sustainability

MDPI

Article

Data-Driven Decision Making for Sustainable IT Project Management Excellence

Vladan Pantović [1,*], Dejan Vidojević [2], Slađana Vujičić [3], Svetozar Sofijanić [4] and Marina Jovanović-Milenković [5]

[1] Faculty of Information Technology and Engineering, University Union-Nikola Tesla, 11070 Belgrade, Serbia
[2] Department for Informatics and Computing, University of Criminal Investigation and Police Studies, 11080 Belgrade, Serbia; dejan.vidojevic@me.com
[3] Faculty of Business Economics and Entrepreneurship, 11108 Belgrade, Serbia; sladjanakonto@gmail.com
[4] Department Belgrade Polytechnic, Academy of Applied Technical Studies, 11050 Belgrade, Serbia; ssofijanic@atssb.edu.rs
[5] Department for Informatics, Project Management College, Educons University, 11040 Belgrade, Serbia; marina.jovanovic.milenkovic@pmc.edu.rs
* Correspondence: vladan@pantovic.rs; Tel.: +381-63-304449

Abstract: In today's rapidly evolving technological landscape, effective management of information technology (IT) projects is paramount for organizational success. However, ensuring sustainability in IT project management remains a persistent challenge. This paper proposes a novel approach centered on data-driven strategies to enhance sustainability and excellence in IT project management. By harnessing the power of data analytics, organizations can derive actionable insights to optimize resource allocation, mitigate risks, and streamline project workflows. The integration of data-driven decision making processes enables project managers to make informed choices, fostering adaptability and resilience in the face of dynamic project environments. This research explores the utilization of IT software project performance metrics and historical project data to fuel analysis of how strategies drive business sustainability. Moreover, this paper examined these dimensions with the help of advanced analytics techniques such as multiple linear regression. By aligning IT project management practices with business sustainability objectives, organizations can enhance project success rates, while minimizing adverse environmental impacts and resource consumption. Prospectively, this kind of research should expand to determining factors for the adoption of data-driven strategies to empower organizations to achieve sustainable IT project management excellence, ensuring long-term competitiveness and value creation in a digitalized world.

Keywords: data-driven; project; excellence; sustainability

check for updates

Citation: Pantović, V.; Vidojević, D.; Vujičić, S.; Sofijanić, S.; Jovanović-Milenković, M. Data-Driven Decision Making for Sustainable IT Project Management Excellence. *Sustainability* **2024**, *16*, 3014. https://doi.org/10.3390/su16073014

Academic Editor: Fabrizio D'Ascenzo

Received: 18 February 2024
Revised: 1 April 2024
Accepted: 2 April 2024
Published: 4 April 2024

1. Introduction

In contemporary project management, the adoption of data-driven decision making processes stands as a cornerstone for success. By harnessing empirical evidence and sophisticated data analysis techniques, organizations can make informed decisions that steer projects towards optimal outcomes. This paper explores the intersection of data-driven decision making and IT sustainability integration within project management practices, aiming to elucidate their collective impact on enhancing project management excellence.

At the core of data-driven decision making lies the strategic utilization of vast datasets and advanced analytical techniques. Through the collection, processing, and analysis of data, organizations gain actionable insights that inform every aspect of project management, from planning to execution and evaluation. This approach not only facilitates optimized resource allocation and risk mitigation but also aligns project objectives with broader sustainability goals.

Moreover, the integration of predictive analytics and performance analytics further fortifies the decision making process. Predictive analytics enables proactive risk management by leveraging historical data and predictive modeling to anticipate challenges before they materialize. Conversely, performance analytics offers a continuous improvement framework by tracking key performance indicators and identifying areas for refinement.

In parallel, the convergence of IT sustainability with project management excellence opens new avenues for value creation. By aligning IT initiatives with sustainability objectives and leveraging technological innovations, organizations can drive business sustainability while delivering successful projects. Stakeholder engagement, agile methodologies, and adaptive governance structures further enhance organizational resilience and responsiveness to dynamic sustainability demands.

Throughout this paper, we delve into key dimensions of IT project management excellence, emphasizing the quantifiable metrics that underpin success. By evaluating these dimensions, organizations can pinpoint areas for improvement, fostering continuous growth and optimization of project performance.

