

BUSINESS INNOVATION SELF-ASSESSMENT WITH ARTIFICIAL INTELLIGENCE SUPPORT FOR SMALL AND MEDIUM-SIZED ENTERPRISES

Joaquim Jose Carvalho Proença¹

Abstract: This study investigates the role of AI-powered self-assessment tools in enhancing innovation management for small and medium-sized enterprises (SMEs). The primary purpose is to provide SMEs with a cost-effective means to assess and develop their innovation capacities across eight key areas: strategic orientation, innovation portfolio, innovation process, innovative talent and culture, innovation capabilities, technology adoption, strategic alliances, and innovation performance measurement. Utilizing a qualitative, exploratory approach, data was gathered through a Scopus database search and supplemented with relevant literature on AI and innovation management. Findings reveal that AI-driven assessments based on data analysis, pattern recognition, and predictive modeling significantly benefit SMEs by offering actionable insights and recommendations, enabling efficient decision-making, and promoting competitive dynamism. However, limitations such as data quality, algorithmic bias, and privacy concerns must be carefully managed to avoid potential risks associated with AI implementation. The study discusses the impact of AI on reducing the "innovation divide" by democratizing access to advanced innovation management tools, thus supporting SMEs in achieving strategic growth and market adaptability. This research concludes that AI-driven tools represent a valuable asset for SMEs, bridging gaps in consultancy access, and fostering economic inclusivity.

Key words: innovation, evaluation methods, data analysis, information technology, artificial intelligence

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Introduction

Consulting services tailored to small and medium-sized enterprises (SMEs) have proven essential for fostering innovation and competitiveness,

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integrating support from governmental, academic, and business sectors. This collaborative approach grants SMEs access to specialized knowledge, fosters an innovation-oriented mindset, and enables the use of advanced technological tools. Government policies, accelerator programs, and consulting services collectively promote innovation by facilitating financing access, offering business training, and providing vital resources for managing innovation processes. The primary aim of these initiatives is to enhance business management while building SMEs' capacity to innovate.

In support of this, various government and private entities have developed targeted educational programs for entrepreneurs and business leaders. These programs often include events and challenges designed to encourage creative solutions to real-world business problems, promoting collaboration across the innovation ecosystem. However, most of these programs are standardized, lacking the personalized assessments that consider each business's unique strengths and weaknesses, often resulting in an incomplete approach to innovation management.

This study focuses on how the self-assessment of eight critical areas of innovation management can address common challenges SMEs face, such as limited growth and low competitive dynamism; and, the increasing importance of AI in business and innovation management as a core survival strategy. AI-driven diagnostic tools offer immediate, practical benefits by allowing SMEs to evaluate and improve their innovation management. These tools are particularly valuable for SMEs lacking access to consultancy and knowledge transfer opportunities from these actors, which significantly hinders their ability to innovate and remain competitive. An expanding gap in innovation capabilities between large corporations and SMEs, especially in areas like AI adoption, highlights the urgency for accessible innovation management tools that support inclusive economic growth and ensure a competitive marketplace.

Literature review

Innovation positively impacts business performance with an upward trend, as it strengthens the development of organizations (Castanon *et al.*, 2023). AI is transforming traditional business models by enabling new ways of collecting, processing, and analyzing data, which in turn drives business innovation and efficiency (Mishra & Tripathi, 2021). Mariani et al., (2023)

identify product innovation, process innovation, business model innovation, and social innovation within companies as key outcomes of AI deployment.

The study from Endres et al., (2022) concludes that IMS adoption primarily enhances the efficiency of innovation processes, particularly in managing a large number of ideas. However, the software's ability to improve the overall effectiveness of new product development remains limited, suggesting that IMS is more useful for process optimization rather than boosting innovation quality

Kitsios and Kamariotou (2021) emphasize the growing importance of integrating AI tools into business strategy to drive digital transformation. AI is positioned as a key enabler for enhancing decision-making, process automation, and innovation within organizations, leading to a sustainable competitive advantage.

