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Evaluating Business Efficiency: The Role of Digital Transformation in Modern Enterprises

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Abstract: Digital transformation, renowned for its capacity to stimulate economic expansion and enhance business landscapes, requires a supportive ecosystem comprising universal digital infrastructure, skilled workforce, appropriate legal frameworks, adequate investment, effective governance, educational initiatives, robust security measures, and other conducive environments. This transformation presents governments with strategic opportunities to shape various economic sectors, encompassing finance, retail, healthcare, agriculture, manufacturing, education, tourism, media, and culture. Existing literature extensively investigates digital transformation in academic and practical spheres, yet a consensus on its fundamental principles remains elusive. This study contributes by summarizing the effects of digital technologies on business and management, stressing the need to broaden existing business domains and explore novel areas. Advocating for pro-social objectives, sustainable business models, and widespread adoption of artificial intelligence (AI) are suggested strategies for navigating digital transformation. Furthermore, the research scrutinizes the concept of digital disruption, focusing on how emerging digital technologies and innovative business models reshape established value propositions. Business process management (BPM) is examined for its role in facilitating these changes, despite historical challenges in terminology and methodological coherence. The study underscores the importance of a structured approach to change management, advocating for flexibility and real-time decision-making to address complex business activities. Additionally, the research evaluates the performance of multiple companies using key performance indicators such as customer satisfaction, operational efficiency, employee productivity, and IT infrastructure cost reduction. Employing the Weighted Sum Method (WSM) to rank these companies, the study offers insights into their relative performance. These findings aim to guide stakeholders in strategic decision-making by providing a holistic assessment of company performance across various dimensions, identifying areas for potential enhancement, and deepening understanding of digital transformation's ramifications.

Keywords: Digital Transformation, Business Process Management, Digital Disruption, AI Adoption, Sustainable Business Models and Performance Evaluation

1. Introduction

Though digital transformation holds the potential to bring about substantial economic benefits and foster a more favorable business climate, it necessitates the backing of essential components such as universal digital infrastructure, proficient human resources, appropriate legal and regulatory frameworks, sufficient investment, effective governance, educational initiatives, robust security measures, and other supportive environments to thrive. The rapid pace of digital transformation presents a strategic opportunity for the government to influence numerous economic sectors and industries, spanning from financial services, retail, healthcare, agriculture, and manufacturing to education, tourism, media, culture, and beyond [1]. Digital transformation has become a focal point of research in both academic circles and practical applications. While current literature reflects heightened research attention in this domain and examines how business leaders navigate digital transformation endeavors, there's clear indication of a shared challenge: a dearth of consensus on the concept. Both scholarly inquiry and practical implementation lack unified perspectives on the core tenets of digital transformation [2, 3]. The focus lies in cultivating novel business domains, achieved not only by expanding upon existing core business sectors but also by venturing into entirely new realms outside of today's primary business areas [4].

In the case of business models such as Go Get, it's recommended that companies prioritize pro-social goals over purely business-oriented objectives, establish a sustainable long-term business model, and harmonize both business and social principles in instances where business expansion compromises the original pro-social identity (Tan, Tan, &, 2017). Regarding artificial intelligence (AI), (2018) suggests that companies should aim for widespread AI adoption as soon as feasible, concentrate on implementing AI applications that foster product and service innovation to harness the technology's potential for revenue growth, and finalize digitization initiatives as the foundation for AI implementations [5, 6]. This research is a component of a broader project that examines the effects of significant disruptive technologies on marketing organizations within the marketing industry itself, as well as within organizations operating across various other industries. Digital transformation strategies vary in perspective and objectives. From a business-centric viewpoint, these strategies emphasize transforming products, processes, and organizational elements through the adoption of new technologies [7]. The evaluation of how digital transformation strategies intersect with business growth and business models also requires examination from a managerial standpoint [8]. Digital transformation involves swiftly integrating technology innovations into business operations to enhance enterprise performance, processes, practices, and models in response to the increasing influence and opportunities presented by data and computing technologies [9, 10]. Peter Drucker famously asserted that the sole legitimate purpose of a business is to generate a customer, highlighting that the fundamental functions of a business enterprise revolve around marketing and innovation [11]. Transformational processes within the economy, exemplified by events like “the COVID-19 pandemic”, intensify preexisting challenges in the economic advancement of nations and further deteriorate indicators of macroeconomic stability. Against the backdrop of COVID-19, there is a pressing need in most countries to restructure business models by embracing online economic transactions. Concurrently, the implementation of these measures [12].

