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AI-DRIVEN BUSINESS PERFORMANCE: TRANSFORMING INSIGHTS INTO ACTION AT SIEMENS

ЕФЕКТИВНІСТЬ БІЗНЕСУ НА ОСНОВІ ШІ: ПЕРЕТВОРЕННЯ АНАЛІТИЧНИХ ВИСНОВКІВ НА ДІЇ В КОМПАНІЇ SIEMENS

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Бенхіра М., Бенахмед С., Хансаль А., Мезоуагі Д. Ефективність бізнесу на основі ШІ: перетворення аналітичних висновків на дії в компанії Siemens. Науково-методична стаття.

У дослідженні розглядається впровадження штучного інтелекту (ШІ) у системи управління ефективністю на прикладі компанії Siemens. У статті показано, як Siemens трансформував традиційні показники ефективності на динамічні, що ґрунтуються на даних, завдяки впровадженню ШІ в рамки збалансованої системи показників. Результати демонструють значне покращення фінансових показників, задоволеності клієнтів, внутрішніх операцій, дослідницького потенціалу та кваліфікації працівників. Дослідження доходить висновку, що ШІ не лише підвищує ефективність бізнес-аналітики, але й узгоджує операційну діяльність зі стратегічними цілями, стаючи, таким чином, життєво важливим інструментом для інновацій, вдосконалення процесів та сталого розвитку в умовах сучасної конкурентної боротьби.

Ключові слова: штучний інтелект, управління ефективністю, збалансована система показників, показники ефективності, операційна діяльність, бізнес-аналітика, Siemens

Benkhira M., Benahmed S., Hansal A., Mezouaghi D. AI-Driven Business Performance: Transforming Insights into Action at Siemens. Scientific and methodical article.

The study examines the incorporation of artificial intelligence (AI) into performance management systems, with the company Siemens serving as a case study. The paper illustrates how Siemens transformed traditional performance indicators into dynamic, data-driven insights through the implementation of AI within a Balanced Scorecard framework. The results demonstrate notable enhancements in financial performance, customer satisfaction, internal operations, research capabilities, and employee skills. The study concludes that AI not only enhances business intelligence but also aligns operational activities with strategic objectives, thereby becoming a vital tool for innovation, process improvement, and sustainable growth in today's competitive landscape.

Keywords: Artificial Intelligence, Performance Management, Balanced Scorecard, Performance Indicators, Operational Activities, Business Intelligence, Siemens

Although the concept of artificial intelligence (AI) and AI systems has been in existence since the 1950s, it has only recently experienced a period of rapid expansion due to the growth and emergence of complex big data in the digital age and the increasing need to process it at faster rates. AI technology is being used to revolutionise processes, increase productivity, and drive innovation. It has opened up new opportunities across industries, including healthcare and finance, marketing, and manufacturing (Psarras et al., 2022, p.2), and One of the most prominent examples of AI applications is the digital assistant, Amazon's Alexa (amazon, 2023). This has become increasingly integrated into our lives and businesses. Furthermore, AI is enhancing the efficiency and precision of navigation, as evidenced by its integration into GPS guidance and autonomous vehicles in the industry. This is transforming the manner in which we address a multitude of challenges by automating routine tasks, thereby freeing up time and resources for more complex tasks. The impact of AI on industries such as healthcare and manufacturing is profound, with its deployment facilitating the analysis

of complex data and enhancing decision-making processes. Furthermore, AI has the potential to revolutionise the field of diagnostics, as it is capable of processing and analysing data in a way that is beyond the capabilities of humans. As AI continues to evolve, it will continue to impact our lives and businesses, opening up new opportunities across industries. This is due to its ability to process and analyse data in ways that humans simply cannot. This is achieved through the use of advanced algorithms, machine learning (ML), and neural networks (Karnati et al., 2022, p. 2). This trend is expected to continue, as businesses look to unlock the potential of big data and drive further innovation in the field of artificial intelligence (Psarras et al., 2022, p. 2).

The Fourth Industrial Revolution (Industry 4.0) represents a significant shift in the adaptation of advanced technologies across industries. By facilitating collaboration between humans and artificial intelligence (AI), it reshapes traditional workflows and opens up new opportunities for innovation and productivity. This can enhance businesses' agility, competitiveness, and value creation. The synergy optimises results (Psarras et al., 2022, p. 1).

The Balanced Scorecard was initially conceived as a means of measuring strategic performance (Fabac, 2020, p.10) and was first introduced in 1992. In 1996, Kaplan and Norton expanded the scope of the Balanced Scorecard as a strategic management tool, leading to a rapid increase in its adoption across numerous companies (Tawse & Tabesh, 2023, p. 125). It has become a globally popular system for supporting strategic planning and management processes. Over the past two decades, it has been widely adopted by leading companies across a range of sectors (Fabac, 2020, p.3). A recent study revealed that 88% of users believe that the Balanced Scorecard enhances performance in a context characterised by turbulence, volatility, uncertainty, complexity and ambiguity (Tawse & Tabesh, 2023, p. 125). This increases the necessity for companies to respond expeditiously (Kumar et al., 2023, p. 29). To implement artificial intelligence (AI) to support the balanced scorecard, to promptly identify and implement novel approaches to integrate AI into their strategic frameworks and operational processes (balancedscorecard, 2023) that can enhance a firm's strategy execution, performance measures, and decision-making (Angel, 2024).

The implementation of artificial intelligence (AI) and machine learning (ML) presents a multitude of benefits. For example, the Group Management of Siemens believed that its processes for strategy implementation were too complex, which resulted in a disconnect between the strategic direction and the everyday operational activities. The Balanced Scorecard was identified as the most effective tool for simplifying strategy implementation. The management team had identified a pressing need for a robust framework for managing within an environment characterised by constant change. In light of these considerations, the question that arises is: How did Siemens enhance strategic management by integrating AI into the Balanced Scorecard framework? Most existing studies on AI and the BSC either discuss the two in general, conceptual terms (e.g. balancedscorecard, 2023; Sterling, 2023) or examine AI's contribution to a single BSC perspective in isolation, such as knowledge management (Mahboub & Ghanem, 2024) or internal process automation (Helo & Hao, 2022); what remains largely absent from the literature is an in-depth, single-firm account of how AI-related tools are positioned across all four BSC perspectives simultaneously. This study addresses that gap by examining Siemens, a global technology group whose scale of operations, multi-year public sustainability and financial reporting, and explicitly documented AI-related initiatives across its business units make it a data-rich setting in which this cross-perspective picture can be traced.

