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Business Intelligence for Sustainable Growth: A Strategic Model for Innovative SMEs

Shrinidhi V S[1], Dr. H H Ramesha[2], Dr. Veldandi Ramchander Rao[3], Dr. Leelavathi H[4], Dr. Rohit Goyal[5], Babitha Lucin Rani B[6]

[1] Assistant Professor, Department of Economics, IIBS, Bangalore, Karnataka, India.

Email: shrinidhi.vs@yahoo.com

[2] Professor, Department of Management Studies (MBA), Visvesvaraya Technological University Belagavi, Center for PG Studies, Muddenahalli-562101, India.

Email: drhhramesh@gmail.com

[3] Associate Professor, Department of Business Management, Vaagdevi College of Engineering, Bollikunta, Warangal, Telangana, India-506005.

ORCID: 0009-0000-2310-6404,**Email:** vrcrao74@gmail.com

[4] Assistant Professor, Department of Commerce and Management, Govt. First Grade College, Madhugiri, Tumkur District, Karnataka, India

Email: leelakas2017@gmail.com

[5] Associate Professor, Department of Computer Science and Engineering, Dev Bhoomi Uttarakhand University, Dehradun, India.
Email: rohitgoyalhzu@gmail.com

[6] Assistant Professor (SG), Department of Management Studies, Rajalakshmi Engineering College, Chennai-602105, India

.**Email:** babithalucin@gmail.com

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KEYWORDS

Business Intelligence, Sustainable Growth, SMEs, Innovation, Strategic Model and Data-Driven Decision Making

ABSTRACT

Business Intelligence (BI) is a very crucial facilitator of sustainable business growth, especially by the innovative small and medium-sized enterprises (SMEs) in the increasingly data-driven business environment. This article will be discussing the strategic importance of BI in promoting sustainability-based performance and decision making among the SMEs. A convenience sampling of 150 SME stakeholders was conducted through the use of a quantitative research design to gather data. The article is devoted to the most important dimensions of BI, such as generation and analytics, sustainability performance metrics, competitive advantage, operational efficiency, high-quality decisions, and lifelong learning and innovation. The coefficient of concordance was used by Kendall in determining the degree of agreement the respondents had with respect to the relative importance of these factors. The results show that there is a statistically significant difference among the priorities of BI dimensions, which means that SMEs have different strategic orientations. Although the importance of operational and decision-support capabilities are more emphasised, sustainability measurement and continuous learning components are given relatively less focus. The findings emphasize the versatile use of BI in the context of the sustainable development and demonstrate the necessity of context-related approaches to BI that should be developed to meet the specific needs of innovative SMEs. The research enhances the literature that is already emerging on BI-inspired sustainability and also provides useful lessons to SME managers and policymakers.....