Besides having adequate IT support, there's a need for a certain level of knowledge and skills in navigating the digital environment, among both consumers and businesses. Digitalization has far-reaching effects, influencing everything from individual lifestyles and small-scale entrepreneurial activities to the operations of large enterprises and government regulations. Presently, EU countries have formulated and implemented numerous legislative measures governing the digitization processes within their economies, addressing both individual entities and national levels [13]. However, despite these advancements, many micro, small, and medium-sized enterprises (MSMEs) in developing nations remain ill-equipped to capitalize on the opportunities presented by the digital economy. Small businesses, in particular, utilize online platforms for sales far less frequently compared to larger corporations. Additionally, the utilization of 3D printers in Africa and Latin America collectively accounts for just 4% of the global total [14, 15]. The concept of digital transformation continues to be highly pertinent for both scholars and professionals. Digital transformation encompasses the alterations in a company's business model induced by digital technologies, leading to modifications in products, organizational structures, or the automation of processes [16]. Moreover, there exists ambiguity regarding the effects of digital transformation on the business models of established firms [17]. Business process modeling is a heavily studied area, yet it lacks clear organization and classification. There is significant confusion surrounding terminology within this field. For instance, Object Orientation (OO) is interpreted and defined differently by various sources. Some view OO as a comprehensive methodology for process modeling, while others perceive it as a philosophy illustrating real-world behavior or simply as a basic technique. Similar ambiguity exists regarding other methodologies such as SSADM, Workflow, and GRAI. Despite its approximately three-decade history, the discipline of BPM still struggles to define fundamental terminologies such as business process, BPM versus workflow management (WfM), workflow, and business process reengineering (BPR). This chapter seeks to fill this void by elucidating these concepts. Let's commence by exploring the basic concepts and terminologies of BPM [18]. Business process management (BPM) is a management discipline centered around processes and their optimization. Contrary to common misconception, BPM is not a technology itself. Workflow, on the other hand, refers to a technology for managing flows, typically found within Business Process Management Suites (BPMSs) and other related product categories [19]. Despite its approximately three-decade history, the discipline of BPM still struggles to define fundamental terminologies such as business process, BPM versus workflow management (WfM), workflow, and business process reengineering (BPR). This chapter seeks to fill this void by elucidating these concepts. Let's commence by exploring the basic concepts and terminologies of BPM [20]. As outlined in this book, various factors contribute to change. These may include alterations in business regulations, audit standards, or advancements in our comprehension of resource mobilization and activation. The inadequacy, disparity, and disjointedness of current process management methods and technological systems only serve to accentuate the differences Numerous organizations are initiating business process reengineering (BPR) endeavors in response to heightened market competition and volatile business conditions. BPR is characterized as "the fundamental reevaluation and radical redesign of business processes to achieve significant enhancements in essential contemporary performance metrics, such as cost, quality, service, and speed" (Hammer and company, 1993) [21]. While Business Process Management (BPM) may seem like a novel initiative, it does not imply that business processes have not been managed previously. Indeed, many organizations have been modeling and managing their business processes for years, employing a varied array of tools and methods. However, these techniques have often met with partial success or outright failure due to the absence of standards and a comprehensive lifecycle to oversee and guide the design and execution of business processes. Effective management of change necessitates a structured approach, with management exerting control over the discovery, architecture, design, and deployment of processes. To facilitate this understanding, standards for business modeling and business execution language are essential [22].