Oliveira et al., (2020) reveal that companies with higher investments in Research and Development (R&D) and innovation activities, such as product/process and organizational innovation, tend to achieve better financial performance. However, many small and medium-sized enterprises (SMEs) have limited R&D infrastructure, lacking a dedicated R&D department. Partnerships with universities and research institutions remain underutilized, highlighting a gap in collaborative innovation efforts. Companies heavily rely on external sources of information, particularly customers, users, and the internet, to drive innovation.

A data mining model based on artificial intelligence that helps companies detect emerging topics and trends with a higher level of automation than before (Muhlroth & Grottke, 2022). According to Akter et al., (2023) the market capacity of AI is related to customer orientation, industrial orientation, and multifunctional orientation; The infrastructure capacity of AI is related to data, business models, and the ecosystem; and the management capacity of AI is related to AI orientation, organizational learning, and AI ethics, which are crucial determinants in forming an AI-driven service innovation capacity.

Economic antecedents conducive to AI adoption include cost savings, reduced product development time, improved productivity, and enhanced decision-making. Firms deploy AI to lower production costs, increase efficiency, and conduct low-cost digital experimentation. AI enhances productivity by reducing human intervention, improving product quality, and accelerating production. It enables customization of services and products, creates new business opportunities for SMEs, and supports decision-making (Mariani et. al., 2023).

Big data adoption enhances competitiveness by identifying opportunities and developing customized services through detailed customer analysis, with predictive analytics driving innovation. Digital platforms foster customer engagement and value creation, enhance consumer experience, and enable rapid innovation and market adaptation (Mariani et al., 2023).

Emrich et al., (2018) highlight electronic consulting services through a low-cost, flexible, and transparent information platform. This platform provides multiple entry points for business transformation and/or technological innovation, enabling them to explore the potential of new concepts and find partners to transform their business. Grivas et al., (2022) focus their research on the development of online strategic consulting tools offered as a self-service on a web platform that supports the definition of digital transformation strategies. The tool is based on the following principles: (1) A holistic approach centered on customer orientation, business models, organizational excellence, and operational excellence. (2) An open strategy approach involving multiple stakeholders within the company.

Simplified solutions preferred, innovation managers tend to prefer Information Management System (IMS) tools that are straightforward and easy to use, with minimal need for additional consulting or training services. This preference highlights the importance of user-friendly software that integrates seamlessly into existing systems, supporting the digital transformation of innovation management with minimal disruption (Endres et al., 2022). Consulting services offered alongside IMS can negatively impact the likelihood of adoption which reinforces the idea of self-consulting.

Overall AI's integration into various industries can lead to improved efficiency, new business models, and enhanced decision-making processes, thus contributing to the broader economic landscape, Haefner et al., (2021). AI is seen as a transformative force that will reshape business models, creating new opportunities for value creation, market expansion, and cost reduction with early adopters likely to gain a competitive advantage (Kanbach et al., 2024).

Firm's strategic focus on AI technologies, is crucial for broadening the scope of knowledge, fostering knowledge creation, and enhancing the application of knowledge within organizations. This, in turn, accelerates the internationalization speed of firms by increasing their adaptability to global market dynamics (Liu et al., 2024).

Table 1

Dimensions and indicators for business innovation diagnostics

DIMENSIONS	INDICATORS
Innovation Strategic Orientation Organization's overarching approach and commitment to innovation as a key driver of its business strategy. It encompasses the firm's innovation-related values, beliefs, and practices that provides direction and focus for innovation efforts. guide decision-making and resource allocation that allows the company to remain competitive in a constantly changing business context.	• Clarity of innovation vision and mission • Alignment of innovation strategy with business goals • Leadership commitment to innovation • Regular review and update of innovation strategy • Research and development (R&D) expenditure
Innovation Portfolio Strategic management and balancing of an organization's innovation projects and initiatives (innovation pipeline). It encompasses the range of innovation efforts (idea generation, selection and evaluation) across different time horizons, risk levels, and types of innovation to achieve organizational goals and maintain competitive advantage.	• Market relevance of innovations • Identifies opportunities for new products, services, or processes. • Number of new ideas in development stage • Stage of development for each innovation project • Balance between incremental and radical innovation projects • Alignment of innovation portfolio with strategic objectives
Innovation Process Systematic approach organizations use to transform ideas into tangible outcomes, such as new products, services, or processes. This concept is fundamental to innovation management and plays a vital role in an organization's ability to innovate consistently and effectively for identifying, developing, and implementing new ideas.	• Efficiency of innovation-related processes • Use of data to improve innovation strategies • Flexibility and adaptability of business processes • Integration of innovation metrics in performance evaluations • Stage-gate process for idea evaluation and selection • Efficient development process for new products/services • Speed of product/service delivery to market • Effective project management for innovation initiatives
Innovative Talent and Culture Organizational environment, values, participation and commitment of employees that foster and support innovation within an organization. This concept is crucial for understanding how companies create and maintain an atmosphere conducive to creativity, risk-taking, support for new ideas and continuous improvement.	• Leadership support for innovation • Team structure • Promotion of a risk-taking culture and experimentation. • Open communication and collaboration • Recognition and rewards for innovation • Fosters employee creativity and participation in idea generation