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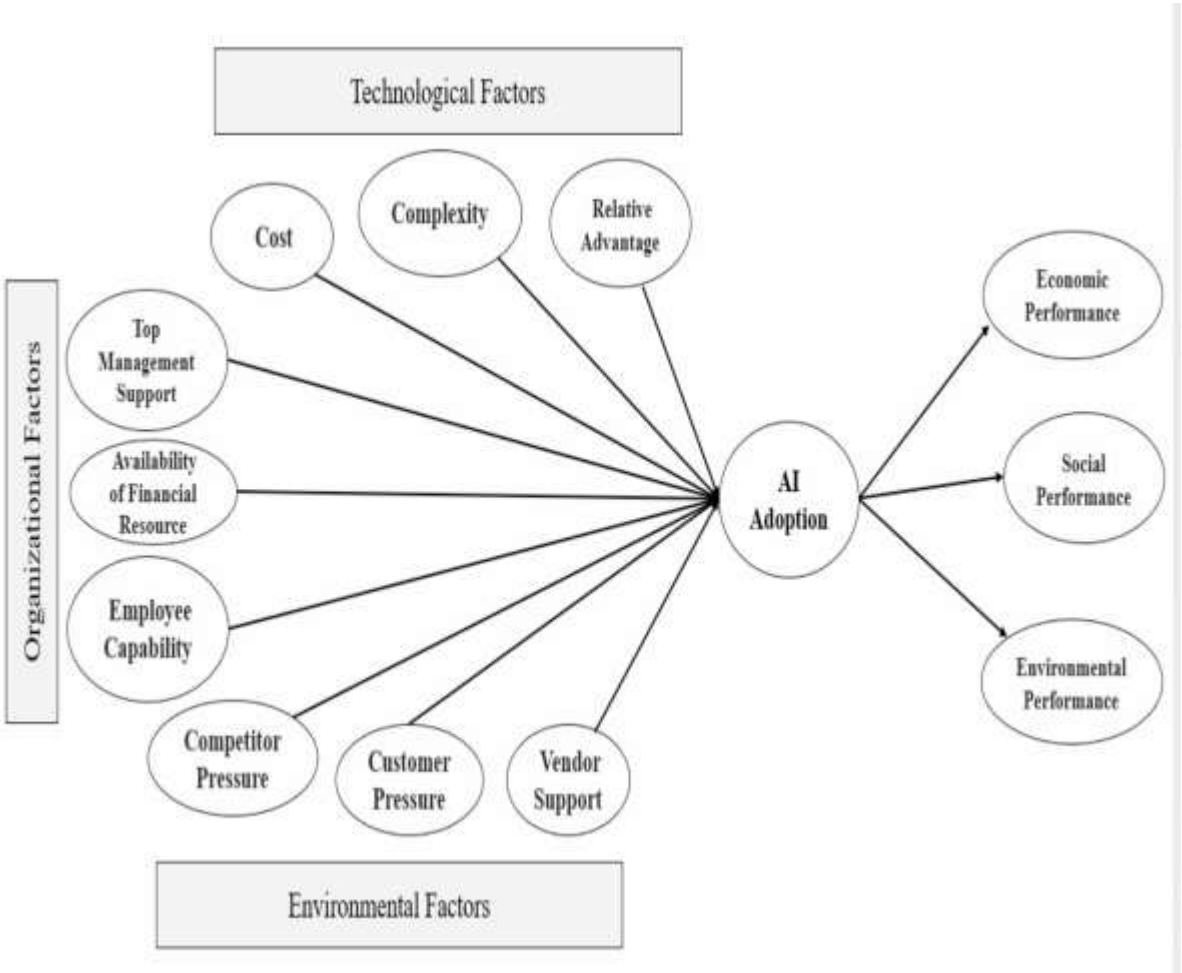
1. INTRODUCTION

Small and Medium-sized Enterprise is significant in economic growth, job creation as well as innovation in both developed and emerging economies. Irrespective of their significance, SMEs are usually characterized by constraint on financial resources, absence of analytical skills, and unstable market economic situations. In that regard, the sustainable growth of the business, that is, the profitability alongside long-term social and environmental responsibility has turned into a burning strategic question. Business Intelligence is a collection of technologies, processes, and practices which gather, combine, examine, and report on business information to aid in the improved decision-making. Although the uptake of BI has always been linked to large companies, the use of cloud computing, open-source software and low-priced analytics have made BI more accessible to SME companies. Properly coordinated with sustainability objectives, BI may aid in innovative SMEs predicting the changes in the market, enhancing resource use, and responsible development.Business Intelligence and Sustainable Growth. Small and Medium-sized Enterprises (SMEs) operate in an increasingly complex, data-driven, and competitive business environment. To remain viable and achieve sustainable growth, SMEs must move beyond intuition-based decision-making and adopt systematic, evidence-based strategies. Business Intelligence (BI) has emerged as a powerful enabler that transforms raw data into actionable insights, supporting strategic planning, operational efficiency, and innovation. This article proposes a strategic BI model tailored for innovative SMEs, integrating sustainability objectives with data-driven decision-making. The study highlights the role of BI in economic, environmental, and social sustainability and offers practical guidance for SME leaders seeking long-term growth.

Figure: 1



Concept of Business Intelligence

Business Intelligence (BI) is a methodical arrangement of technologies, procedures, and analytical methods employed to gather, put together, examine and show business information so that they may be used in determining informed choices. The paramount aim of BI is to convert uncooked and disjointed information and to create valuable and operational insights that lead to better organizational output. BI is a broad category of tools that comprise data warehouses, data mining methods, reporting systems, dashboards and advanced analytics, which when combined allow the organization to trace its activities, analyze trends, and analyze strategic options. BI was traditionally related to large organizations because of the high cost of implementation and technical complexity. Nevertheless, recent developments in cloud computing, open-source solutions, and easy to use analytics solutions have turned BI into something that Small and Medium-sized Enterprises (SMEs) can now afford. In the case of SMEs, BI is a strategic asset that helps them to engage in evidence-based management, decrease uncertainty, and enhance market responsiveness. With an appropriate alignment to the goals of innovation and sustainability, the Business Intelligence can be a potent instrument of responsible, long-term, and data-driven organizational development.