Given the unpredictable nature of business activities, business process management should offer flexibility to adapt to change. Traditional workflow methods, rooted in predetermined process logic, offer limited support for today's intricate and dynamic business landscape [23]. Therefore, a cognitive approach is recommended for managing complex business activities, emphasizing continuous situational awareness and real-time decision-making. This approach perceives the business environment as tracking events and the status of tasks and resources, integrating business logic related to process routing and operational constraints, and including mechanisms for handling exceptions. Business strategy is employed to identify suitable actions for the current situation. By expanding process management to encompass business logic, this methodology provides flexibility, agility, and adaptability in managing complex business processes [24]. Industrial and service enterprises face mounting pressures to reduce customer service times, accelerate product development, and meet demand promptly. The ability of a business manager to minimize risks while maximizing profits hinges on their capacity to swiftly assess alternative courses of action. Whether these alternatives involve automating or outsourcing processes, expanding or downsizing the workforce, businesses must evaluate the impact of change swiftly and accurately. Understanding and estimating the time and cost required to complete product development processes presents a significant challenge for businesses [25]. This introductory tutorial offers an overview of business process simulation and its functioning. It presents descriptions of modeling elements and performance measures of models. The classification of business processes precedes discussions on unique modeling, simulation procedures, and analysis considerations. Additionally, various types of business process simulation tools are discussed [26]. Company managers depend on a blend of judgment and information from various departments, such as marketing, sales, research, development, manufacturing, and finance, to make informed decisions. Ideally, all relevant information should be consolidated before making judgments. However, gathering pertinent, consistent, and up-to-date information across a large company is a complex and time-consuming task. To tackle this challenge, organizations have developed Information Technology (IT) systems to assist in managing their business processes [27]. Business process and enterprise activity modeling are crucial for representing enterprises within the framework of Computer-Integrated Manufacturing (CIM) and integration. Business processes define enterprise behavior, while activities describe functionality [28]. The more extensive business process changes were innovative and radical, transcending business and functional unit boundaries, leading to a more significant business impact. The practical implication of the study is that before initiating any form of Business Process Reengineering (BPR), managers should conduct a business audit of their IT infrastructure capabilities, as these capabilities significantly influence the speed and nature of business process changes [29, 30]

2. Methodology

The Weighted Sum Method (WSM) is a fundamental approach commonly used in open challenges. It calculates the total cost of all potential options. However, when applied to decision-making scenarios, this method encounters limitations. The assumption of additive utility is violated when combining different components, leading to discrepancies across various systems [31]. In scenarios with numerous feasible alternatives and inferred option combinations, resolving such issues can be achieved by first computing the set of non-dominated points. Subsequently, an aggregation model is established in advance, preference information is solicited, and an optimal solution is determined based on this model [32]. To evaluate and select a procedure, “the enhanced Weighted Sum Model (WSM)” incorporates objective measures, subjective measures, critical values, and criteria weighting. Essentially, all factors deemed crucial by decision-makers for the operation's success are encompassed within the objective and subjective criteria [33]. “The Gray Weighted Sum Model (GWSM)” extends the WSM by incorporating Gray numbers to simulate uncertainty. These interim data types enable the model to handle uncertainties effectively [34]. Within the confines of the Weighted Sum Grey Gas Model (WSGGM), any non-grey emission issue can be addressed by employing a chosen solution approach after substituting the medium with a minimal number of Gray media possessing constant absorption coefficients [35]. The Weighted Sum of Grey Gases Model (WSGG) elucidates windows in the spectrum. However, the accuracy of this model depends on the fitting technique used. While it reliably predicts emission from homogeneous materials, it cannot quantify absorption in a generic manner, as it relies on the spectral structure of the incident light. Additionally, the spectrum dependency of wall radiative characteristics, crucial in glass furnaces, remains unaccounted for in such models [36, 37]. A conventional method for formulating a standard optimal control problem through a series of co-optimisation problems is the Weighted Sum-based Method. Each objective requiring optimization is assigned scalar weights, which are then combined into a single variable that can be addressed using any standard optimal solution [38].

3. Analysis and Discussion

TABLE 1. Data set

Company Name	Customer Satisfaction Score (out of 10)	Operational Efficiency Index (0-100)	Employee Productivity Improvement (%)	IT Infrastructure Cost Reduction (in thousands USD)
Tech Innovate	9	85	15	500
Digital Solutions	7	80	12	450
E-Commerce Co	9	88	18	600
Data Analytics Inc	8	82	14	480
Cloud Services Ltd	8.5	87	16	550