This research examines case studies theoretically and presents the results of empirical research to illustrate practical applications of a data-driven approach to decision making in enhancing sustainability outcomes within IT project management. By elucidating the synergies between data-driven approaches and sustainability principles, this research contributes to advancing knowledge and practice in sustainable IT project management, offering valuable insights for practitioners, scholars, and policymakers alike.

The authors identify key data-driven approaches to decision making and validate those approaches within a sample of SMEs, as has been previously analyzed in similar papers [1,2]. Based on the arguments and analysis made in a research study by Arsic [3], the authors of this research analyze key success (excellence) factors of IT software projects within the Serbian economic environment [4]. Therefore, this research presents a form of continuing efforts on this topic.

In subsequent sections, this paper delves into the existing literature on data-driven strategies for optimizing the outputs of IT software projects, presenting key theoretical findings essential for data-driven decision making in companies. The methodological framework for conducting quantitative research on a sample of Serbian companies is outlined in Section 3, accompanied by a breakdown of the research instruments used. Section 4 then presents the outputs of the quantitative research, including profiling of SMEs. Section 5 discusses the main findings, comparing them with similar research, and engages in a broader discussion with relevant authors. The paper concludes in Section 6 with future research and possible research implications.

2. Materials and Methods

Drawing upon a multidisciplinary approach, this research synthesizes insights from fields such as project management, sustainability science, and data analytics. Key concepts and frameworks from the literature on topics such as sustainable project management [5], data-driven decision making [6], and IT project success factors [7] provide a foundation for understanding the complexities and dynamics inherent to technical-related projects.

Below is presented Figure 1, displaying the research methodology framework to be used within the theoretical part of this research.

Figure 1. Research methodology framework (Source: Authors).

The literature review that follows in the remainder of the chapter will focus two key topics: (1) data-driven decision making processes and (2) key dimensions of IT project management excellence.

2.1. Data-Driven Decision Making Processes

Data-driven decision making processes have emerged as essential tools in contemporary project management practices, facilitating strategic decision makers to define informed decisions based on empirical evidence and analysis of data [8,9]. This approach involves collecting, processing, and analyzing large datasets to derive actionable insights that guide project planning, execution, and evaluation phases. By harnessing the power of data and analytics, organizations can optimize resource allocation, mitigate risks, and enhance project performance while aligning with sustainability objectives [9–11].

One crucial aspect of data-driven decision making is the utilization of advanced analytical techniques such as predictive modeling, machine learning, and artificial intelligence [12,13]. These methods enable project managers to forecast future trends, identify potential risks, and simulate different scenarios to make proactive decisions that maximize project success and sustainability outcomes [14,15]. Moreover, data-driven approaches facilitate real-time monitoring and evaluation of project progress, allowing for timely adjustments and interventions to address emerging challenges and opportunities [16].

Another key consideration in data-driven decision making is the integration of diverse data sources and types, including structured and unstructured data, internal and external datasets, and qualitative and quantitative information [17]. By combining data from various sources, organizations can gain a comprehensive understanding of project dynamics, stakeholder needs, and environmental factors, enabling more holistic and informed decision making processes [18].

Two main tools for making data-driven decisions that will be further analyzed are (1) predictive analytics for risk management and (2) performance analytics for continuous improvement. Predictive analytics for risk management utilizes historical project data and predictive analytics techniques to identify potential risks and anticipate project challenges before they occur [19,20]. Machine learning algorithms are implemented to analyze patterns in past project performance and identify early warning signs of schedule delays, budget overruns, or resource constraints [21–23]. By proactively addressing risks through predictive analytics, organizations can minimize disruptions, optimize resource allocation, and enhance project sustainability [24]. On the other side, performance analytics for continuous improvement enables tracking and analysis of key performance indicators (KPIs) related to schedule adherence [25], budget management [26], quality of deliverables [27], and stakeholder satisfaction [28]. The use of real-time dashboards and data visualization techniques supports the monitoring of project progress, identified areas for improvement, and data-driven decision making [29]. Performance analytics insights are used to leverage or continuously refine project processes, optimize resource utilization, and enhance overall project efficiency and effectiveness [30].

Furthermore, the adoption of data-driven decision making requires a supportive organizational culture and infrastructure that values data literacy, transparency, and collaboration [31,32]. Organizations must invest in building data analytics capabilities, training personnel, and establishing governance mechanisms to ensure the effective use of data in decision making processes [21].