Sustainable Growth in SMEs

Sustainable growth of Small and Medium-sized Enterprises (SMEs) is the possibility of firms to attain long-term growth and competitiveness and be economically viable, environmentally responsible, and socially well-being. Sustainable growth is in contrast to short-term growth that focuses on profit maximization only and disregards balanced value creation without jeopardizing the future resources and stakeholder interests. This is especially the case with SMEs who have limited resources, they are susceptible to market volatility and have growing regulatory and social demands. It is through sustainable growth that SMEs are able to improve operational efficacy, minimize environmental influence and develop optimistic connections with employees, customers, suppliers, and communities. It also promotes products, process and business model innovation that is in alignment with the concept of sustainability. SMEs are able to be more resilient by embracing sustainable growth approaches, increasing brand equity, and acquiring competitive edge by entering more sustainability-aware markets. Finally, long-term survival and successful development is facilitated by sustainable development that combines business profitability and responsibility in making sound business decisions and adapting continuously to the economic, environmental and social environment.

Linking BI with Sustainability

1. Monitoring Energy and Resource Use: Business Intelligence is an important tool in empowering SMEs to monitor the use of energy and resources in operation activities in a systematic manner. Using information on production systems, utility bills, IoT, and enterprise software, BI platforms allow seeing the real-time picture of the energy consumption trend and of the movement of materials. Dashboards and analytics tools enable managers to keep an eye on the primary metrics, including electricity per unit of output, water intensity of use, and efficiency of raw materials. This grain of insight assists in determining abnormal consumption, peak usage and leakage of resources. In the long run, predictive analytics may predict the future energy demand and allow making informed investments in energy-efficient solutions. In the case of innovative SMEs, this type of data-driven monitoring is not only cost-saving in terms of operational expenses; it helps to meet environmental requirements and sustainability measures. By integrating energy and resource measurements into the strategic decision-making, BI helps SMEs to shift the operational approach to sustainability planning, which is more proactive to facilitate long-term environmental and economic performance.

2. Eliminating Wastes and Inefficiencies in Business Operations: Business Intelligence helps to reduce waste and achieve operational efficiency by converting process-level information into decisionable information. Wastes are common in SMEs as the workflow is ineffective, the production is inefficient, and there is a poor inventory management system and quality faults. BI tools run an analysis of the operational data to find out the bottlenecks, redundancies and non-optimal performance. As an example, data visualization can draw an attention to the high scrap rates or high frequency of the machine outages, which will make it possible to take the corrective measures in time. Process mining and diagnostic analytics can be used to reveal the root causes to inefficiencies, whereas predictive analytics is applicable to preventive maintenance and demand forecasting. Reduced materials, time and labour can cut down costs and environmental impact by the SMEs greatly. Furthermore, efficiency enhancements brought by BI add to the lean operations and the continuous improvement cultures. By combining waste reduction metrics with sustainability targets, it is possible to make both SMEs more profitable and more responsible to the environment, which, once again, contributes to the strategic importance of BI in sustainable operational excellence.

3. Enhancing Supply Chain Supervision.

A sustainable and responsible business practice cannot be attained without supply chain transparency, and Business