The table 1 presents key performance metrics for several companies, including their Customer Satisfaction Score (out of 10), Operational Efficiency Index (ranging from 0 to 100), Employee Productivity Improvement percentage, and IT Infrastructure Cost Reduction in thousands of USD. E-Commerce Co emerges with notably high scores across the board, boasting a Customer Satisfaction Score of 9, an Operational Efficiency Index of 88, an Employee Productivity Improvement of 18%, and significant IT Infrastructure Cost Reduction of 600 thousand USD. Close behind is Cloud Services Ltd, demonstrating strong performance with a Customer Satisfaction Score of 8.5, an Operational Efficiency Index of 87, and an Employee Productivity Improvement of 16%, alongside a substantial IT Infrastructure Cost Reduction of 550 thousand USD. Tech Innovate, Digital Solutions, and Data Analytics Inc also exhibit competitive metrics, reflecting their efforts towards maintaining customer satisfaction, operational efficiency, productivity enhancements, and cost-effectiveness within their respective operational frameworks.

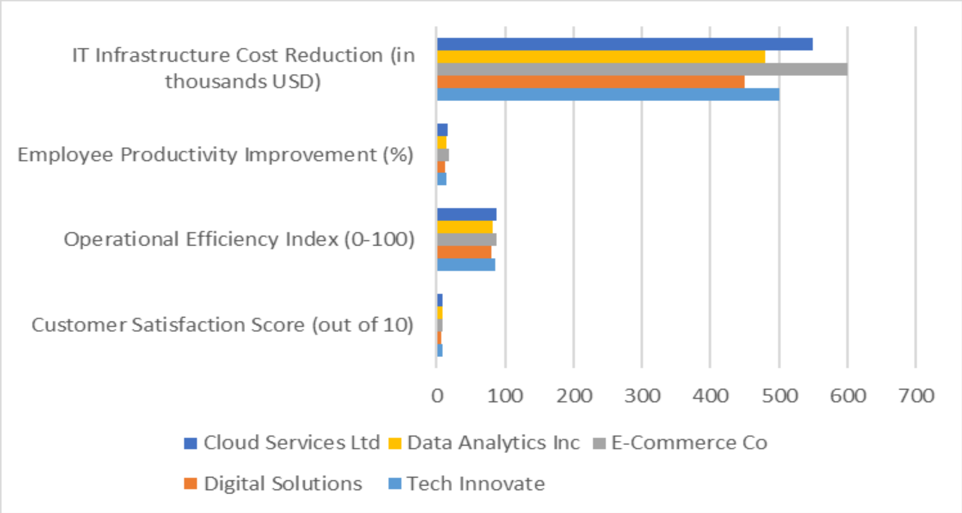

FIGURE 1. Data set

Figure 1 illustrates the performance metrics of several tech companies. Tech Innovate achieved a customer satisfaction rating of 9 out of 10, alongside an operational efficiency index of 85. Additionally, they recorded a remarkable 15% increase in employee productivity, resulting in a substantial $500,000 reduction in IT infrastructure costs. Digital Solutions secured a customer satisfaction score of 7 out of 10 and an operational efficiency index of 80. Their efforts led to a 12% enhancement in employee productivity, resulting in a cost reduction of $450,000 in IT infrastructure. E-Commerce Co attained a notable customer satisfaction rating of 9 out of 10, with an operational efficiency index of 88. They also experienced an impressive 18% improvement in employee productivity, leading to a significant $600,000 reduction in IT infrastructure costs. Data Analytics earned an 8 out of 10 in customer satisfaction, alongside an operational efficiency index of 82. They demonstrated a 14% increase in employee productivity, resulting in a $480,000 reduction in IT infrastructure costs. Lastly, Cloud Services Ltd achieved a customer satisfaction score of 8.5 out of 10, with an operational efficiency index of 87. Their efforts led to a 16% rise in employee productivity, resulting in a notable $550,000 reduction in IT infrastructure costs.

TABLE 2. Normalized data

0.88889	0.96591	0.8	0.9
0.77778	0.90909	1	1
1	1	0.66667	0.75
0.88889	0.93182	0.85714	0.9375
0.94444	0.98864	0.75	0.818181 8

Table 2 displays the normalized metrics for various companies' key performance indicators (KPIs) utilizing the weighted sum technique. Each company's performance across diverse metrics is depicted by a normalized score ranging from 0 to 1. Higher scores in the normalized values signify superior performance compared to other companies in the dataset. For instance, E-Commerce Co achieved a flawless score of 1 for both customer satisfaction and operational efficiency, indicating top-tier performance in these aspects relative to other companies. Conversely, Digital Solutions obtained relatively lower ratings in customer satisfaction compared to the other companies, registering a score of 0.77778. The normalized values enable a fair comparison of company performance across different metrics. For instance, although Tech Innovate and Cloud Services Ltd received comparable scores for customer satisfaction and operational efficiency, Tech Innovate Surpassed Cloud Services Ltd in terms of employee productivity improvement and IT infrastructure cost reduction.

