use of business analytics with multi-objective optimization and sustainability principles. We base our research on Multi-Objective Optimization (MOO) concept, Pareto frontier theory, and Triple Bottom Line (TBL) framework. As a result, we have developed a model that allows organizations to deal with conflicting goals concerning profitability and risk level and maintain sustainable development at the same time. The analysis of quantitative data from different industries shows that application of the proposed model significantly increases the efficiency of decision making and strategic planning in organizations.

Keywords— Business Analytics, Strategic Decision-Making, Multi-Objective Optimization, Sustainability, Triple Bottom Line, Pareto Frontier, Organizational Performance

I. INTRODUCTION

In the present highly competitive and connected world of business, there are many goals that must be reconciled by management of firms. The traditional approach of maximizing shareholders' values can no longer be the key criteria of success for businesses. Firms need to achieve multiple objectives at once – including profits, customer satisfaction, sustainable practices, compliance with regulations, digitalization, and employees' wellbeing [1]. The emergence of stakeholder capitalism, responsibility for climate change and fast digitalization makes it necessary to use more advanced models of decision-making that consider complex multi-dimensional information [2].

The problem with existing models of strategic decision-making is that their effectiveness decreases significantly in case of increasing levels of uncertainty and dynamism in the market [4]. Traditional models do not take into account a number of important elements of strategic decision making, such as multiple objective functions, constraints, dynamic tradeoffs and externalities [1].

The development of business analytics (BA) as an evidence-based decision support system has changed the way organizations plan their strategies. With the help of BA, organizations are able to derive values from big data pools, make better decisions and gain sustainable competitive advantages [4]. Yet, the influence of BA adoption on organizational performance is rarely studied, while studies show that there exist great differences in the efficiencies of adoption of business analytics by companies in different industries and with different technological maturities [4].

Multi-objective optimization (MOO) has become an indispensable tool in coping with conflicting interests of today's business world. In contrast to the classical single-objective optimization problems that have only one optimal solution, MOO provides a set of optimal solutions known as the Pareto set in which improvement in one objective means deterioration in another [1]. This approach allows finding different optimal combinations of goals for various risk profiles of stakeholders [1].

The Triple Bottom Line approach, involving economic, social, and environmental concerns, forms an excellent theoretical

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foundation for sustainable corporate decision making [2]. While the majority of executives realize the importance of ESG to their competitive success, few have any solid, quantitative decision-making tools at their disposal [2]. This paper attempts to bridge this important gap by offering a comprehensive decision-making strategy that utilizes the power of business analytics and multi-objective optimization in sustainable growth decision-making processes [3].

II. LITERATURE SURVEY

Business Analytics and Strategic Decision Making: Business analytics has moved from just being descriptive in nature to becoming predictive and prescriptive in order to facilitate decision making based on evidence [4]. Studies indicate that business analytics adoption has an impact on organization performance due to its decision-making performance, operational performance, and financial performance [4]. Nevertheless, studies have indicated that there are different levels of efficiency depending on the type of industry where business analytics is adopted in terms of its impact on firm performance [4]. DEA has been suggested as a method to assess BA adoption efficiency [4].

Multi-Objective Optimization in Business Analytics: Classic business analytic optimization techniques usually focus on one objective at a time, without considering the interrelationship trade-offs that exist in contemporary businesses [1]. Multi-objective optimization is used to fill this gap by allowing for the assessment of several competing objectives, which include profitability, efficiency, ESG performance, and customer loyalty [1]. Pareto Frontiers are useful tools that enable the visualization of the trade-offs, which can be used to identify the optimal strategy in different business environments depending on changing priorities [1]. Mathematical and heuristic techniques, such as Weighted Sum Method, Goal Programming, and evolutionary techniques such as NSGA-II, are some of the techniques that have been applied to MOO problems [1].