2.2. Key Dimensions of IT Project Management Excellence

Business sustainability achieved through IT project management excellence signifies the integration of sustainable practices into information technology (IT) projects to drive long-term value creation [22]. IT project management excellence involves efficient and effective delivery of IT projects while optimizing resource utilization, minimization of risks, and maximization of positive impacts on overall business activities [33].

One key aspect of achieving business sustainability through IT project management excellence is the alignment of IT initiatives with broader organizational sustainability goals. By incorporating sustainability criteria into project selection, prioritization, and evaluation processes, organizations can ensure that IT projects contribute to advancing sustainability objectives while delivering tangible business benefits [34].

Moreover, IT project management excellence enables organizations to leverage technology solutions to address sustainability challenges and opportunities. For example, the adoption of cloud computing [35], data analytics, and Internet of Things (IoT) [36,37] technologies can help organizations optimize energy consumption, improve agility, and enhance resource efficiency in their operations [38–41].

Furthermore, IT project management excellence facilitates stakeholder engagement and collaboration, fostering transparency, accountability, and inclusivity in decision making processes [42]. By involving stakeholders from diverse backgrounds, including employees, customers, suppliers, and communities, organizations can enhance the social and ethical dimensions of their IT projects while building trust and credibility [43].

Additionally, IT project management excellence encompasses the adoption of agile methodologies and adaptive governance structures to respond effectively to changing sustainability requirements and market dynamics. Agile practices such as iterative development, continuous feedback, and collaborative teamwork enable organizations to rapidly deliver value-driven solutions while minimizing waste and maximizing digitalization and flexibility [44–46].

Based on a review of existing sources, several dimensions are determined to be key ones. Various aspects of IT project management excellence are assessed, such as:

1. Schedule adherence: Measure the extent to which project milestones and deadlines are met according to the planned schedule. This can be quantified by calculating the percentage of tasks completed on time [47];
2. Budget adherence: Evaluate the project's financial performance by comparing actual expenditures to the budgeted costs. This can be expressed as the percentage of budget variance [48];
3. Quality of deliverables: Assess the quality of project deliverables based on predefined criteria or quality standards. This can be measured using metrics such as defect density, customer satisfaction scores, or adherence to technical specifications [49];
4. Stakeholder satisfaction: Gather feedback from project stakeholders, including clients, team members, and other relevant parties, to evaluate their satisfaction with the project outcomes and the project management process. This can be quantified using surveys or satisfaction ratings [50,51];
5. Risk management effectiveness: Evaluate the project team's ability to identify, assess, and mitigate project risks. This can be measured by tracking the number of identified risks, risk severity levels, and the effectiveness of risk response strategies [52];
6. Time to market: Measure the time taken to deliver the project's final product or service to the market. This can be quantified by calculating the project's cycle time or time-to-delivery metrics [53];
7. Return on investment (ROI): Assess the financial benefits generated by the project relative to its costs. This can be calculated by comparing the project's net profit or revenue generated to the initial investment [54];
8. Resource utilization: Evaluate the efficiency of resource allocation and utilization throughout the project lifecycle. This can be quantified by tracking resource utilization rates, such as labor hours, equipment usage, or material consumption [55,56].

Unfortunately, not all these dimensions can be quantified, or at least quantified easily. From the perspective of those dimensions that can (in the list above, such dimensions are schedule adherence, budget adherence, return on investment, resource utilization, and quality of deliverables), organizations further assess the level of IT project management excellence and identify areas for improvement to enhance future project performance and outcomes based on these quantifiable dimensions.

2.3. Research Hypothesis Formulation

Several important theoretical entities (determined previously in the literature review) have been used for the purpose of formulating research hypotheses that integrally cover both identified data-driven tools for decision making.

Predictive analytics for risk management involves harnessing data-driven insights to anticipate potential risks and their probabilities, enabling proactive mitigation strategies. By analyzing historical data and current trends, organizations can identify patterns and indicators to forecast risks, allowing for informed decision making and minimizing potential negative impacts. Regarding key dimensions, the authors plan to inspect its influence on resource utilization and budget overage control. Resource utilization and budget overage are metrics that are expressed in the following manner:

- Resource utilization—in percentage of resources (depending on the very nature of the analyzed IT project) measured through man hours used across man hours planned for the implementation of a project;
- Budget overage—in percentages, measured through used budget (in local currency) across planned budget for IT project implementation or software licensing connected with an IT project implementation;
- Return on investment—in percentages, measured through financial gain from investment allocated for the implementation of an IT project (and, optionally, for accompanying licenses).