TABLE 3. weight

0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

Table 3 demonstrates the equitable allocation of weights to each key performance indicator (KPI) across various companies. Each company's performance across diverse metrics receives equal weighting, with a quarter of the total weight assigned to customer satisfaction score, operational efficiency index, employee productivity improvement percentage, and IT infrastructure cost reduction. This uniform allocation of weights suggests that all KPIs are regarded as equally significant in assessing company performance. Regardless of the industry or context, each facet—customer satisfaction, operational efficiency, employee productivity, and cost reduction—is considered to contribute equally to the overall performance evaluation. Through the equal distribution of weights to every KPI, Table 3 establishes a fair assessment framework that prevents any single metric from unduly influencing the overall evaluation. This method fosters impartiality and objectivity in performance appraisal, enabling a comprehensive analysis that encompasses multiple dimensions of company performance concurrently. Furthermore, the standardized distribution of weights simplifies the evaluation process by obviating the necessity to assign varying levels of importance to different metrics. This uniform approach streamlines decision-making and facilitates inter-company comparisons, as all evaluations are based on the same criteria with equal weighting.

TABLE 4. weight-normalized decision matrix

0.22222	0.24148	0.20000	0.22500
0.19444	0.22727	0.25000	0.25000
0.25000	0.25000	0.16667	0.18750
0.22222	0.23295	0.21429	0.23438
0.22222	0.24148	0.20000	0.22500

Table 4 showcases the weight-normalized decision matrix generated using the weighted sum method across a range of companies. Each company's performance across various metrics is illustrated through a normalized score, computed according to the weights allocated in Table 3. These normalized scores signify the relative significance of each metric for each company, enabling a thorough evaluation of performance while acknowledging the differing weights assigned to distinct KPIs. For example, E-Commerce Co garnered the highest normalized score for operational efficiency, indicating its robust performance in this aspect relative to its counterparts. Conversely, Digital Solutions attained the highest normalized scores for employee productivity improvement and IT infrastructure cost reduction, implying commendable accomplishments in these domains. In essence, the weight-normalized decision matrix furnishes valuable insights into each company's performance vis-à-vis the assigned weights for key performance indicators. This aids stakeholders in pinpointing areas of strength and areas requiring improvement, thereby facilitating well-informed decision-making and strategic planning grounded in a comprehensive assessment of performance across multiple dimensions.

TABLE 5. Preference Score

Company Name	Preference Score
Tech Innovate	0.88870
Digital Solutions	0.92172
E-Commerce Co	0.85417
Data Analytics	0.90384
Cloud Services Ltd	0.87532

Table 5 presents the preference scores obtained through the Weighted Sum methodology for a variety of companies. These scores reflect each company's overall ranking or preference based on their performance across key performance indicators (KPIs) and the corresponding weights assigned to them. Digital Solutions emerges as the top-ranking company with a preference score of 0.92172, indicating its status as the most favoured among those assessed. This high score underscores Digital Solutions' robust performance across the designated metrics, positioning it favourably compared to its counterparts. Data Analytics follows closely behind, achieving a preference score of 0.90384, signifying a strong performance that positions it as a noteworthy competitor in the evaluation. Similarly, Tech Innovate garners a respectable preference score of 0.88870, reinforcing its competitive position among the companies examined. E-Commerce Co and Cloud Services Ltd secure preference scores of 0.85417 and 0.87532, respectively. While these scores reflect commendable performances, they also suggest potential areas for improvement compared to companies with higher preference scores.