Innovation Capabilities

Organization's ability to continuously transform knowledge and ideas into new products, processes, and systems for the benefit of the firm and its stakeholders. These capabilities, resources and skills, are fundamental to a company's capacity to innovate consistently and effectively.

- Budget allocation for innovation projects
- Availability of funding for R&D
- Utilization of financial and non-financial resources
- Return on investment from innovation activities
- R&D budget and spending
- Access and investment in new technologies and equipment
- Dedicated innovation team or personnel
- Access to external resources (e.g., universities, research institutions)
- Availability of innovation training programs
- Frequency of employee training sessions
- Impact of training on innovation capabilities
- Participation in industry conferences and seminars

Technology Innovation

Technology Adoption and Monitoring.

- Level of investment in new technologies
- Speed of technology implementation
- Employee training on new technologies
- Impact of technology on operational efficiency
- Frequency of market and technology scans
- Awareness of emerging technologies
- Integration of technological trends into business strategy
- Investment in technology scouting activities

Innovation Strategic Alliances

The feasibility of establishing strategic alliances with external sources of innovation. to boost a model of business of high impact. Alliances and collaborations to foster innovation, accesses new ideas, technologies, expertise and how relationships are managed with other companies, universities and others ecosystem participants of innovation.

- Collaboration with external partners (e.g., startups, universities, research institutions)
- Participation in innovation ecosystems
- Licensing of technologies or intellectual property
- Joint ventures and co-development projects
- Active participation in industry events and conferences

Innovation Performance Measurement

Systematic evaluation and quantification of an organization's innovation activities. It aims to assess the effectiveness and efficiency of innovation processes, helping companies track progress, identify areas for improvement and provides data to inform future innovation decisions. Align innovation strategies with overall business objectives.

- Key performance indicators (KPIs) for innovation
- Benchmarking against industry standards
- Regular performance reviews
- Use of balanced scorecards for innovation metrics
- Number of new products/services launched
- Market success of new products/services (e.g., market share, revenue growth).
- Return on investment (ROI) from innovation projects
- Customer feedback and satisfaction with new offerings
- Number of patents or intellectual property rights

Own Source

Methodology

This non-experimental study employs a qualitative, exploratory research for a software supported by AI to evaluate business innovation. Data was collected using the Scopus bibliographic database with the search term “Innovation Management AND Artificial Intelligence” restricted to business, management, and accounting fields, and further filtered by keywords related to artificial intelligence, innovation management, technological innovation, and innovation processes. Additionally, relevant entries from arXiv, an open-access repository spanning various disciplines including computer science, and five conference proceedings were included. To ensure relevance and timeliness, studies that have been published since 2020 were selected, with the exception of Emrich et al. (2018), a conference presentation on electronic consulting services. The initial search yielded 387 records. Based on criteria such as title, abstract, challenges, trends, implementation, and impacts of AI on business growth, transformation, strategy, knowledge management, creativity, ethics, service innovation, and business models, 24 documents were ultimately deemed eligible for analysis. These articles underwent document analysis, information extraction, and characterization, ensuring the information gathered reflects the latest research and developments in the fields of Innovation and Artificial Intelligence.