Background. AI concept.

The current era is characterised by the extensive influence of advanced technologies, including artificial intelligence (AI), which has become a ubiquitous phenomenon across a multitude of domains. AI has a long history, with origins dating back to the Dartmouth workshop (Helo & Hao, 2022, pp. 1574-1575). However, Alan Mathison Turing is regarded as the pioneer of artificial intelligence since 1950; his work has undergone significant developments over time (Grzybowski et al., 2024).

The utilisation of AI is becoming increasingly widespread across countries worldwide. In sectors such as finance and manufacturing, the deployment of AI has become a common practice (Bawa, 2023, p. 1187). Recently, companies began to realize the potential of artificial intelligence in developing innovative products and services that enhance their performance (Helo & Hao, 2022, p. 1574). One significant factor influencing the uptake of AI in the business sector is the rising expectations of customers, which have created a conducive environment for its growth (Helo & Hao, 2022, p. 1574).

AI has become a strategic imperative due to three main technological forces: increasing computing power, the increase in the amount of data, and advancements in data processing capabilities. The combination of these three forces has led to the development of more efficient AI applications. The enormous growth in data from a variety of sources provides a vast range of information that can be used to derive valuable insights and improve decision-making processes (Helo & Hao, 2022, p. 1575).

The implementation of AI allows organisations to automate repetitive tasks, predict outcomes, analyse massive datasets and make accurate decisions in a briefer period of time. This leads to enhanced productivity, in the detection of fraudulent activity, the provision of investment advice, the reduction of costs, and the improvement of customer satisfaction. Furthermore, in the context of manufacturing, robots can optimize production processes, enhance quality control, and decrease downtime. In the retail sector, AI-powered chatbots can provide customer service and analyse customer behaviours to create targeted marketing strategies. (Bawa, 2023, p. 1187).

In a recent investigation, Forbes Advisor inquired of 600 business proprietors who are either currently employing or intending to incorporate artificial intelligence into their commercial activities. The findings of this survey, as illustrated in the accompanying figure, have provided several notable insights (Haan & watts, 2023).

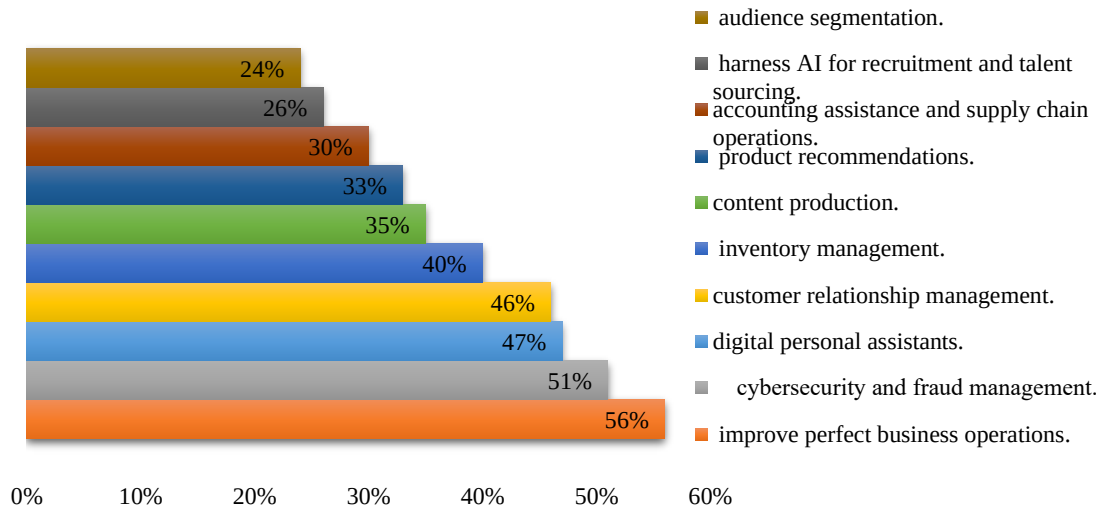


Figure 1. Principal Areas Business Owners Use Artificial Intelligence

Source: elaborated by the author based on [8]

The data provided by Forbes Advisor indicates that a notable proportion of businesses are integrating artificial intelligence tools into their operations across a range of domains. A total of 56% of businesses have adopted AI in order to enhance efficiency and optimisation within their organisational structures. Furthermore, 51% of businesses utilise AI tools for the purpose of enhancing cyber-security and fraud management, thereby seeking to safeguard sensitive information and assets. A total of 46% of businesses have employed AI for the purpose of customer relationship management, with the objective of fostering and maintaining strong customer relationships. Moreover, 40% of businesses have employed AI for inventory management, 35% for content production, and 33% for product recommendations. These findings illustrate the extensive applicability of AI in contemporary business operations.

As demonstrated by the findings of AI Statistics for Business (Padrig, 2024), it can be observed that a significant proportion, approximately 34% of all business-related tasks, are presently being carried out by machines. The deployment of such automated systems has been found to lead to substantial savings in costs and revenue for companies. To illustrate, 46% of American companies have realised savings of between \$25,000 and \$70,000 through the utilisation of ChatGPT. This serves to underscore the financial advantages associated with the adoption of AI. Furthermore, organisations that adopt AI can anticipate a revenue growth of between 6% and 10%. This evidence substantiates the general positive influence of AI on business efficiency and profitability.

Based on an extensive survey of 1,684 respondents conducted by McKinsey in 2023, the analysis covered a wide range of geographies, industries, company sizes, functional areas, and tenure. The primary focus of the study was on the integration of AI capabilities across different functions and business units, as shown in Figure 1.