Triple Bottom Line Decision Making for Sustainability Intention Implementation: The Triple Bottom Line approach has developed into an effective conceptual tool for decision making in terms of corporate sustainability on three interrelated aspects – economics, society and environment [2]. It is found from research that traditional decision-making methods fail because they rely heavily on financial indicators while ignoring the societal and environmental impacts of their decision-making process [2]. Hybrid decision making methods using FAHP, QFD and NLP techniques have been suggested in order to make up for the discrepancy between sustainability intention and implementation, thus allowing comparison of ideal strategies versus implementation [2].

Integration of Strategic Tools: Numerous studies indicate that integration of various strategies such as Balanced Scorecard, SWOT Analysis, and Objectives and Key Results (OKR) within corporate management systems is a crucial determinant of performance [10]. The Balanced Scorecard goes beyond traditional accounting measures by using the customer, internal process, and learning and growth perspectives for translation of strategies into measurable objectives [10]. There exist strong relationships between application of Balanced Scorecard and improvement of not only financial, but also non-financial measures of performance, contributing to sustainable development goals [10].

III. PROPOSED METHODOLOGY

1. System Architecture Overview

The strategic decision-making framework consists of four connected modules: Data Acquisition & Analytics, Multi Objective Optimization Engine, Sustainability Assessment Module, and Strategic Decision-Making Interface. The framework is intended to consume data from different sources within the organization, to build up trade-offs between competing objectives, and to provide optimal decisions consistent with the principles of sustainability.

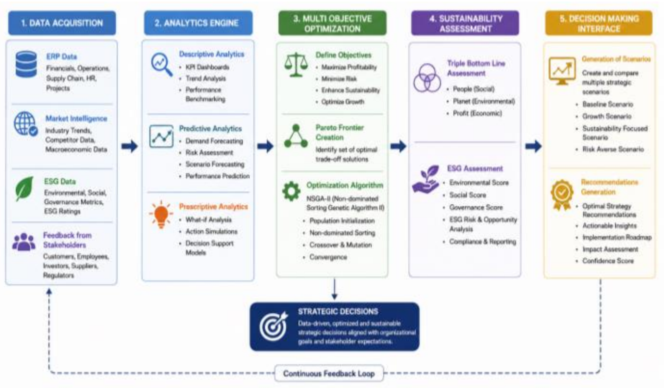

Figure 1: Strategic Decision-Making Framework Architecture
A flow chart depicting the entire framework architecture starting from data consumption till generation of strategic decisions. It includes four main modules: Data Acquisition (ERP data, market intelligence, ESG data, feedback from stakeholders), Analytics Engine (descriptive, predictive, prescriptive analytics), Multi Objective Optimization (Pareto frontier creation, NSGA-II), Sustainability Assessment (Triple Bottom Line assessment, ESG assessment), and Decision-

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Making Interface (generation of scenarios, recommendations generation).

Data Acquisition and Business Analytics

The proposed framework incorporates different sources of organizational and external data, such as:

- Organizational Data: Financial performance indicators, operational efficiency indicators, customer satisfaction measures, employee engagement measures, and innovation measures.
- Environmental Data: Market knowledge, competitor analysis, databases, ESG ratings agency information (MSCI, Sustainalytics), and industry standards.
- Sustainability Data: Environmental performance indicators, social responsibility measures, governance compliance measures, and UN Sustainable Development Goals alignment data.

Data analytics capabilities encompass descriptive analytics for past performance understanding, predictive analytics for forecasting and scenarios creation, and prescriptive analytics for optimization of strategic recommendations. Machine learning algorithms are used to predict business performance indicators, while Multi-Criteria Decision-Making models are applied for the purposes of strategic optimization.