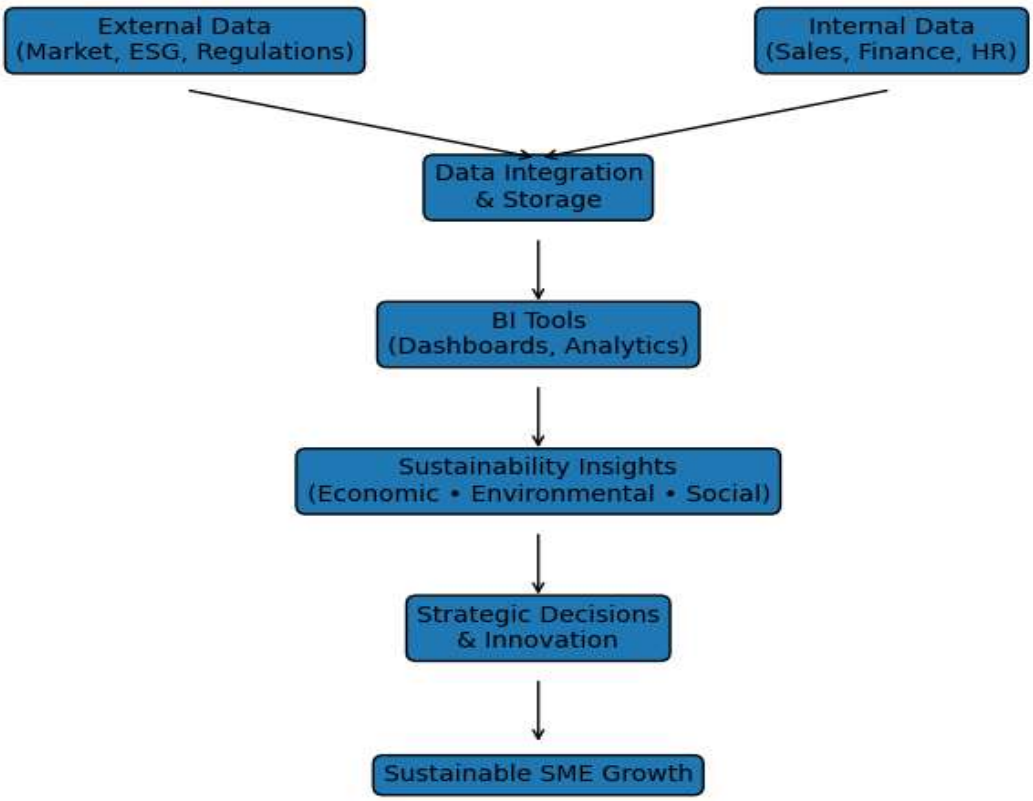
Intelligence can equip SMEs with the capacity to achieve analytically. BI systems combine supplier data, logistic partner data, inventory data and customer order data to provide end to end visibility throughout the supply chain. With real-time dashboards, SMEs have access to performance by the supplier, their delivery schedule, turnover in the inventory, and their level of exposure to risk. Such transparency allows tracing materials more effectively, uncovering unsustainable or unethical sourcing behavior, and measuring environmental consequences in the value chain. The BI analytics is also used in terms of scenario analysis, which allows SMEs to react proactively upon the supply disruption and new regulations. Improved transparency will promote accountability and improve cooperation with suppliers and stakeholders. Innovative SMEs, BI-powered supply chain visibility plays a crucial role in establishing operational resilience in addition to brand credibility and adherence to sustainability and ESG demands in more conscientious markets.

4. Supporting Ethical and Inclusive Business Practices

Business Intelligence also helps in ethical and inclusive business processes in that it allows monitoring of social sustainability indicators based on data. BI tools can assist SMEs in monitoring diversity of the workforce, staff turnover, participation in training, health and safety accidents, and wage equity. Through visualizing these indicators, managers will have an idea about the culture of the organization, the well-being of staff members, and inclusiveness. BI will also contribute to ethical governance by improving transparency on decision-making, financial reporting, and monitoring on compliance. Evidence-based information assists in identifying prejudices, malpractices, or imbalance that would be overlooked. Moreover, BI helps SMEs to assess the social effect of their activities on the communities and stakeholders. When SMEs introduce ethical and inclusion-related KPIs into performance dashboards, this will be an indicator of their seriousness in responsible business operations. This not only increases the internal trust and employee involvement, but also the confidence of the external stakeholders, which contributes to sustainable development based on social responsibility.

Figure: 2

Conceptual Framework



Strategic BI Model for Innovative SMEs

The proposed strategic BI model consists of five interrelated components designed specifically for SMEs with innovation-driven growth ambitions.

Conceptual Framework: BI–Sustainability Model for Innovative SMEs

1. Data Sources and Integration

The effectiveness of Business Intelligence system of innovative SMEs is based on data sources and integration. The SMEs produce information which was gathered through various internal sources including sales transactions, financial systems, production systems, human resources and customer relationship management systems. Moreover, the external data can be used to get valuable contextual insights in the form of market trends, regulatory requirements, supplier data, and sustainability standards. The difficulty is how to unify these multifarious data streams into one structure which is uniform. The data warehouses and data lakes could be cloud-based and provide cost-effective and scalable solutions to SMEs with low available resources. Good data integration will guarantee accuracy, consistency, and availability of data throughout the organization. The SMEs can get a comprehensive perspective of performance when sustainability-linked information is added to financial and operating information. Such a unified data environment allows conducting a thorough analysis, facilitates cross-functional decision-making, and preconditions the further development of analytics and sustainability-related approaches.