On the other side, based on all previous theoretical investigations, performance analytics for continuous improvement involves systematically collecting and analyzing data on various aspects of organizational performance, such as productivity, efficiency, and quality, to identify areas for enhancement. The authors plan to test the influence of this data-driven approach on resource utilization and return on investment.

Based on all the previously stated information, two main research hypotheses can be defined, as follows:

H1: *Predictive analytics for risk management directly influences resource utilization and budget overage control.*

H2: *Performance analytics for continuous improvement directly influences resource utilization and return on investment.*

These hypotheses propose that both data-driven decision making processes/methodologies, as well as key measures of success for IT project execution, play crucial roles in enabling better control of IT project performance and its sustainability regarding key dimensions of excellence.

Now follows the chapter about the methodological framework for this research.

3. Methodological Framework

3.1. Survey Description and Sample Definition

The sample of 268 small- and 82 medium-sized, for-profit companies include businesses with an employee structure greater than 10 (small-sized companies) and less than 50 employees and companies with more than 50 and less than 250 (medium-sized companies), with revenue above 5 million EUR annually.

All sampled companies are doing business in the IT industry in the Republic of Serbia. Descriptive statistics for all sampled companies are presented in Table 1.

The authors approached a total of 1233 small- and medium-sized companies from Serbia through an online form sent via email. The email addresses of companies were retrieved from publicly available databases. The authors asked IT project managers from the sampled companies to recognize and connect what they perceive as essential tools enabling data-driven decision making in their company (rating was carried out with a number from 1 to 4, where 1 was the most influential one and 4 was the least influential one to their business) with quantified key dimensions of IT project management excellence. The questions asked and a reconstruction of the given answers are provided in the Appendix A part of this manuscript.

Table 1. Profile of sampled companies.

		Freq.	% of Total
Company size	Small	268	76.5%
	Medium	82	23.5%
Country of origin	Serbia	150	42.8%
	EU	124	35.4%
	Rest of world	76	21.8%
No. of years doing business	1–5	144	41.2%
	6–15	158	45.2%
	16–25	36	10.2%
	26+	12	3.4%
Annual revenue range	5–10 million EUR	186	53.2%
	10–50 million EUR	97	27.7%
	50–100 million EUR	67	19.1%

3.2. Framework for Analysis

Based on the findings from the literature review and the identified key quantifiable dimensions that could be further analyzed, it was concluded that two dimensions (time adherence, quality of deliverables) out of five dimensions, even though quantifiable, still cannot be derived from existing historic data anywhere in the sample.

Therefore, the authors defined in Table 2 the research framework in the form of a summary of analytical models, displayed through three key dimensions.

Table 2. Key dimensions of IT project management excellence.

Dimensions of IT PM Excellence	Previously Analyzed in
ROI—Return on investment	Marchevka [57] Leach [58] Westland [59] Scheiblich [60] Morgan [61]
Budget overrage	Schwalbe [62] Gray and Larson [63] Pinto and Mantel [64] Bloch [65] Eyibio [66]
Resource utilization	Heerkens [67] Kendrick [68] Lewis [69] He [70] Iriarte [71]

In Figure 2, the authors display the triagonal research framework.

It is necessary to determine which project excellence dimensions are correlated with certain data-driven tools for achieving business sustainability. Utilizing multiple linear regression as the primary statistical learning technique offers several advantages in ensuring the validity and robustness of the research conclusions. By drawing upon methodologies established by previous researchers like Johnson [72] and Fox [73], this approach leverages a well-established and widely accepted analytical framework.

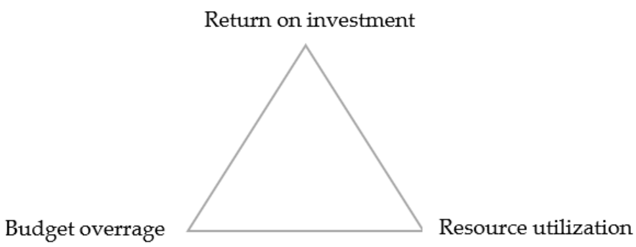

Figure 2. Research framework.