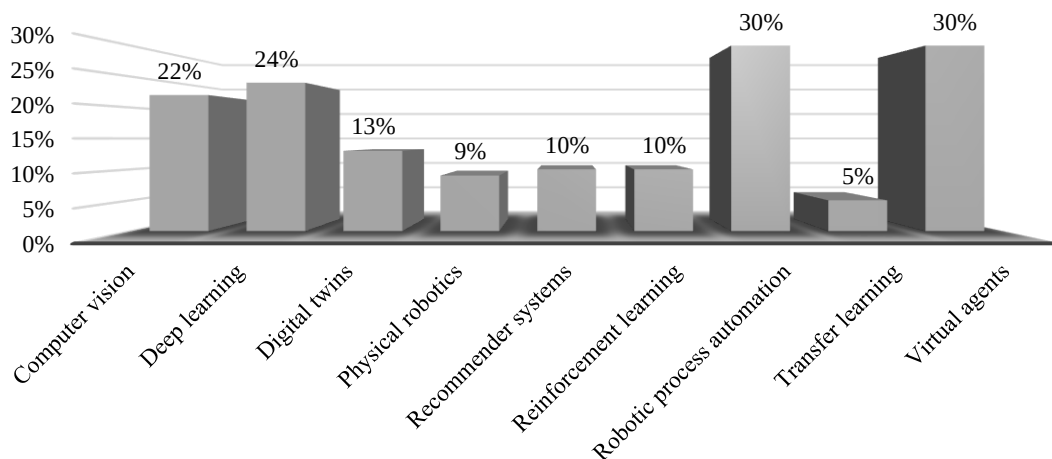


Figure 2. Prevalence of AI Technologies in Various Applications 2023

Source: elaborated by the author based on [17]

The bar chart presents a visual representation of the degree to which various artificial intelligence (AI) technologies are employed within the field of business operations. The chart demonstrates that organisations are making considerable investments in AI technologies that automate tasks and enhance customer interactions. The results suggest that virtual agents and robotic process automation have the highest prevalence, each accounting for 30% of all instances of AI technology usage. Deep learning represents the third most frequently utilised technology, with a usage rate of 24%. Computer vision is the fourth most utilized technology, exhibiting a usage rate of 22%. The survey results indicate that approximately 13% of businesses utilise digital twins. In comparison, approximately 10% of businesses employ reinforcement learning and physical robotics, respectively. A mere 9% of businesses employ recommender systems, while transfer learning is the least utilised technology, with a usage rate of just 5%.

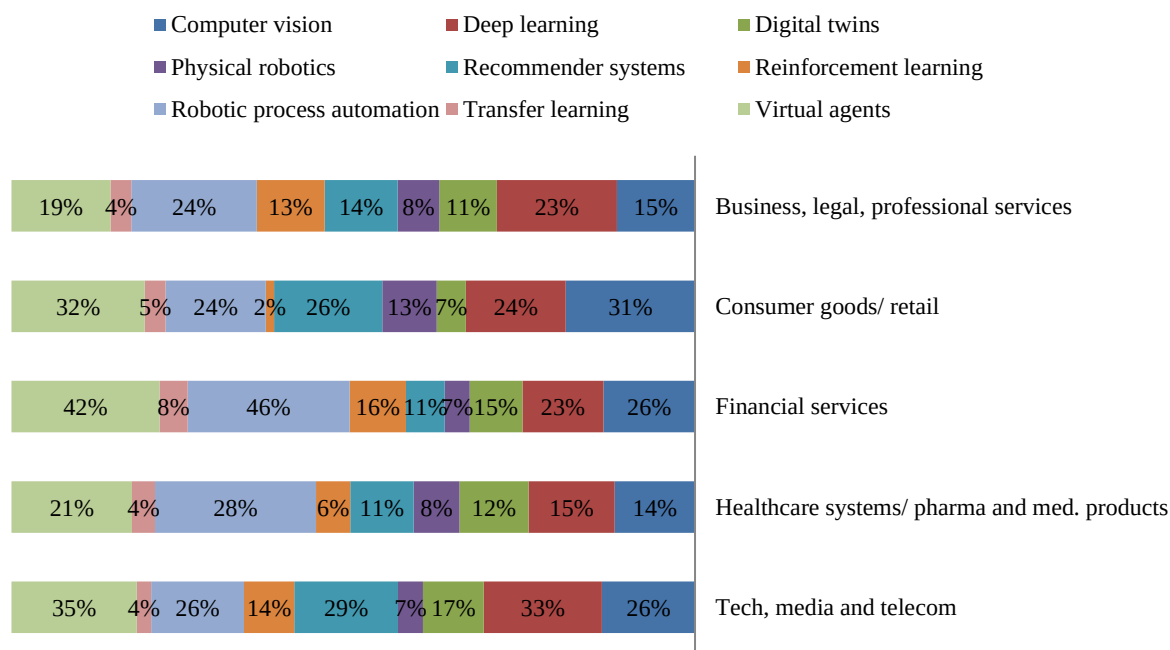


Figure 3. Adoption of AI Technologies Across Various Industries 2023

Source: elaborated by the author based on [17]

As illustrated by the bar graph, the deployment of artificial intelligence (AI) technologies differs significantly across various industrial sectors. Within the sector of technology, media and telecommunications, the most common applications of AI are deep learning (33%) and virtual agents (35%). In the healthcare sector, the highest rates of utilisation are observed for robotic process automation (28%) and virtual agents (21%). The financial services sector demonstrates a pronounced reliance on virtual agents (46%) and computer vision (26%). In consumer goods and retail, computer vision (31%) and virtual agents (32%) are observed to be particularly prevalent. In the business, legal and professional services sector, virtual agents (24%) and deep learning (23%) are utilised to notable extents.

Balanced Scorecard.

The advent of rapid and intricate changes in business operations has prompted a reconsideration of the traditional models used for the measurement of organisational performance. These models have previously focused on the financial aspects of organisational performance to the exclusion of other key considerations.

The requirement for a more balanced and comprehensive approach to performance evaluation has given rise to the creation of innovative methodologies that combine traditional quantitative metrics with other relevant measures. The Balanced Scorecard (BSC) represents a pivotal business tool that has been refined over the past few decades and is employed in a diverse array of contexts. The BSC has been successfully implemented in a number of sectors, including manufacturing, government, non-profit organizations, services, and other industries worldwide (Kartalis et al., 2023, p. 413).

The BSC tool was invented by Kaplan and Norton in 1992 (Kartalis et al., 2023, p. 413) and subsequently popularized in the Harvard Business Review (Kumar et al., 2023) to assist managers in comprehending organizational performance (Tawse & Tabesh, 2023). The BSC offers a structured approach for organisations to evaluate their performance from four distinct perspectives: financial, customer, internal business processes, and learning and growth.