2. Insight Generation and Analytics

The value-creating mechanism of Business Intelligence systems is analytics and the generation of insights. After integrating data, SMEs can use descriptive analytics to determine the past performance, diagnostic analytics to determine the reasons behind the gap in performance, predictive analytics to determine future trends, and prescriptive analytics to suggest the best course of action to take. These analytics abilities convert unstructured data to meaningful information that is used in the goals of innovation and sustainability. As an illustration, predictive models can be used to predict demand variations, energy usage, or supply chain risks, and thus plan ahead. Dashboards and scorecards are examples of visualization tools that enable the insights to be available to non-technical decision-makers. In the case of innovative SMEs, analytics-based insights increase agility, less uncertainty, and more strategic responsiveness. By integrating components of sustainability in the analytics processes, SMEs will have the ability to consider both the economic performance and the environmental or social impacts simultaneously, which supports the idea of sustainable growth based on data.

3. Performance Metrics on Sustainability

The use of sustainability performance metrics makes sure that the environmental and social factors are integrated in the BI system other than being marginal issues. Such measures are usually in line with the triple bottom line, which includes economic, environmental and social aspects. Economic benchmarks might be cost effectiveness, increase in revenue, and productivity whereas environmental benchmarks are energy usage, waste production, emissions and resource usage. Social metrics represent employee well being, diversity, safety, customer satisfaction, and community impact. BI dashboards combine these indicators in one performance view allowing them to monitor and benchmark continuous performance. In the case of SMEs, clear KPIs of sustainability would improve accountability and facilitate adherence to regulatory and ESG standards. More importantly, sustainability measures will inform strategic trade-offs and investments that long-term value creation and responsible business practices are not jeopardized by current financial profits.

4. Strategic Decision Support

Innovative SMEs are strategic decision support of the Business Intelligence adoption. BI systems are timely, accurate, and relevant in presentation to the managers due to interactive dashboards, scenario analysis, and performance reports. These tools facilitate strategic planning as they help SMEs to consider other paths of action, analyze risks, and coordinate operational processes with the sustainability goals. The use of BI may reveal a decision on market expansion, innovation of the product, selection of suppliers, and allocation of resources. When implementing sustainability metrics in decision-support systems, SMEs make sure that strategic decisions are based on the economic viability, as well as the environment and social effects. This fact-based method will decrease the use of hunch and improve the quality of decisions. Therefore, the leaders of SMEs will be able to react better to the changing market conditions without losing their course towards long-term sustainability and innovation.

Dynamic aspect of the BI Sustainability model

Life-long Learning and Innovation.

The dynamic aspect of the BI Sustainability model is continuous learning and innovation. Business Intelligence systems create feedback through inputting performance results into the decision-making process constantly. This helps SMEs to be informed of what has been done before, adjust strategies and fit in the dynamic environment. BI insights help in experimentation, process enhancement, and creation of new products or business models that are related to the sustainability objectives. With time, the same application of analytics builds a data-driven organizational culture that appreciates evidence-based learning and innovation. In the case of innovative SMEs, such perpetual learning capacity improves the resilience and competitiveness in the long term. The combination of BI with the sustainability goals can enable SMEs to undertake innovation that along with its expansion can also achieve environmental stewardship and social responsibility, which is an addition to sustainable value generation.

1. Improved Decision Quality: One of the greatest advantages of BI-based sustainability in SMEs is enhanced quality of decisions. The systems of Business Intelligence deliver relevant, accurate, and timely information that is useful in supporting evidence-based decisions so that the use of intuition or partial information is minimized. BI allows managers to assess the various aspects of business performance at once by combining financial, operational and sustainability data. This remarkable transparency reduces cognitive bias and uncertainty of strategic decisions. Scenario analysis and predictive analytics are also used to complement the decision-maker, as it evaluates the possible outcome in case of various assumptions. In the case of SMEs with unstable and competitive surroundings, the quality of decisions is important in improving the strategic alignment and risk management. Once sustainability knowledge is integrated into BI dashboards, managers are able to evaluate the long-term environmental and social impacts of their decision together with the economic outcomes. Consequently, the SMEs can make balanced, responsible and future-oriented strategic decisions that facilitate sustainable growth.