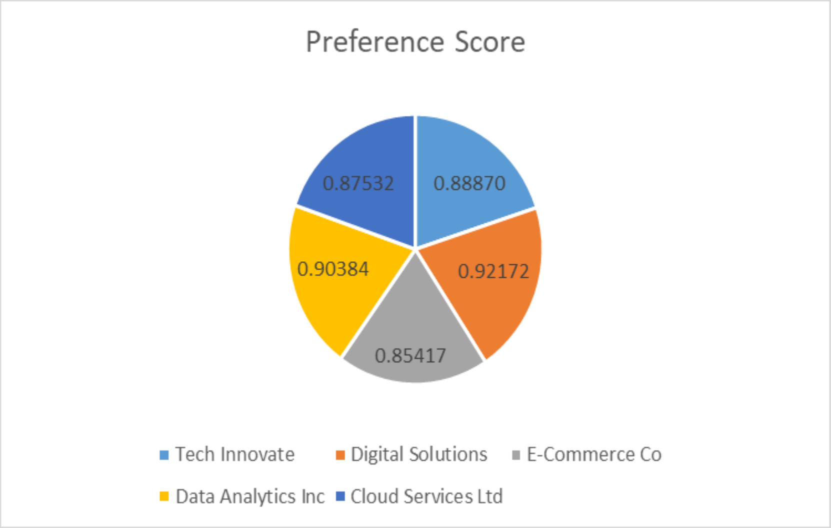

FIGURE 2. Preference Scores

Figure 2 illustrates the preference scores derived using the Weighted Sum methodology for various companies. These scores depict the overall ranking or preference of each company based on their performance across key performance indicators (KPIs) and the corresponding weights allocated to them. Digital Solutions emerges as the leading company with a preference score of 0.92172, indicating its status as the most preferred among those evaluated. This high score highlights Digital Solutions' strong performance across the specified metrics, positioning it favourably compared to its counterparts. Following closely behind is Data Analytics, attaining a preference score of 0.90384, which signifies a robust performance, positioning it as a notable competitor in the assessment. Similarly, Tech Innovate achieves a respectable preference score of 0.88870, reinforcing its competitive standing among the examined companies. E-Commerce Co and Cloud Services Ltd secure preference scores of 0.85417 and 0.87532, respectively. While these scores denote commendable performances, they also suggest potential areas for enhancement compared to companies with higher preference scores. In conclusion, the preference scores offer valuable insights into the relative rankings of the companies based on their performance across essential metrics. This information can assist stakeholders in making informed decisions regarding collaborations, investments, or strategic initiatives.

TABLE 6. Rank

Company Name	**Rank**
Tech Innovate	**3**
Digital Solutions	**1**
E-Commerce Co	**5**
Data Analytics	**2**
Cloud Services Ltd	**4**

Table 6 displays the rankings assigned to different companies computed through the Weighted Sum Method. These rankings reflect the relative standings of each company based on their overall performance across key performance indicators (KPIs) and the respective weights attributed to them. Digital Solutions secures the highest rank of 1, indicating its leading position among the assessed companies. This ranking underscores Digital Solutions' exceptional performance across the specified metrics, positioning it as the most favoured choice. Following closely behind, Data Analytics achieves a rank of 2, highlighting its strong performance and positioning it as the second-best option among the evaluated companies. Tech Innovate secures the third rank, demonstrating its competitive position despite being outranked by Digital Solutions and Data Analytics. Cloud Services Ltd attains the fourth rank, indicating its performance is below that of the top three companies but still places it ahead of E-Commerce Co. E-Commerce Co, ranking 5th, obtains the lowest position among the evaluated companies, indicating areas for improvement compared to its counterparts. In summary, the rankings derived from the Weighted Sum Method offer a clear hierarchy of company performance based on their overall scores across crucial metrics. This information assists stakeholders in comprehending each company's relative standing and can aid decision-making processes such as collaborations, investments, or strategic initiatives by identifying the most favourable options.