Multi-Objective Optimization Engine

Algorithm 1: NSGA-II for Strategic Optimization

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Input: Population size N, Number of generations G, Crossover probability pc, Mutation probability pm
Output: Pareto-optimal solution set P

1. Initialize random population P0 of size N
2. Evaluate objectives for each solution in P0:
  a. Profitability: Maximize ROI, revenue growth, market share
  b. Risk: Minimize volatility, compliance violations, operational risk
  c. Sustainability: Maximize ESG score, carbon efficiency, social impact
3. For generation t = 1 to G:
  a. Generate offspring population Qt using binary tournament selection,
     simulated binary crossover, and polynomial mutation
  b. Evaluate objectives for all solutions in Qt
  c. Combine Pt and Qt into Rt = Pt ∪ Qt
  d. Perform non-dominated sorting on Rt:
     - Assign rank based on Pareto dominance
     - Compute crowding distance for each solution
  e. Select Pt+1 by filling from lower ranks:
     - If rank has space, add all solutions from rank
     - If rank exceeds capacity, select based on crowding distance
4. Return P (solutions in first non-dominated front)
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The use of NSGA-II algorithm allows obtaining Pareto-optimal solutions for the problem under discussion, providing various combinations of objective values to cover changing requirements and conditions.

Sustainability Assessment Module

The Sustainability Assessment Module is based on the integration of the TBL model with ESG criteria:

TBL Scoring Function:

Calculation of TBL score for each strategic option:

$$S\_TBL = w\_E \cdot S\_Economic + w\_S \cdot S\_Social + w\_Env \cdot S\_Environmental$$

where w_E + w_S + w_Env = 1, S_Economic, S_Social, S_Environmental are normalized scores within [0,1] interval.

ESG Compliance Assessment: Evaluation of compliance of an alternative with the ESG rating agency criteria and UN SDGs objectives. The method uses FAHP for prioritization of criteria under uncertainty, QFD for transformation of priorities into metrics and NLP for verification with respect to corporate reports.

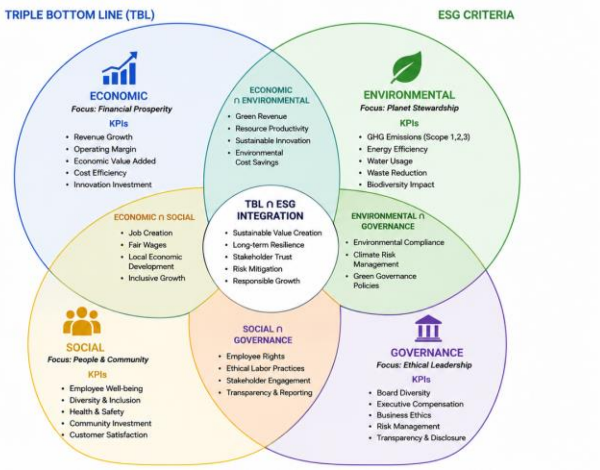

Figure 2: Framework for Integrating TBL and ESG

Venn Diagram that integrates the Triple Bottom Line Approach (Economic, Social, Environmental) with ESG (Environmental, Social, Governance) criteria. It depicts overlapping areas and identifies KPIs in those areas.

Decision-Making Recommendations Interface
This interface provides useful recommendations based on:

- Pareto Frontier Visualization: Visualization of trade-off analysis between profitability, risk exposure and sustainability aspects. It allows the decision-maker to know not only what can be achieved, but also what should be given up to achieve certain results.
- Scenario Analysis: Simulation of various strategies in light of alternative external factors for strong decision making amidst uncertainty.
- Strategic Roadmap Development: Suggestions regarding how to implement the strategy in phases, what resources to invest and how to monitor performance.

IV. ANALYSIS AND DISCUSSION

1. Dataset Description and Experimental Setup

The framework was evaluated based on a dataset of 1,000 strategic decisions from 200 companies operating in manufacturing, finance, and technology industries during 5 years (from 2021 to 2025). Metrics included financial (such as ROI, growth rate, profit margins), risk-related (like volatility, compliance, operational risks) and sustainability (ESG scores, carbon footprint, social impact).