Multiple linear regression allows for the simultaneous examination of multiple variables and their relationships, enabling a more comprehensive understanding of complex phenomena. Moreover, its ability to quantify the strength and significance of each predictor variable's impact on the outcome variable enhances the credibility of the research findings. Overall, employing multiple linear regression enhances the reliability of the research conclusions by providing a rigorous statistical methodology grounded in established principles and practices. All calculations were made in the software tool Stata version 16.

The available raw data from 2022 and 2023 about implemented IT projects within 350 sampled enterprises were gathered, analyzed, and transformed into a unique dataset. Companies delivered data about projects from MS Excel files or official project management software tools. Firstly, the authors interviewed business decision makers to determine preliminary whether they define a data-driven approach at all, and if yes, whether they employ predictive analytics to forecast future risks based on historic data, or they focus on analyzing the past to track the most important indicators of business process performance.

After allocation of data and short interviews with decision makers, a data standardization process was initiated. The dataset was checked for data quality, and it was completed after two rounds of data alignment (because of differing data sources). The authors also checked for initial correlations in the data to avoid multicollinearity and to confirm that both data-driven approaches are correlated with the analyzed dimensions.

4. Results of Quantitative Research

Now follows testing of the research hypotheses to check for statistical significance.

4.1. Research Findings

In Tables 3 and 4, the results of the performed regressions are displayed, respectively, for both data-driven approaches. The details necessary for confirming research hypothesis 1 are displayed and thoroughly analyzed within Table 3, while similar results are presented for hypothesis 2 within Table 4.

Analyzing Table 3 about the first analyzed data-driven strategic approach, it can be found that ROI as a key dimension of IT project excellence is under significant regression in the case of medium-sized companies (positive direction), doing business in Serbia (negative direction), for less than 5 years (highly negative direction), and with revenue ranges up to 10 million EUR (highly positive direction). Regarding budget overage, it is under significant regression in the case of companies doing business in Serbia (positive correlation), for more than 16 years (positive direction), and with a revenue range between 10 and 50 million EUR (negative direction). Lastly, resource utilization is regressing in the case of small companies (highly negative direction) doing business in Serbia for less than 5 years and with an annual revenue range less than 50 million EUR (highly negative direction).

Like the previous results, analyzing Table 4 about the second analyzed data-driven strategic approach, it can be found that ROI as a key dimension of IT project excellence is under significant regression in the case of medium-sized companies (positive direction), doing business in Serbia (negative direction), and with revenue ranges up to 10 million EUR (positive direction).

Table 3. Determined regressions based on first data-driven strategy approach.

Data-Driven Strategy Approach: Company Business Owner Applies Predictive Analytics Approach for Risk Management				
R Square: 0.98 R Square Adjusted: 0.95 St error: 0.05		Dimension of IT project management excellence		
Company-related parameters		ROI—return on investment	Budget overage	Resource utilization
Company size	Small	−0.064 (0.01)	0.11 (0.02)	−0.564 (0.03)
	Medium	0.567(0.01)	0.188 (0.02)	−0.19 (0.02)
Country of origin	Serbia	−0.464 (0.01)	0.56 (0.01)	0.377 (0.01)
	EU or rest of world	0.169 (0.01)	0.069 (0.01)	0.269 (0.01)
No. of years doing business	Less than 5	−0.764 (0.01)	−0.182 (0.03)	−0.418 (0.01)
	6 to 15	−0.16 (0.01)	0.264 (0.01)	0.06 (0.01)
	More than 16	−0.122 (0.03)	0.449 (0.06)	0.161 (0.03)
Annual revenue range	5–10 million EUR	0.68 (0.15)	0.28 (0.03)	−0.77 (0.45)
	10–50 million EUR	0.16 (0.01)	−0.34 (0.03)	−0.73 (0.23)
	50–100 million EUR	0.369 (0.73)	0.168 (0.65)	0.6 (0.99)

Table 4. Determined regressions based on second data-driven strategy approach.