In 1996, the inventors expanded the theoretical basis of their model, placing greater emphasis on the causal relationships between aspects, and rebranding the BSC as a systematic and comprehensive approach to strategic management and implementation. This approach was developed with the objective of translating strategy into action (Tawse & Tabesh, 2023, p. 124).



Figure 4. Causal Links in BSC Perspectives
Source: elaborated by the author based on [32]

The Balanced Scorecard framework views the four perspectives as interdependent, with each influencing and being influenced by the others. This illustrates how different elements of organisational performance are interconnected. By connecting the organisation's strategy with particular performance indicators, the progress of the action plan can be evaluated using the metrics assigned to each of the four aforementioned perspectives (Alkinoos, Anagnostopoulos, Salmon, Psaromiligkos, & Vryz, 2022, p. 6).

The BSC facilitates the translation of strategy into actionable goals and aligns the objectives of different departments. As a strategic planning and change management tool, the BSC ensures that the organisation's strategy and vision are identified and understood by all employees (Weller, 2017).

It can be deployed at both the tactical and operational levels. It is therefore essential to rapidly gather, verify and process data in order to comprehend the outcomes and present them in a clear and concise manner (Żółtowski, 2022, p. 4077).

performance, enabling the implementation of necessary adjustments in a prompter and efficacious manner. Ultimately, this should result in enhanced strategy deployment and enhanced financial performance. As the founders of the BSC concept described it, the BSC is akin to the dials in an airplane cockpit, providing managers with complex information in a concise manner. (Tawse & Tabesh, 2023, p.123). By 2008, 53 percent of companies around the globe were utilising the BSC, which represented its apogee in popularity (Tawse & Tabesh, 2023, p. 124).

In the year 2020, the management consultancy firm 2GC spearheaded a Balanced Scorecard Usage Investigation. This investigation was based on responses from a cohort of informed managers in either corporate or employee roles, and it spanned 21 countries. The survey findings indicated that the BSC is primarily utilized for strategic management (88%), followed by operating management (63%) and reporting (58%) Source spécifiée non valide.. Recently, the BSC has been adapted to facilitate the implementation of sustainability strategies, a process known as the Sustainability Balanced Scorecard (SBSC) (Tawse & Tabesh, 2023).



Figure 5. Strategic-Operational Planning Cycle
Source: elaborated by the author based on [32]

The figure illustrates the strategic and operational planning cycle, designated as closed-loop management, wherein the BSC plays a pivotal role. It enables the formulation of clearly defined strategies, their translation into concrete objectives, and the integration of organisational coherence. It guides the process of operational planning and facilitates the continuous monitoring and learning through the tracking of performance. In essence, the BSC provides a framework for the testing and adaptation of strategies, thereby ensuring their continued efficacy and relevance. In this context, Robert S. Kaplan, co-creator of the BSC, states that integrating this system with strategic planning and operations enhances the BSC's effectiveness, ensuring ongoing improvement and evolution of strategic and operational plans. (Weller, 2017).

Analysis of recent publications on the problem

The incorporation of artificial intelligence (AI) into performance management, particularly through frameworks such as the Balanced Scorecard (BSC), is transforming the manner in which organisations measure performance, facilitate employee success, and attain sustainable growth. This literature review synthesises the pivotal findings from recent studies that investigate the roles of AI and BSC in optimising performance management and decision-making processes.

Recent research suggests that AI will have a profound and transformative impact on traditional performance management systems. According to the (Madhumita et al., 2024), in their study: *AI-powered Performance Management: Driving Employee Success and Organisational Growth*, state that AI tools automate performance tracking and provide real-time feedback, improving the objectivity and efficiency of reviews. By leveraging data analytics, organisations can identify employee strengths and weaknesses, enabling the creation of personalised development plans that align individual performance with organisational goals. In addition, the study shows a reduction in bias and increased transparency in assessments, ultimately leading to improved productivity and growth.

Similarly, The study: *Artificial Intelligence and Performance Management*, conducted by (Varma et al., 2024), investigates the integration of AI into performance management systems across a range of organisational contexts. The study identifies the various applications of AI-enabled tools within corporations and evaluates the benefits and drawbacks of utilising AI in performance management. It draws on practitioner literature to provide an overview of the current landscape of AI and AI-enabled tools and analyses the various components of performance management systems, discussing how each component may be affected by the introduction of AI.

The application of artificial intelligence technology to enterprise management has the potential to significantly enhance the technical support systems within organisations, thereby fostering improved decision-making and operational efficiency. The article by (Huang et al., 2021) explores the pivotal nexus of artificial intelligence and knowledge management performance evaluation, elucidating the ways in which AI can facilitate the assessment and enhancement of knowledge management practices. Furthermore, the authors examine the relationship between the balanced scorecard, a strategic planning and management tool, and knowledge management performance. They propose that a systematic approach utilising AI can provide enterprises with comprehensive insights into their performance metrics. Consequently, the integration of AI technologies not only facilitates performance evaluation but also enables enterprises to capitalise on their knowledge assets more effectively, thereby fostering innovation and competitive advantage in an increasingly complex business landscape.

(Angel, 2024) explores The future of strategic management is poised for a significant transformation through the integration of artificial intelligence (AI), particularly when applied to frameworks like the Balanced Scorecard (BSC). The application of AI-driven analytics enables organisations to process vast quantities of data from a multitude of perspectives, including financial, customer, internal processes and learning and growth. This facilitates the identification of intricate patterns and trends that may otherwise remain undetected. Moreover, predictive modelling capabilities permit businesses to utilise historical data in order to forecast future performance, thereby proactively identifying potential risks and uncovering new opportunities that can inform strategic decision-making. The automation of reporting processes through AI not only enhances the accuracy and timeliness of reports by minimising manual errors but also frees up valuable human resources for more strategic tasks. Furthermore, AI's capacity to establish feedback loops enables it to learn and adapt its recommendations continuously based on real-time outcomes, thereby facilitating the generation of increasingly refined insights that enhance strategic alignment and operational effectiveness. As organisations adopt these transformative capabilities, they will find themselves better equipped to navigate the complexities of the modern business landscape, driving innovation and competitive advantage in their respective sectors.