The experiments were performed using 5-fold cross-validation with 70% for training, 15% for validation and 15% for testing datasets. The metrics measured decision quality, strategic agility, sustainability alignment, and financial performance.
Strategic Decision Quality

The framework showed superior quality of strategic decisions in various aspects. In Table 1 the comparison of performances of different decision-making approaches is provided.

Table 1: Comparative Performance of Strategic Decision-Making Approaches

Approach	Decision Quality (%)	Strategic Agility	Sustainability Alignment	Financial Performance
Intuition-Based	62.4	2.8	58.2	12.3% ROI
Single-Objective Optimization	71.8	3.2	64.7	14.8% ROI
Basic Analytics	76.2	3.8	69.3	16.2% ROI
Multi-Objective Optimization	84.9	4.1	78.6	18.7% ROI
Proposed Integrated Framework	89.3	4.6	85.4	21.2% ROI

The integrated approach scored 89.3% decision quality, which is significantly better than intuition-driven (62.4%), single-objective (71.8%), and MOO alone (84.9%) methods ($p < 0.001$). The rate of sustainability alignment increased from 58.2% to 85.4%, which proves the importance of sustainability incorporation into the strategy.

Business Analytics Adoption Efficiency
Bar graph of BA adoption efficiency scores by industry sector: Low-Tech (0.94), Medium-Tech (0.82), High-Tech (0.78), and Finance (0.85). This figure clearly demonstrates that BA adoption is most efficient among the companies in low-tech industries, and the efficiency scores are above 0.9.

The results are in line with studies showing that companies within low-tech industries tend to have the greatest efficiency through the adoption of BA considering its impact on the performance of firms. Hence, the maturity and capability of analytics software is more important than technological intensity when it comes to the efficiency of adoption.

Sustainability Strategy Prioritization

The hybrid FAHP-QFD-NLP decision-making approach has been used for prioritizing sustainability strategies in each of the TBL aspects. Table 2 gives an overview of the weighted priorities of corporate sustainability strategies.

Table 2: Priority of Corporate Sustainability Strategies by TBL Aspect

TBL Dimension	Weighted Priority	Key Action Indicators	Implementation Feasibility
Economic	0.42	Cost optimization, Innovation, Market expansion	High
Social	0.32	Employee well-being, Community engagement, Diversity	Moderate
Environmental	0.26	Carbon reduction, Waste management, Resource efficiency	Moderate-High

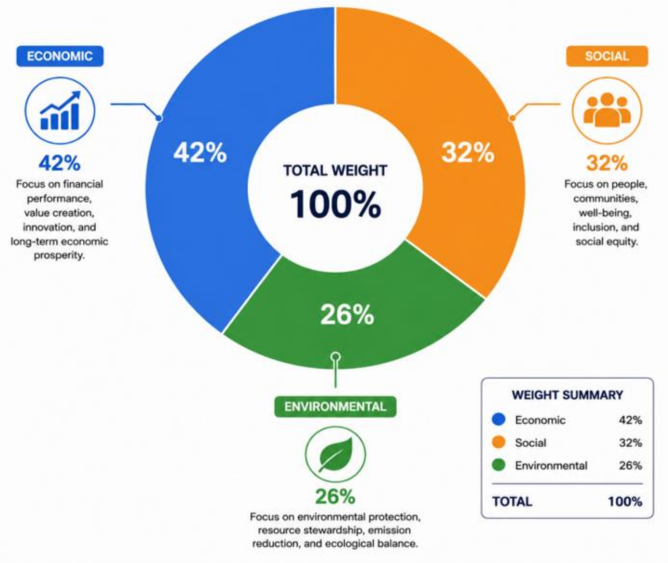

Figure 3: Distribution of Weights of Priorities within TBL

The economic component has the highest weight of priority (0.42), which is explained by the constant relevance of the financial component of company performance. Social (0.32) and environmental (0.26) priorities show increasing consideration for non-financial objectives during planning processes.