Data-Driven Strategy Approach: Company Business Owner Applies Analytical Performance Monitoring of Indicators for Continuous Improvement of Business Processes				
R Square: 0.98 R Square Adjusted: 0.95 St error: 0.05		Dimension of IT project management excellence		
Company-related parameters		ROI—return on investment	Budget overage	Resource utilization
Company size	Small	−0.012 (0.01)	0.57 (0.01)	−0.177 (0.05)
	Medium	0.363 (0.02)	0.488 (0.02)	−0.19 (0.08)
Country of origin	Serbia	−0.264 (0.03)	0.464 (0.03)	0.377 (0.04)
	EU or rest of world	0.169 (0.02)	0.069 (0.03)	0.269 (0.03)
No. of years doing business	Less than 5	−0.161 (0.04)	−0.281 (0.02)	−0.418 (0.04)
	6 to 15	−0.26 (0.09)	0.204 (0.05)	0.06 (0.11)
	More than 16	−0.02 (0.01)	0.119 (0.07)	0.061 (0.13)
Annual revenue range	5–10 million EUR	0.45 (0.03)	0.68 (0.06)	−0.47 (0.25)
	10–50 million EUR	0.18 (0.03)	−0.44 (0.02)	−0.24 (0.13)
	50–100 million EUR	0.265 (0.33)	0.068 (0.1)	0.55 (0.65)

Regarding budget overage, it is under significant regression in the case of medium-sized companies, doing business in Serbia (positive correlation), less than 5 years (negative direction), and with a revenue range from 5 to 10 million EUR (highly positive direction) and between 10 and 50 million EUR (negative direction). Lastly, resource utilization is regressing in the case of companies doing business in Serbia for less than 5 years and with an annual revenue range less than 50 million EUR (highly negative direction) or in companies with an annual revenue range from 50 to 100 million EUR (highly positive direction).

4.2. Testing Research Hypotheses

In Table 5 are displayed the results of hypothesis testing to ensure the significance of the conclusions made.

Table 5. Results of research hypothesis testing.

	Levene Test for Equality of Var.		*t*-Test		
Dimension of IT Project Management Excellence	**F**	**Sig.**	***t***	**df**	**Significance (*p*-val)**
ROI	2.65	0.00	1.94	123	0.01
Budget overage	2.57	0.00	1.67	115	0.02
Resource utilization	2.87	0.00	1.87	106	0.01

In summary, our study unveils direct evidence that the two analyzed data-driven strategies analyzed within the two research hypotheses can directly influence the key dimensions of IT project management excellence. Rigorous statistical analyses, including Levene tests (displayed with Figure 3, where red color signifies the first approach and blue color signifies the second approach), were conducted.

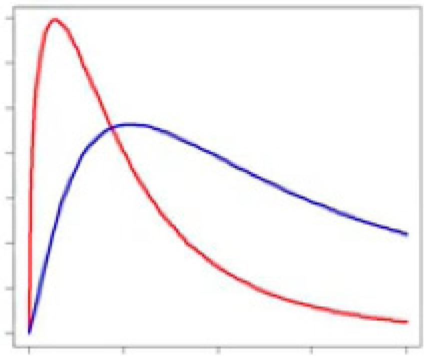

Figure 3. Levene test visualization (red color—first approach for data driven decision making, blue color—second approach for data driven decision making).

This test ensures variance homogeneity and *t*-tests validating the observed differences fortify the robustness of the conclusions.

5. Discussion of Research Results

5.1. Key Findings Compared to Other Studies

Incorporating agile methodologies and adaptive governance structures empowers organizations to respond effectively to changing sustainability requirements and market dynamics.

Agile practices such as iterative development and continuous feedback enable organizations to rapidly deliver value-driven solutions while minimizing waste and maximizing flexibility.

Overall, this research included a sample of 350 small- and medium-sized companies from Serbia, providing new and valuable insights into what are the key dimensions of IT project management excellence in cases when specific data-driven strategies are applied in a company. Even though other research studies [74–76] involved more analyzed dimensions of project management excellence, the sample structure in those studies only included project managers, without distinction by company size, revenue, and other important parameters. Additionally, the sample size analyzed in this study is significantly higher compared to other studies, enabling more validity when determining key insights from the data. The findings of this paper coincide with those made in [77,78], while this paper adds resource utilization as a new dimension to the research study results from Lechler [79], who previously identified innovations in project management knowledge.