The study of (Sterling, 2023) demonstrates The role of AI in the transformation of the modern workplace is multifaceted and far-reaching. It automates routine tasks and enhances decision-making processes. As technological developments such as computer vision and deep learning continue to advance, it seems inevitable that AI will transform operational dynamics and the nature of work. In this context, data accessibility and AI's analytical capabilities assume a pivotal role in strategic decision-making. The internal process perspective of the Balanced Scorecard is particularly relevant, as organisations must establish effective internal processes that align with AI initiatives in order to fully harness its potential. By concentrating on the most appropriate metrics and operational frameworks, organisations can guarantee that their AI strategies are not only innovative but also sustainable and ethically sound. This will ultimately result in long-term business performance and societal benefit.

The convergence of AI and BSC is particularly noteworthy in the context of change management. The study of (Psarras et al., 2022) demonstrates how combining BSC with Artificial Neural Networks (ANNs) improves the predictive accuracy of program outcomes in public organizations. By analyzing both financial and non-financial metrics, the study shows that AI enhances decision-making processes, particularly in forecasting the impacts of EU co-financed programs. This integration supports efficient management of funding programs and facilitates better decision-making based on insights generated from data. Moreover, the study "Company's Performance Prediction Using Balanced Scorecard Software and Neural Networks as a Tool for Strategic Management" illustrates the effectiveness of combining BSC software with ANNs to predict overall company performance.

The integration of AI and the Balanced Scorecard presents a significant opportunity for enhancing performance management and decision-making processes within organisations. Although the studies reviewed indicate the potential advantages of this integration, there are still gaps in empirical research examining its practical applications across diverse industries. Future research could concentrate on case studies that exemplify optimal practices for implementing AI tools within the BSC framework, particularly in diverse business environments and sectors. Furthermore, investigating the ethical implications and challenges of AI integration in performance management will be vital for ensuring fairness and transparency in organisational practices.

Formulation of research objectives (task setting)

The aim of the article explores how Siemens has integrated AI into its Balanced Scorecard (BSC) framework to improve strategic management, using a single-case, qualitative case study approach. Theoretical insights are drawn from peer-reviewed academic articles identified in the literature review, while Siemens' publicly available corporate materials – including its annual and sustainability reports (FY2019–FY2023), executive statements, and corporate communications – are used as case-specific data on financial performance, customer satisfaction, internal processes and innovation.

Materials and methods

The unit of analysis is the set of Siemens performance indicators and managerial statements relating to AI adoption within each of the four BSC perspectives (financial, customer, internal process, and learning and growth). Data analysis combines thematic content analysis – in which statements from corporate materials are coded into categories corresponding to the four BSC perspectives – with a systematic evaluation of the associated quantitative KPIs reported in Table 1 and Table 2. Cross-referencing between the qualitative statements and the quantitative KPI data was used to check consistency between what Siemens' management reports about its use of AI and the performance trends recorded in the same period; this cross-referencing supports the internal consistency of the case description but does not, on its own, establish a causal relationship between AI adoption and the reported performance changes. Accordingly, the findings below are presented as an in-depth description of Siemens' AI-related practices and their associated performance trends, rather than as evidence of a proven causal effect of AI on performance. Limitations include the focus on a single company, reliance on Siemens' own publicly available reports rather than independently audited or third-party data, and the resulting risk of selection and reporting bias inherent to corporate self-disclosure.

Presentation of main results and their justification

Case study: Siemens.

Siemens AG is one of the foremost global entities in the technology field, with a diverse portfolio encompassing energy, transportation, and healthcare. The company employs over 300,000 individuals and distributes its products in over 200 countries. In 2022, Siemens announced an estimated revenue of \$78.037 billion, representing a 4.83% increase from 2021. Siemens has implemented a strategic plan based on the Balanced Scorecard (BSC) and driven by artificial intelligence, aiming to boost innovation and improve products to create added value worldwide.

The EcoVadis performance assessment has determined that the BSC is an effective technique for the realisation of streamlined strategy execution and the alignment of operational processes with strategic objectives. Furthermore, in 2023, Siemens Mobile has attained a score of 77 on the EcoVadis scorecard; as a consequence, the company is now placed within the top percentile of organisations assessed. This ranking has led to Siemens being bestowed with the EcoVadis Gold Medal, which acknowledges the company's Core Technologies initiative in advancing technological advancement to overcome pivotal sustainability challenges (SIEMENS, 2023, p. 29).

Dr. Bernhard Gueldner, Director of Management Systems at Siemens AG, highlights the value of this approach in terms of streamlining strategy deployment and ensuring that daily operational activities are aligned with the company's overarching strategic vision (Siemens ICM, 2000).

At Siemens Company, the implementation of this strategic tool involves the conduct of extensive workshops with senior management teams from each unit over a period of three to four months. This structured process constitutes a crucial element of Siemens Mobile's strategy implementation, guiding the transition from strategy formulation to operational execution (Siemens ICM, 2000).

In this context, in a previous discussion, Dr Gildner outlined the stages involved in the formulation and implementation of Siemens' business strategy. First, an entire set of procedures is conducted at various managerial levels with the objective of transforming the strategy into concrete actions. He asserts that the company deploys the most effective management tools to guarantee optimal operational and performance outcomes.