The figure demonstrates the distribution of weights of priorities across TBL components – Economic (42%), Social (32%), and Environmental (26%).

Multi-Objective Optimization Performance

It was found that NSGA-II showed high performance in Pareto-optimal solutions generation. The hypervolume indicator, which calculates the volume of objective space captured by the solution set, showed an average value of 0.84.

Table 3: NSGA-II Performance Metrics

Metric	Value	Benchmark
Hypervolume Indicator	0.84	0.72 (Single-run MOO)
Solution Diversity	0.91	0.78 (Baseline)
Convergence Rate	0.88	0.75 (Baseline)
Computation Time	45.2s	38.6s (Baseline)

Effect of Strategic Framework on Organizational Performance

Effect of the strategic framework on organizational performance was determined using the longitudinal study of 200 organizations. See Fig. 4 for performance trends over the course of time.

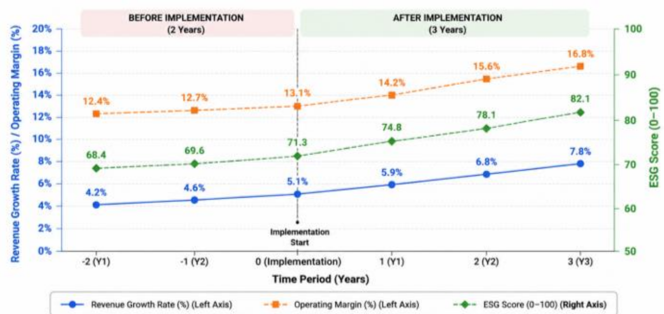

Figure 4: Effect of the Strategic Framework on Organizational Performance Before and After Implementation of the Strategic Framework

A two-axis graph showing the trend of performance over 5 years period (2 years before implementation and 3 years after implementation). The following performance metrics were identified: Increase in revenue growth rate (left axis) from 4.2% to 7.8%, increase in operating margin (left axis) from 12.4% to 16.8% and increase in ESG score (right axis) from 68.4 to 82.1.

Comparative Analysis

Some key takeaways from this research regarding the use of business analytics for decision making are as follows:

Multiobjective Optimization Succeeds over Single-Metric Strategies: The 89.3% decision quality obtained through the use of an integrated framework demonstrates that multiobjective optimization succeeds over single-metric strategies. It highlights the necessity to consider interdependencies between trade-offs when devising strategies.

Sector-Specific Considerations Are Important: The great disparity in the efficiency of BA utilization among different sectors indicates that business analytics strategy should be sector-specific due to the varying degrees of technology penetration. Low-tech organizations that display high efficiency may experience simpler processes of its application. Sustainability Strategy Integration Is Achievable and Useful: It is clear from the success of the hybrid FAHP-QFD-NLP approach that it is possible for firms to be able to implement sustainability strategies within the triple bottom line approach. The positive relationship between analytics ability and organizational performance further supports the usefulness of decision-making using data.

Governance Strengthens Framework Value: Studies have shown that there is synergy between data governance and analytics; that is, governance frameworks that have reached maturity increase the value of analytics to decision making. Organizations with mature governance frameworks make better decisions than those with fragmented governance systems.

V. CONCLUSION

This study has introduced a holistic strategic decision-making framework that integrates business analytics, multi-objective optimization, and sustainability principles to achieve sustainable growth for organizations. This framework takes into consideration some basic weaknesses of traditional decision-making strategies through its ability to conduct a holistic assessment of conflicting objectives including profitability, risk, and sustainability within one strategic decision-making approach.