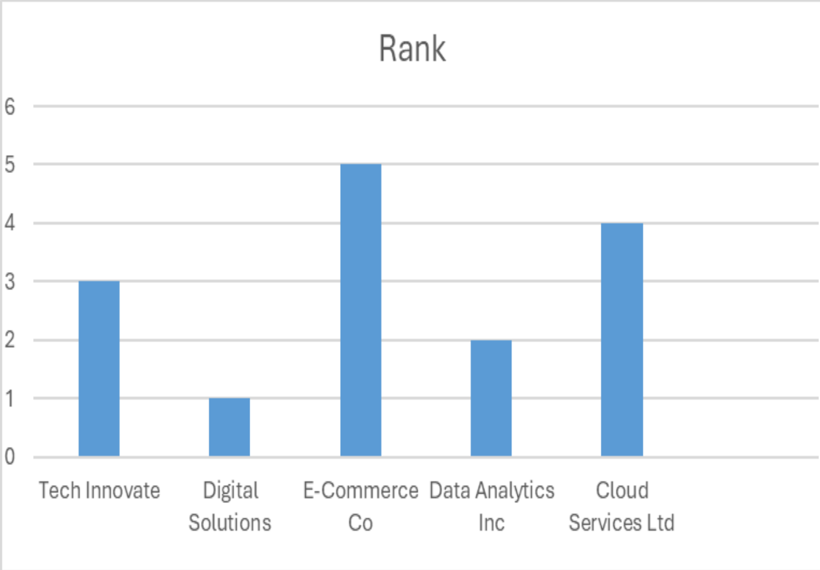

FIGURE 3. Rank

Figure 3 exhibits the rankings allocated to various companies calculated using the Weighted Sum Method. These rankings depict the relative positions of each company based on their comprehensive performance across key performance indicators (KPIs) and the corresponding weights assigned to them. Digital Solutions secures the top rank of 1, signifying its prominent position among the evaluated companies. This ranking underscores Digital Solutions' outstanding performance across the designated metrics, positioning it as the most preferred choice. Following closely behind, Data Analytics achieves a rank of 2, emphasizing its robust performance and positioning it as the second-best option among the assessed companies. Tech Innovate secures the third rank, showcasing its competitive standing despite being surpassed by Digital Solutions and Data Analytics. Cloud Services Ltd obtains the fourth rank, indicating its performance falls below that of the top three companies but still places it ahead of E-Commerce Co. E-Commerce Co, ranking 5th, acquires the lowest position among the evaluated companies, indicating areas for improvement compared to its counterparts. These rankings offer a clear hierarchy of company performance, aiding stakeholders in decision-making processes such as collaborations or investments. Digital Solutions emerges as the preferred choice, while E-Commerce Co shows areas for improvement. Overall, the rankings provide valuable insights into each company's standing relative to others, facilitating informed decision-making and strategic planning.

4. Conclusion

Digital transformation, with its considerable economic potential, requires robust digital infrastructure, skilled workforce, legal frameworks, investments, governance, education, and security measures. The rapid pace of digital transformation presents governments with a strategic opportunity to influence various “economic sectors, including financial services, retail, healthcare, agriculture, and more”. Despite its promising outlook, research on digital transformation lacks consensus on its fundamental principles, posing challenges for scholars and practitioners alike. This study aims to summarize “the impact of digital technologies on business and management” and explore strategies for coping with it. It emphasizes the importance of balancing prosocial goals and business objectives, particularly in the adoption of AI, to foster innovation and revenue growth. While the concept of digital disruption is often overused, it remains crucial for “understanding the impact of emerging technologies on traditional business models". This research, as part of a broader project, examines the effects of disruptive technologies on marketing organizations and their strategies. Digital transformation entails integrating technological innovations into business operations to improve performance and adapt to the growing influence of data and computing technologies. Evaluating digital transformation's intersection with business growth necessitates a managerial perspective, focusing on business activities, processes, customer approaches, and business models. The Weighted Sum Method (WSM) employed in this study offers a structured approach to decision-making by assigning weights to key performance indicators (KPIs) and assessing companies' performance. Analyzing companies such as Digital Solutions, Tech Innovate, E-Commerce Co, Data Analytics, and Cloud Services Ltd provides insights into their customer satisfaction, operational efficiency, employee productivity, and cost reduction efforts. Digital Solutions emerges as the top-ranking company, followed by Data Analytics and Tech Innovate. The preference scores derived from the WSM provide a clear hierarchy of company performance, aiding stakeholders in making informed decisions regarding collaborations, investments, and strategic initiatives. Digital transformation plays a pivotal role in economic and business development. By leveraging technologies and adopting strategic approaches, companies can enhance their performance and competitive standing. The WSM serves as a valuable tool for evaluating and ranking companies, facilitating informed decision-making and strategic planning.

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