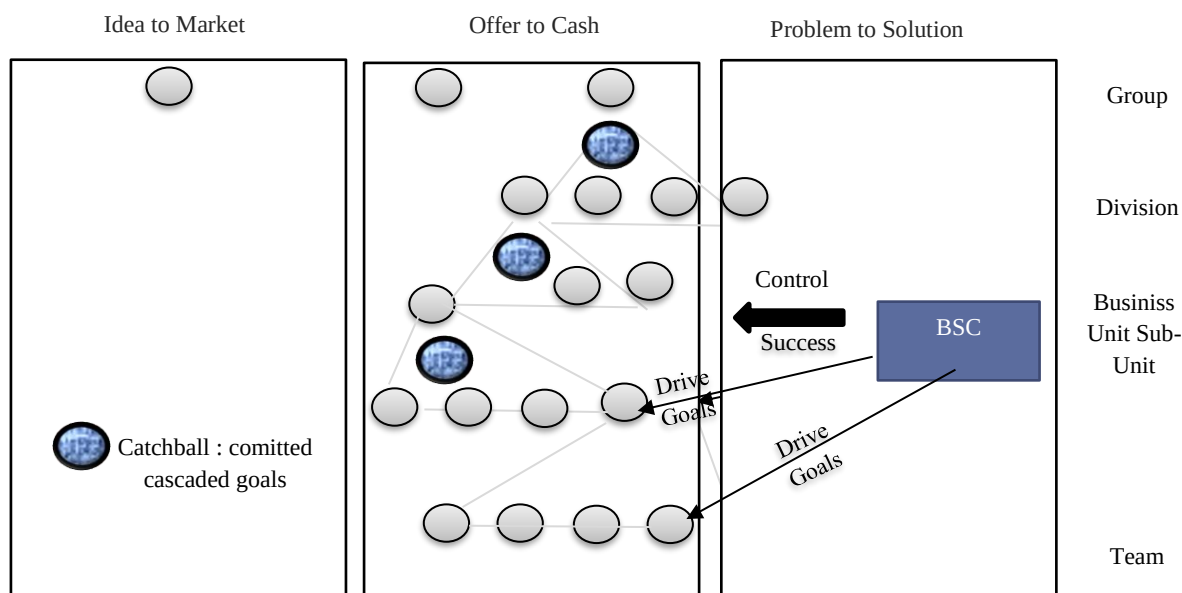


Figure 6. Strategic Goal Alignment Via The Balanced Scorecard

Source: elaborated by the author based on [23]

He highlights that Siemens has a well-defined understanding of its business environment, encompassing a comprehensive awareness of its strengths, weaknesses, opportunities, and threats. Once the strategic plan has been finalised, a concise set of objectives is established to assess the business's performance and clarify the company's strategic direction. Dr Gildner notes that Siemens utilises the balanced scorecard technique to achieve this, which involves mapping out operational processes, defining objectives and key performance indicators, and translating the strategy into tangible actions.

The BSC provides a methodology to translate strategic objectives into quantifiable goals within an organisational context. It delineates the process from the initial strategic design phase through to market entry, cash flow generation, and finally, the problem identification and resolution phase. This approach ensures that all members of the company are engaged in the achievement of the organisation's overall goals.

Many companies remain unaware of the capacity of artificial intelligence to facilitate the effective analysis of their data. However, a report published in 2024 indicates that Siemens has recognised the significant advantages of artificial intelligence and advocates its implementation across all its business operations (siemens, 2024).

Eckard Eberle, the Chief Executive Officer (CEO) of Siemens Global Business Services, states that the integration of AI will facilitate the analysis of large quantities of data, enable the company to make pertinent decisions in a prompt manner, and learn from patterns, thereby significantly transforming the manner in which it handles its operations. Moreover, he emphasises that AI enables the transformation of tools that facilitate companies' ability to undertake tasks that require creativity and innovation in novel ways, such as the automation of intricate design processes (siemens, 2023).

In a statement, the director of the Balanced Scorecard Institute, who has over 30 years of experience, confirmed that the first step for an organisation to achieve the best performance is to review its plan by reviewing its objectives and key performance indicators. In this context, he posits that utilising artificial intelligence algorithms for the collection and analysis of external and internal data will facilitate the achievement of this objective. He highlights Siemens as a notable organisation that has employed artificial intelligence to identify deficiencies in strategic outcomes and opportunities for resource optimisation, and has proffered recommendations for enhancing performance based on this analysis (Sterling, 2023).

The Siemens company convenes events designated as "Scorecard User Clubs" for the purpose of facilitating the exchange of experiences and insights among employees regarding the utilisation of Balanced Scorecards. This initiative is intended to enhance overall performance and implementation. The scope of discussion encompasses a range of pertinent topics, including (Siemens ICM, 2000, p.10):

- -Align budget allocation and the budgeting process with the strategic priorities of the Siemens company.
- Include financial and non-financial metrics and assure that the scorecard is effectively conveyed to all levels of the Siemens company.
- Include supplier performance metrics in the scorecard to evaluate the effectiveness of the procurement strategy and mitigate supply chain risks.

One of the prevailing topics of discussion on this forum is the utilisation of tools for IT implementation, such as dashboards and software platforms that integrate data from diverse sources to facilitate real-time insights. Another common topic is the assessment of the impact of digital initiatives on pivotal business outcomes.

The Siemens Group's strategy is based on customer-centricity, aiming to combine the physical and digital worlds to enhance the sustainability impact of its offerings. It focuses its business on enabling customers to achieve positive sustainability outcomes, with its offerings structured around three customer value propositions:

- Business performance assessment;
- Business strategy development;
- Business strategy operationalization.

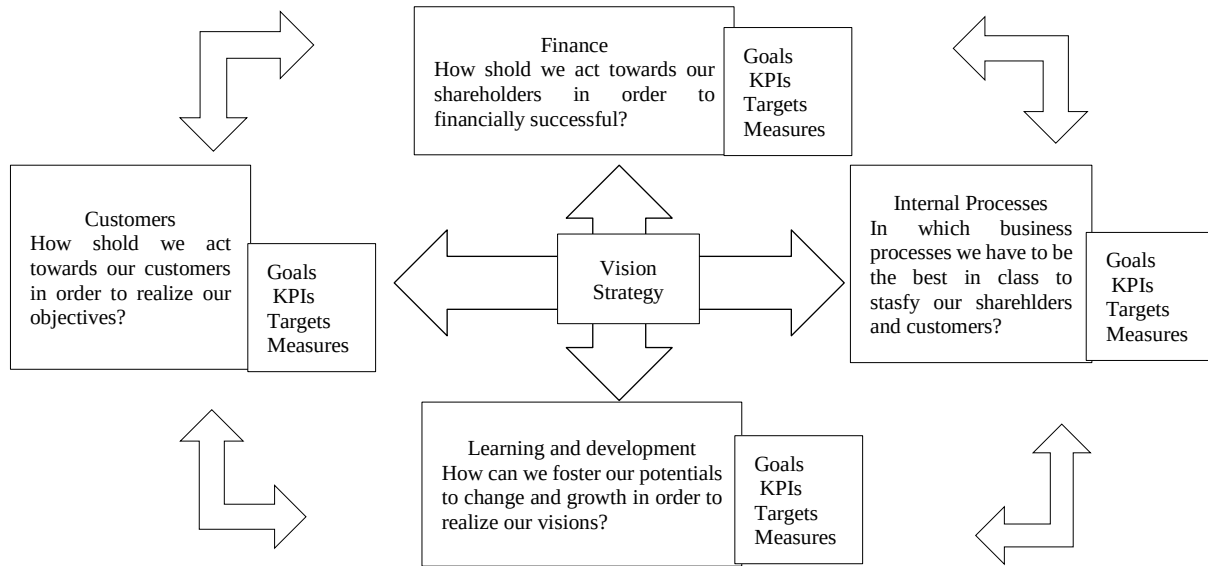


Figure 7. BSC: Key Strategic Areas
Source: elaborated by the author based on [5]