2. Operational Efficiency: Operation efficiency is a key impact of the application of BI-based sustainability measures in SMEs. Business Intelligence tools provide businesses with the opportunity to see the real-time process, find areas of inefficiency, and reveal areas of waste in the use of energy, material and labor, and time. Data visualization and performance analytics are able to identify bottlenecks, unused resources and cost overruns that adversely impact productivity in the SMEs. BI enables predictive maintenance, inventory optimization and demand forecast as well, which also increase operational efficiency. With these metrics of sustainability, namely energy consumption, waste generation and resource utilization, SMEs can achieve better environmental performance and lower operational costs at the same time. This is a two-fold advantage of increasing profitability and reducing ecological impact. In the long term, BI-induced efficiencies lead to lean operations, constant process improvement, and more sustainable business models, which place SMEs in the position of success in the long term.

3. Competitive Advantage: BI-driven sustainability grants SMEs sustainable competitive advantage, through the ability to innovate, differentiate, and stay shifted. Through the assessment of customer tastes, market dynamics, and sustainability performance indicators, SMEs can create environmental-friendly goods, conscientious services and novel business approaches, which will satisfy changing stakeholder demands. Business Intelligence facilitates discovery of emerging opportunities and unmet market requirements when it comes to sustainability enabling the SMEs to stand out among the competitors. Furthermore, BI insights are useful in streamlining pricing, supply chain, and allocating resources to increase competitiveness. The analytics that are focused on sustainability also reinforces the brand positioning and market credibility, especially in those industries where the ethical and environmental factor plays a role in buying behavior. In the case of innovative SMEs, the capacity to use BI to create a sustainability-driven differentiation builds the long-term value, customer loyalty, and resilience, which guarantees that the competitive advantage is economically feasible and socially responsible.

4. Stakeholder Trust: Enlightened and evidence-based sustainability reports enhance trust among customers, investors, regulators, staff, and supply chain. BI dashboards enable SMEs to monitor the adherence to the environmental standards, ethical standards, and the corporate governance requirements, minimizing reputational and regulatory risks. Accountability and responsible management practices are also enshrined in transparent sustainability reporting and are currently being treasured by stakeholders. To investors and financial institutions, sustainability data is reliable in informing investment and lending decisions. In the internal environment, transparency promotes staff confidence and involvement by showing that they are devoted to ethical and equal practices. When SMEs employ the BI to deliver sustainability performance, it becomes possible to enhance the relationship with the stakeholders and increase long-term organizational legitimacy.

5. Scalability: Business Intelligence systems offer scalable and flexible decision support capabilities that can be expanded as the organization expands. BI platforms based on cloud computing can help SMEs to increase the volume, complexity, and accessibility of the data without an enormous investment in infrastructure. BI guarantees uniformity in performance monitoring and sustainability measurement of various locations, products, or markets as the SMEs expand their operations. The presence of standardized dashboards and KPIs can enable the management to sustain a strategic control and facilitate the decision-making that is decentralized. Also, the BI-driven insights facilitate the capacity planning processes, resources optimization, and market expansion processes, minimizing the risks associated with growth. By incorporating the concept of sustainability in scalable BI systems, SMEs will be able to avoid the idea of growth at the expense of environmental and social performances. This alignment facilitates responsible growth and enhances organizational stability to survive in a dynamic and competitive business landscape.

Analysis and Results

Business Intelligence (BI) has become an important strategic instrument to facilitate sustainable development of innovative small and medium-sized enterprises (SMEs). BI allows organizations to gather data, process, and analyze it effectively, helping them to make decisions, improve operational results, and become competitive in the long term. Regarding sustainability, BI assists SMEs in balancing the economic goals and environmental and social factors and, thus, enhances their ability to grow responsibly and resiliently. The main dimensions of BI that are applicable to sustainable development are the generation capabilities and analytics capabilities, performance measurement based on sustainability, creating competitive advantage, operational efficiency, the quality of decisions, and continuous learning and innovation. It is important to observe how these dimensions are viewed and how stakeholders value them, to formulate successful BI-based strategies. On this note, the coefficient of concordance developed by Kendall will be used in order to determine how much of the respondents agree on the relative importance of this BI factors in enhancing sustainable growth in innovative SMEs.