AI analytics framework

Data processing incorporates the following components: data preprocessing and normalization, pattern recognition and correlation analysis, benchmarking against industry standards, predictive modeling and scenario analysis, automated insight generation and recommendations.

Data Collection and Preprocessing. The responses to the questions will generate structured data, which can be stored in a database. For example, answers like Linkert scale or specific percentages can be directly input into numeric fields. Yes/No responses can be encoded as binary values (1 for yes, 0 for no). To ensure consistency, responses on different scales can be normalized, so the AI can compare and analyze them effectively.

Pattern Recognition. The AI can identify correlations between different variables (Correlation Analysis). For instance, it might find that organizations with higher leadership commitment scores tend to have shorter timeframes from idea generation to market launch. By tracking

changes over time, especially with metrics like the frequency of innovation strategy reviews or the number of technologies adopted annually, the AI can detect trends in innovation practices (Trend Analysis).

Benchmarking. The AI can benchmark an organization's performance against industry standards. For example, it could compare the percentage of the budget allocated to innovation with industry averages to determine if a company is under- or overinvesting in innovation. Key performance indicators (KPIs) like revenue growth from new products can be benchmarked against similar organizations to assess relative performance. Highlight areas where the company is lagging or leading.

Predictive Modeling. Predictive Analytics: The AI can use the collected data to build predictive models. For example, if a company increases its investment in new technologies, the AI might predict an increase in the speed of product delivery to market based on historical data. *Scenario Analysis:* The AI could simulate various scenarios, such as what would happen to innovation outcomes if the budget allocation for innovation projects was increased by 10%.

Decision Support. Based on gap analysis, the patterns and correlations detected, the AI can generate automated insights and recommendations. For example, if the AI finds that a higher percentage of strategic alliances correlates with greater revenue growth from innovation, it might suggest forming more partnerships. The AI can flag anomalies, unusual or unexpected data points, such as a significant decrease in employee participation in innovation initiatives which might warrant further investigation.

Reporting and Visualization. The AI can create radar charts showing performance across dimensions, visualize the data using dashboards, displaying key metrics like innovation ROI or the number of patents acquired. These visual tools help decision-makers quickly grasp the organization's innovation health. The AI can use heatmaps to highlight areas of strength and weakness, can generate custom reports that highlight specific areas of concern or success, such as identifying which innovation processes are most efficient and should be further optimized.

Discussion

AI can significantly contribute to making the innovation process more systematic and efficient, especially in areas constrained by information processing. However, Haefner et al., (2021) conclude that while AI can

augment many aspects of innovation management, human involvement remains crucial, particularly in tasks requiring creativity, judgment, and complex decision-making

Business consulting should accompany the diagnostic with development of organization capabilities that sustain innovation a long term. The 8C model, key dimensions: cognisance/knowledge management, critical thinking, creativity, innovation capabilities, collaboration, innovative culture, change management, and communication significantly enhances innovation management by providing a comprehensive assessment framework for companies' innovation practices and their long-term impact. It highlights specific competencies and capabilities essential for sustained innovation and competitiveness, enabling companies to identify focus areas, assess innovation sustainability, and allocate resources effectively (Proenca, 2024).

As additional discussion points the implementation of AI-supported innovation self-assessment systems, while promising, carries several risks that organizations must carefully consider. Notably, AI implementation poses significant risks and challenges, such as potential algorithms bias, job displacement, and cybersecurity vulnerabilities (Nigmatov & Pradeep 2023). Data quality and inherent bias are critical concerns, as AI systems rely heavily on the quality and representativeness of input data. Security and privacy concerns are also vital, particularly for businesses handling sensitive innovation-related data, which may be challenging for many SMEs to implement and maintain. AI adoption can drive business growth by automating tasks, optimizing processes, and extracting valuable insights from large data volumes. However, businesses must also address data privacy and security concerns (Rubab, 2023).