As illustrated in the accompanying figure, Siemens' Balanced Scorecard (BSC) has the same framework, that translates strategic vision into four principal axes: financial, customer, internal operations, and learning and development. With the financial axis, Siemens prioritises actions that guarantee financial success and shareholder value. The customer axis emphasises the importance of understanding and meeting customer needs in order to maintain a competitive advantage. The internal operations axis assesses the efficiency of operations with a view to improving service delivery to both shareholders and customers. The learning and development axis underscores the significance of enhancing employee skills and innovation in order to adapt and grow.

Finance Perspective.

The financial perspective of Siemens' balanced scorecard reflects the extent to which it achieves its financial objectives. The following table shows the key performance indicators that Siemens relies on to measure and evaluate its financial performance, which are: the company's revenues, net income, and dividend per share, as well as their values during the period: 2019-2023.

Table 1. Siemens Key Financial performance indicators: FY 2019 - FY 2023

Revenue and profit	Revenue	Net income	Dividend per share
FY 2023	77.769	8.529	4.7
FY 2022	71.977	4.392	4.25
FY 2021	62.265	6.697	4.00
FY 2020	55.254	4.2	3.50
FY 2019	56.797	5.648	3.90

Source: elaborated by the author based on [25]

Siemens' financial performance from FY19 to FY23 shows a robust upward trend in revenue, increasing from €56,797 million in FY19 to €77,769 million in FY23. Furthermore, there was a notable increase in net income, rising from €5,648 million to €8,529 million over the same period, which is indicative of enhanced profitability. As a result, Siemens increased its dividends per share from €3.90 in FY19 to €4.70 in FY23, thereby strengthening shareholder loyalty. These positive financial outcomes highlight Siemens' strong financial health. This period coincides with Siemens' proactive integration of advanced technology, including artificial intelligence; however, the case data illustrate an association rather than establish a causal link, since financial performance is also shaped by market conditions, pricing, and other strategic decisions taken over the same period.

Customers Perspective.

The customer perspective is a significant factor in corporate strategy and the impact on customers represents a strategic priority. Siemens is striving to rapidly comprehend customer needs and to anticipate them before they become familiar.

NPS is a key indicator that enables Siemens to ascertain customer loyalty and satisfaction by soliciting feedback from customers regarding their propensity to recommend Siemens products or services to others. This information is then utilized to implement corrective measures and address customer concerns, thereby enhancing long-term customer loyalty. This approach guarantees the reliability of products and a comprehensive range of offerings tailored to customer needs (SIEMENS, 2023, p. 12). The NPS indicator serves as a foundation for Siemens to identify areas of excellence and potential improvement.

Learning and Development Perspective.

Innovation contributes to a stronger relationship between Siemens and its customers that makes it work through (R&D) to the search for innovative solutions consistent with sustainable development principles so that it can enhance its competitive position. The following table presents key performance indicators for learning and development for the fiscal years 2022 and 2023, including R&D expenditure, R&D intensity, and the number of patents granted. An explanation of these results will be provided immediately following their presentation.

Table 2. Siemens Key R&D performance indicators: FY 2022-2023

	Unit	Fy 2023	2022
R&D Expenses	billion €	6.20	5.60
R&D Strength	% revenue	8.00	7.80
Patents Granted	No. (rounded)	45000	43600

Source: elaborated by the author based on [25]

The following table illustrates the growth in research and innovation over the specified period. The data indicates an increase in research and development (R&D) expenditures during the 2023 period, with a rise of 2.3% compared to the previous year. This suggests a strengthening of investment in research capabilities. Additionally, R&D intensity improved, rising from 7.8% to 8.0% of revenue, indicating a greater focus on innovation compared to total revenue. Furthermore, the number of patents increased to 45,000 in 2023, up 3.2% compared to 2022. These indicators are consistent with Siemens' strategic focus on artificial intelligence tools, although the case data alone cannot isolate AI's specific contribution to this growth from other concurrent investments in research capacity.

Internal Processes Perspective.

Siemens employs the use of artificial intelligence, digital twins, and data analytics to enhance the efficiency of production processes, reduce the time required for new products to reach the market, and improve the overall quality of operations. Furthermore, these technologies assist in reducing the environmental impact by enabling resource-efficient operations (Siemens AG, 2020). This is achieved by identifying a set of indicators:

- The mean time between failures is: It is recommended that the system's reliability be monitored and improved.
- The average time required for repairs is as follows: The objective is to reduce the time required for repairs.
- The proportion of recyclable components is as follows: It is recommended that the percentage of parts that can be recycled be increased.
- Defect rate: The objective is to reduce the number of defects to a rate of fewer than one per one million units.
- Field failure rates: It is essential to maintain low failure rates in operational environments.
- Number of new products completed per year: It is crucial to track the development and launch of new products on an annual basis.
- Portfolio balance: It is vital to ensure an appropriate mix of projects, including new platforms, new markets, and new products.
- Number of targeted real/working hours: It is essential to set and achieve targets for working hours.

Discussion.

The incorporation of AI into Siemens' Balanced Scorecard (BSC) framework demonstrates how contemporary technology can transform conventional performance management instruments. By leveraging AI, Siemens has made considerable progress in transforming strategic insights into operational actions, thereby enhancing the company's agility and responsiveness to both market demands and internal performance metrics.

One of the most notable advantages of Siemens' AI-driven methodology is the enhanced capacity to process copious amounts of data with remarkable swiftness and precision. This capability is associated with more informed decision-making, particularly with regard to financial performance monitoring, customer relationship management, and internal process efficiency. The AI-powered algorithms provide Siemens with real-time insights that appear to support the company's efforts to anticipate market changes, adjust production cycles, and respond to customer feedback through more tailored solutions.