Table 1- Factors influncing Business Intelligence for Sustainable Growth - Kendall's W

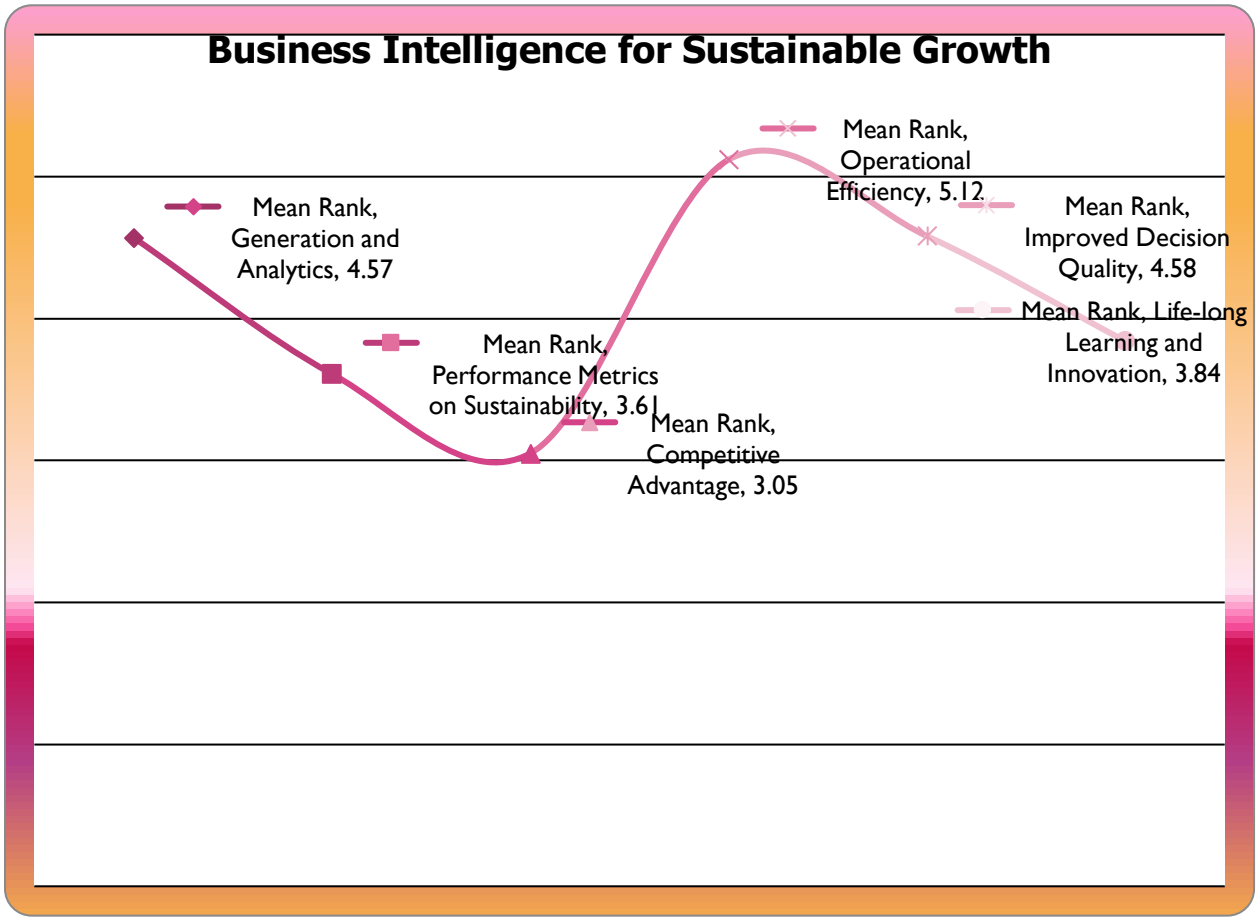
Factors	**Mean**	**Std. Deviation**	**Mean Rank**
Generation and Analytics	3.49	1.180	4.57
Performance Metrics on Sustainability	1.92	.755	3.61
Competitive Advantage	1.52	.683	3.05
Operational Efficiency	3.81	.841	5.12
Improved Decision Quality	3.43	.822	4.58
Life-long Learning and Innovation	1.53	.501	3.84
N	150		
Kendall's W	0.093		
Chi-Square	72.890		
Df	5		
Asymp. Sig.	0.000		

Table 1 presents the results of Kendall's coefficient of concordance (W), examining the level of agreement among respondents regarding key Business Intelligence (BI) factors contributing to sustainable growth in innovative SMEs. The analysis is based on responses from 150 participants.