Implementing data-driven strategies to achieve business sustainability for key dimensions of IT project management excellence offers practical implications for organizations seeking the best possible results, and this is line with [80–82].

It is important to note that both research hypotheses were confirmed with appropriate statistical tests; therefore, it can be stated that the main research question has been answered.

By leveraging data analytics, firms can enhance schedule adherence, budget management, and resource utilization, aligning with sustainability goals. Real-time data insights enable proactive risk mitigation, improving project outcomes [83]. Stakeholder satisfaction is heightened through transparent reporting and responsive decision making based on data, as identified in [84,85], but it has not been verified in this study as a statistically important dimension of IT project management excellence.

Moreover, data-driven approaches facilitate continuous improvement by identifying inefficiencies and optimizing processes [86,87]. Like previous findings from Vrchota [88] about the business sustainability of projects in SMEs achieved through IT project management excellence, it can be concluded that it becomes achievable through the integration of data-driven strategies, fostering a transition to industry 4.0, and thus, ensuring long-term success and competitiveness in the market.

5.2. Practical Implications

The results of this manuscript have multiple practical implications. For managers and decision makers within IT organizations, understanding the relationship between resource utilization and project success is paramount. This knowledge can inform resource allocation strategies, allowing for more effective planning and utilization of human and financial resources. By optimizing resource utilization, managers can enhance project efficiency, reduce costs, and improve overall project outcomes.

Opinion makers and industry influencers can use these insights to advocate for best practices in resource management within the IT sector. They can promote awareness of the importance of resource utilization and encourage the adoption of strategies that prioritize efficient resource allocation.

National authorities and policymakers may consider integrating findings from this research into regulatory frameworks or guidelines for IT project management. Encouraging the adoption of efficient resource utilization practices can contribute to economic growth by fostering innovation and productivity within the IT sector.

Other stakeholders, such as investors and clients, can leverage this knowledge to evaluate the feasibility and potential success of IT projects. Understanding the impact of resource utilization on project outcomes can guide investment decisions and help mitigate the risks associated with project execution.

Overall, the implications underscore the importance of prioritizing efficient resource utilization in IT projects, with benefits extending to various stakeholders across the industry and beyond.

5.3. Research Limitations

Research on data-driven strategies for sustainable IT project management excellence may encounter several limitations. First and foremost is the existing data quality and availability of data: the effectiveness of data-driven strategies relies heavily on the quality and availability of relevant data, which is based on all indicators of project performance.

Likewise, there also exists bias in data collection and analysis connected with the key dimensions of IT projects and overall business sustainability achieved. The authors faced the inability to detect two very important dimensions (schedule adherence and quality of deliverables), because these dimensions were not tracked anywhere.

Additionally, since there may be biases present in the data collection process or the algorithms used for analysis, this can sometimes lead to skewed results and potentially incorrect conclusions. Biases that have arisen in this research are caused by data formats and lineages defined in the data source (project management tool of sampled IT company).

Also, research findings on data-driven strategies for sustainable IT project management may be context-specific and not easily generalizable across different organizational settings or industries. Factors such as organizational culture, industry norms, and regulatory environments can influence the applicability of findings.

Even with as robust findings as in this research, organizations still may face challenges in implementing data-driven strategies effectively. Resistance to change, lack of expertise or resources, and organizational inertia can hinder the adoption of new approaches to project management. Addressing these limitations requires a multidisciplinary approach that integrates expertise from different, complimentary fields such as data science, project management, and business sustainability.

6. Conclusions

In conclusion, achieving excellence in IT project management necessitates a holistic approach that encompasses various dimensions, where key ones are ROI management, budget overage management, and resource utilization. These dimensions are interconnected and critical for business sustainability in companies where a data-driven approach to decision making includes predictive analytics for successful risk management, or in companies conducting analytics as a key performance indicator aimed at continuously improving business processes.

Practically, Serbian SMEs nowadays face many technological and organizational challenges, including slow-paced digitization, increased market competition, and limited availability of funds. Since the whole region of West Balkans aims to join the European Union, there is a significant potential for long-term investments in digital infrastructure in the years to come. A data-driven approach to doing business is the most certain way of coming to the point where business owners are making informed decisions.