These observations are broadly consistent with the literature reviewed above. Fabac (2020) and Tawse & Tabesh (2023) argue that the BSC's continued relevance depends on its capacity to evolve alongside digital tools

capable of real-time data integration; the Siemens case illustrates a concrete instance of this evolution rather than a generic claim about AI's benefits. Mahboub & Ghanem (2024) similarly find that AI supports the BSC mainly through knowledge-management mechanisms rather than through a direct, isolated performance effect, a pattern compatible with what is observed at Siemens, where AI-related initiatives appear alongside, rather than as the sole driver of, the reported gains. This represents a partial divergence from the more deterministic claims found in industry-oriented sources (e.g. *balancedscorecard*, 2023; Sterling, 2023), which tend to present AI's contribution to the BSC in more unequivocal terms than the academic literature does.

AI also appears to be a relevant instrument for harmonizing Siemens' sustainability objectives with its overarching strategic goals. For example, Siemens' deployment of digital twins and predictive analytics is associated with more efficient resource allocation and reduced environmental impact, illustrating how AI-related tools can be integrated with sustainability reporting. Financial and R&D indicators improved over the same period during which Siemens describes its AI-related initiatives, and internal-process indicators such as production cycle times and defect rates moved in a favourable direction. Consistent with the Methodology section above, these trends are best read as observations that coincide with AI adoption rather than as demonstrated effects of AI, since the case design does not isolate AI from other concurrent strategic and market factors.

However, the implementation of AI in Siemens' strategic framework has not been without challenges. Ensuring that all employees and departments can effectively utilize AI tools requires substantial investment in training and development. Additionally, the complexity of integrating AI systems into existing operations can create short-term disruptions as teams adapt to new processes and technologies. Nonetheless, Siemens' commitment to continuous learning and innovation has mitigated many of these challenges, allowing it to maintain its competitive edge.

In general, the Siemens case illustrates how the integration of AI-related tools into strategic management frameworks such as the BSC can plausibly support business performance; further research using designs able to isolate AI's specific contribution would be needed to establish this as a general causal claim rather than a descriptive pattern observed in a single case.

Conclusions and prospects for further research

This case study has described how Siemens has incorporated AI-driven tools into its Balanced Scorecard alongside a period of improved financial outcomes, customer satisfaction indicators, internal-process metrics, and R&D activity. Taken together, the Siemens case offers a descriptive model of how AI-related initiatives can be woven into an established strategic management framework, illustrating a pattern that other enterprises seeking to align strategy and execution may find instructive, while recognising that this study cannot establish that AI was the direct cause of the reported gains. The principal contribution of this study lies in documenting, in an integrated way, how AI-related tools were positioned across all four BSC perspectives at Siemens — a level of cross-perspective detail that is not yet common in the existing literature on AI and the Balanced Scorecard.

By employing AI to transform data into actionable insights, Siemens has aligned its strategic objectives with day-to-day operations, thereby enhancing the company's agility and responsiveness to the dynamic demands of the market. This approach has enabled Siemens to assume a leading position in areas such as sustainability, operational efficiency, and technological innovation, thereby ensuring its long-term success in an increasingly competitive global landscape.

In conclusion, Siemens' experience illustrates the potential of AI to be integrated into traditional business tools and frameworks such as the BSC. While challenges related to AI integration persist, Siemens' approach to addressing them offers a useful reference point for organizations considering similar initiatives. As noted in the Methodology, these conclusions are drawn from a single, publicly-reported corporate case and should be interpreted as an in-depth illustration rather than as generalizable proof of AI's performance effects; future research combining multiple cases, independent data sources, or quasi-experimental designs would be needed to test the causal claims that this case study can only suggest.

Abstract

The Fourth Industrial Revolution fundamentally reshaped industries via artificial intelligence (AI), enabling task automation, data processing, and predictive insights. Since the early 1990s, the Balanced Scorecard (BSC) has anchored strategic management, translating vision into actionable objectives across financial, customer, internal process, and learning perspectives. Yet, modern market complexities demanded more agile, data-driven tools. This highlighted the need to explore how AI could enhance strategic frameworks to bridge the gap between high-level strategy and daily execution.

This study examined the integration of AI into performance management systems, using Siemens AG as a qualitative case study. The primary objective was to investigate how Siemens leveraged AI within its Balanced Scorecard framework to transform conventional indicators into dynamic, real-time insights. It sought to answer how Siemens enhanced strategic management and operational alignment through AI, and what measurable improvements were achieved across financial performance, customer satisfaction, internal operations, research capabilities, and employee development. A qualitative case study methodology was adopted for an in-depth analysis of Siemens' strategic practices. Data were collected from Siemens' official annual and financial reports covering FY2019–2023, corporate sustainability statements, executive insights, and academic literature on AI and

the BSC. The analytical approach combined thematic content analysis with systematic evaluation of quantitative key performance indicators across the four BSC perspectives, with cross-referencing ensuring the validity and robustness of findings.

The findings demonstrated substantial improvements across all performance dimensions. Revenue rose from €56.8 billion in FY2019 to €77.8 billion in FY2023, net income reached €8.5 billion, and dividends per share increased to €4.70, reflecting enhanced profitability. Customer analytics optimized the Net Promoter Score through proactive identification and resolution of client concerns, strengthening customer loyalty. Digital twins, robotic process automation, and predictive analytics streamlined internal operations, markedly reduced defect rates, shortened production cycles, and improved time-to-market for new products. R&D intensity reached 8.0% of revenue, with 45000 patents granted in FY2023, signaling substantial innovation growth. Furthermore, AI aligned sustainability objectives with strategic goals by optimizing resource allocation and minimizing environmental impact.

The study concluded that AI's integration into the BSC framework is consistent with the role of a strategic catalyst, coinciding with the translation of intentions into operational actions and with more real-time, data-driven decision-making. This synergy enhanced business intelligence, organizational agility, and sustainable growth. Despite challenges such as workforce upskilling and system integration complexity, Siemens' proactive approach provided a compelling and replicable model for modern enterprises seeking comprehensive AI-driven business transformation.

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