The findings indicate noticeable variation in respondents' perceptions of the importance of Business Intelligence dimensions for sustainable growth in innovative SMEs. Operational efficiency emerged as the most influential factor, receiving the highest mean score and mean rank. This highlights the central role of BI in streamlining processes, reducing waste, and improving resource utilization to support sustainability objectives.

Improved decision quality and generation and analytics were also ranked highly, reflecting the value placed on data-driven insights and analytical capabilities in enhancing managerial effectiveness and strategic planning. These results suggest that SMEs increasingly rely on BI systems to support timely, accurate, and informed decision-making in complex business environments.

In contrast, performance metrics on sustainability, competitive advantage, and lifelong learning and innovation received comparatively lower mean scores and ranks. While these factors remain relevant, their lower prioritization indicates that SMEs may currently focus more on immediate operational and decision-related benefits of BI rather than long-term learning mechanisms or sustainability measurement frameworks. This pattern suggests a pragmatic orientation among SMEs, where BI adoption is driven primarily by efficiency and decision support rather than strategic innovation and sustainability tracking. Overall, the results demonstrate that although multiple BI dimensions contribute to sustainable growth, SMEs place greater emphasis on operational and analytical benefits, underscoring the need to strengthen awareness and integration of sustainability metrics and continuous learning within BI strategies.



The Kendall's W value of 0.093 indicates a low level of agreement among respondents in ranking the six BI-related factors—namely generation and analytics, performance metrics on sustainability, competitive advantage, operational efficiency, improved decision quality, and lifelong learning and innovation. This suggests that while respondents recognize the relevance of these factors, their perceptions regarding the relative importance of each factor vary considerably.

Despite the low concordance, the Chi-square value of 72.890 with 5 degrees of freedom is statistically significant at the 0.001 level (Asymp. Sig. = 0.000). This indicates that the observed differences in rankings are not due to chance, confirming that respondents meaningfully differentiated among the BI factors when assessing their contribution to sustainable growth.

2. MANAGERIAL IMPLICATIONS

BI must be considered as strategic ability by SME leaders as opposed to a technological investment. Managers should also

lead the way in promoting data-based thinking, incorporate the concept of sustainability into the performance measurement framework, and make sure that the BI insights are actively deployed in the process of strategic conversations. The consistency of BI initiatives against the innovation strategies will increase the capability of the SME to adapt to the dynamic markets and stay sustainable in the long run.

3. CONCLUSION

The article investigated the strategic purpose of the Business Intelligence (BI) in enhancing sustainable development of innovative small and medium-sized enterprises (SMEs). Through the examination of the main BI dimensions, including generation and analytics, sustainability performance metrics, competitive advantage, operational efficiency, enhanced decision quality, and lifelong learning and innovation, the study shows the way SMEs view and value the use of BI-based capabilities in meeting sustainability goals. The results show that SMEs are more concerned with operational efficiency and quality of decision-making because they have a pragmatic attitude towards BI implementation and focus on its applications to enhance performance and managerial performance in the short term. By comparison, the dimensions of sustainability measurement and continuous learning receive somewhat less attention, which implies the lack of strategic integration of BI to achieve long-term sustainability. The findings also indicate that although BI is a globally acknowledged strategic resource, SMEs do not have a unanimous view on the relative significance of the dimensions of this resource. This diversity highlights heterogeneity of SMEs regarding the organisational maturity, availability of resources, and strategic focus. In turn, one BI strategy might not be successful with all companies. The article supports the role of implementing a holistical BI framework that will achieve long term sustainability and innovation objectives in a short term efficient manner. In the case of SME managers, the results indicate that the sustainability metrics and learning-based BI practices should be reinforced. Such insights can be utilized by policymakers and support institutions to create specific initiatives that help build BI resources to enable sustainable and resilient growth of SMEs..

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