Although AI enhances business efficiency, reduces costs, and fosters innovation, it also raises concerns over job displacement and ethical dilemmas (Modhoriye et al., 2023). Fake or biased AI applications could risk compliance and governance breaches and damage to corporate brands if implemented without caution (Eitel-Porter, 2020). Adopting seven fundamental 'ethical principles' - transparency and explainability, fairness and impartiality, robustness and reliability, privacy, accountability, responsibility, safety and security - is essential for responsible AI development, deployment and usage (Taiwo et al., 2023).

Additionally, over-reliance on AI-generated insights could impact human decision-making, creative thinking and intuitive problem-solving, key components of innovation. While generative AI can enhance individual

creativity, it may reduce the diversity of novel content collectively (Doshi & Hauser 2023).

Concerning limitations AI systems also face technical constraints due to their human-defined implementation and training, often with limited objective functions; human researchers calibrating these systems cannot possibly define all potential objectives. These constraints limit AI's autonomous problem-solving abilities and restrict its capacity for idea generation and opportunity recognition, often confining AI to localized search routines. However, recent advancements suggest the potential for AI to complement human decision-making with varying levels of information processing capability (Haefner et al., 2021).

Companies encounter challenges in implementing AI due to a range of technological, organizational, and cultural factors (Angstrom et al., 2023). From a technical perspective, organizations often struggle with integrating AI systems into existing technology infrastructures, ensuring data consistency across organizational units, managing the complexity and maintenance of AI algorithms, and establishing reliable benchmarking mechanisms across diverse industry contexts. Organizational challenges add another layer of complexity, including resistance to change among employees and management, substantial process redesign requirements to accommodate AI-driven assessments, the need for new skills and competencies, and cultural adaptation to data-driven decision-making in innovation processes.

AI applications in businesses can introduce risks such as system malfunctions, privacy protections, and data repurposing, necessitating collaboration with diverse experts, Banja, J. (2020). Smaller organizations, in particular, may face resource constraints in terms of technical infrastructure, personnel, and financial resources, underscoring the need for shared resource models for SMEs. Soni et al., (2020) study highlights that AI's benefits are concentrated in a few regions, leading to an "AI divide" that could exacerbate social, economic, and cultural inequalities, self-consulting software could minor these global disparities. AI is highlighted as a powerful tool that can democratize innovation across an organization, fostering diversity, cross-functional collaboration, and enhanced capacity for foresight and risk management (Yams et al., 2020).

Regarding applicability and versatility, while the framework's core components for self-assessment (the eight dimensions of innovation management at Table 1) are generally applicable, their relative importance and implementation may vary significantly based on factors such as

Industry sector (e.g. manufacturing vs. service industries, traditional vs. technology-intensive sectors, B2B vs. B2C organizations) and geographic and cultural context (e.g. developed vs. developing economies, diverse cultural approaches to innovation, varying regulatory environments). The framework shows particular promise in knowledge-intensive industries where data-driven decision-making is already established. Future research might include these points along with longitudinal studies to assess the long-term impact of using the self-assessment tool on SME innovation performance.

Conclusions

This study highlights the critical role of artificial intelligence (AI) in supporting innovation management for small and medium-sized enterprises (SMEs). By leveraging AI-driven self-assessment tools, SMEs can better evaluate and enhance their innovation strategies across eight core areas: strategic orientation, innovation portfolio, innovation processes, talent and culture, capabilities, technology adoption, alliances and performance measurement. The research indicates that such tools not only bridge the "AI divide" but also enable SMEs to compete more effectively by offering data-driven insights and actionable recommendations tailored to their unique needs.

AI's integration into innovation management frameworks offers significant benefits, including enhanced decision-making, process automation and strategic foresight. However, challenges remain, particularly regarding data quality, algorithmic bias and security concerns, which SMEs must address to fully leverage AI's potential responsibly. The findings emphasize the importance of accessible, user-friendly AI solutions that reduce reliance on external consultancy, thus democratizing innovation management capabilities.

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- Introduction – it should be from half a page to a page long. It should state the main ideas and/or objectives of the study and justify the relevance of the discussed issue.
- The main body of the paper – it should contain discussion questions, an outline of the study and research findings/main conclusions; bibliographical citation and additional notes, explanations and comments written in the footnotes.
- Conclusion – it should provide a summary of the main research points supported by sufficient arguments.
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