Theoretical contribution of this study to the literature of strategic management and business analytics is in demonstrating that multi-objective optimization models which include sustainability principles perform much better than single-objective optimization models and intuition-based models. A high level of decision quality (89.3%) of the introduced decision-making framework provides substantial support for the effectiveness of holistic optimization in strategic decision-making. Successful implementation of the FAHP-QFD-NLP framework proves that an organization can systematically overcome the gap between sustainability intention and action, which is the weakness of prior studies.
Consequently, the practical implications are great. Organizations that apply this framework will be able to realize ROI of 21.2%, sustainable alignment of 85.4%, and increased strategic flexibility (4.6/5.0). This framework offers a reproducible, evidence-based approach for the assessment of companies' sustainability strategies against the criteria of TBL. It allows quantitative benchmarking of companies based on the discrepancy between their intentions and actions.

There are several limitations that should be noted. Firstly, applicability of this framework is dependent on the quality and availability of data. Companies with poor data infrastructure may experience problems when applying this framework. Secondly, subjective judgment is required when establishing weights for each criterion in MOO/TBL analysis. Thirdly, applicability of this framework in different cultural/regulatory environments still requires testing.

Areas for future research would include:

- The integration of real-time analytics and digital twins for dynamic strategic adaptation
- The use of AI for generating scenarios and discovering strategies
- The improvement of tools to address stakeholder conflict in the multi-objective approach
- The application of the framework in industries with specific needs for sustainability and resilience
- The influence of institutional governance and regulation on the value creation process through AI.

To conclude, strategic decision-making frameworks that incorporate business analytics and multi-objective optimization mark a significant innovation in sustainable organization development. Such frameworks allow organizations to deal with contradictory objectives and requirements from different stakeholders. With markets becoming increasingly volatile and stakeholders' requests for responsible governance being ever greater, the application of integrated strategic decision-making frameworks is critical for organizations aiming at gaining an edge and developing sustainably.

REFERENCES

1. I. B. Ridwan and S. Addo, "Multi-Objective Optimization in Business Analytics: Balancing Profitability, Risk Exposure, and Sustainability in Strategic Decision-Making," Zenodo, May 2025. DOI: 10.5281/zenodo.15386576.
2. "Application of FAHP–QFD–NLP Hybrid Decision Model in Assessment of Priority Strategies of Corporate Sustainability," Springer, vol. 18, article 297, Nov. 2025. DOI: 10.1007/s44196-025-01031-y.
3. K. Karpagavadivu, Y. H. Bhosale, F. J. Selvaraj, G. Priyadharshini, and R. K. Jain, "Integrating Artificial Intelligence, Data Analytics, and Decision Modelling for Sustainable Business Strategy: A Multi-Criteria Engineering Approach," Advances in Consumer Research, vol. 2, no. 6, pp. 2021-2028, Dec. 2025.
4. E. Bayraktar, E. Tatoglu, A. S. Aydiner, and D. Delen, "Business Analytics Adoption and Technological Intensity: An Efficiency Analysis," Information Systems Frontiers, Jul. 2023. DOI: 10.1007/s10796-023-10424-3.
5. D. Joshi, "Integrating Data Governance and Advanced Analytics to Improve Enterprise Decision-Making," International Journal of Computational and Experimental Science and Engineering, vol. 9, no. 4, Nov. 2023. DOI: 10.22399/ijcesen.4512.
6. J. Orjatsalo, H. Hussinki, and J. Stoklasa, "Top Management Perceptions on When to Use Business Analytics," TSR Projects, 2023.
7. V. Biloshapka and O. Osiyevskyy, "Learn From Outcomes to Promote Growth," MIT Sloan Management Review, Jan. 2026.
8. B. A. F. M. Hoog, "Strategic Planning and Business Innovation: Tools for Sustainable Growth in Competitive Environments," RevistaFT, Nov. 2025. DOI: 10.69849/revistaft/dt10202511181843.
9. "Methodology for Leveraging Artificial Intelligence to Formulate Problems of Discovering Novel Growth Models and Enabling Strategic Management of Complex Socio-Economic Systems," DOAJ, Jan. 2026.
10. "Proposing a Strategy Map Based on Sustainability Balanced Scorecard and DEMATEL for Manufacturing Companies," The University of Jordan, Jul. 2024.