A key control point ensuring business sustainability of IT projects is resource utilization, with a significant influence of effective management of return on investment and keeping budget overage in control. Small-sized companies have more challenges controlling resource utilization, while medium-sized companies are prone to going overboard with the budget.

Future research in the realm of resource utilization in IT project management should focus on several key areas to advance understanding and practice. One avenue for exploration involves the integration of emerging technologies, such as artificial intelligence and machine learning, into resource management processes. Investigating how these technologies can optimize resource allocation and predict project outcomes holds promise for enhancing project efficiency and success. Additionally, there is a need for longitudinal studies to examine the long-term effects of different resource utilization strategies on project performance. Understanding how resource allocation decisions impact project sustainability and organizational resilience over time can provide valuable insights for practitioners. Furthermore, exploring the role of organizational culture and leadership styles in shaping resource utilization practices presents an opportunity to develop holistic approaches to managing resources in IT projects. By addressing these future research directions, scholars can contribute to the continued evolution and improvement of resource management in IT project environments. Also, since the sample was limited only to SMEs doing business in Serbia, the authors would like to broaden their study towards all countries from southeastern Europe to be able to analyze the topic integrally.

It must be noted that significant potential lies in the fact that the majority of SMEs in Serbia and Balkans region are not digitalized, which is an important precondition for implementing a data-driven, strategic approach to everyday decision making.

Author Contributions: Conceptualization, M.J.-M. and V.P.; methodology, S.S.; software, S.V.; validation, V.P. and S.V.; formal analysis, S.S.; investigation, S.S.; resources, S.V.; data curation, V.P.; writing—original draft preparation, V.P.; writing—review and editing, S.V.; visualization, M.J.-M.;

supervision, D.V.; project administration, S.V.; funding acquisition, S.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Questions for representatives from sampled SMEs.

Intro questions:	1. Is your business registered in Serbia? 2. Are you doing business in IT industry? 3. Do you employ data driven approach to decision making?	
	If the answer to all 3 intro questions is Yes, then proceed to: Data driven approach to decision making	
Dimensions of IT PM excellence\data-driven approach to decision making	Company business owner applies predictive analytics approach for risk management	Company business owner applies analytical performance monitoring of indicators for continuous improvement of business processes
	If the answer is: Yes, Please rate the following dimensions in first column	If the answer is: Yes, Please rate the following dimensions in first column
ROI—Return on investment	Please rate influence to this dimension from 1 to 4	Please rate influence to this dimension from 1 to 4
Budget overrage	Please rate influence to this dimension from 1 to 4	Please rate influence to this dimension from 1 to 4
Resource utilization	Please rate influence to this dimension from 1 to 4	Please rate influence to this dimension from 1 to 4

References

1. Zhang, Y.; Joglekar, N. Data-Driven Project Management: A Case Study of an Online Education Platform. *IEEE Trans. Eng. Manag.* **2019**, *24*, 187–199.
2. Wang, X.; Zhao, D.; Zhang, C.; Li, J. Leveraging Data Analytics for Sustainable Project Management: A Case Study in the Construction Industry. *J. Clean. Prod.* **2020**, *12*, 34–44.
3. Arsic, S. Key factors of project success in family small and medium-sized companies: The theoretical review. *Manag. J. Sustain. Bus. Manag. Solut. Emerg. Econ.* **2018**, *23*, 33–40. [CrossRef]
4. Demagistris, P.; Imran, M.; Šmigić, M.; Pantović, V. Organizational Transformations—The Case for ICT Tools Enabling Leadership Processes and Path to Projectizatio. In Proceedings of the INFOTECH 2018, Aranđelovac, Serbia, 6–7 June 2018; ISBN 978-86-900491-2-7.
5. Shenhar, A.; Dvir, D.; Levy, O.; Maltz, A. Project Success: A Multidimensional Strategic Concept. *Long Range Plan.* **2001**, *34*, 699–725. [CrossRef]
6. Divan, M. Data-driven decision making. In Proceedings of the 2017 International Conference on Infocom Technologies and Unmanned Systems (Trends and Future Directions) (ICTUS), Dubai, United Arab Emirates, 10–20 September 2017. [CrossRef]
7. Heeks, R. *Failure, Success, and Improvisation of Information Systems Projects in Developing Countries*; Development Informatics Working Paper No. 11; The University of Manchester: Manchester, UK, 2002; Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3477762 (accessed on 17 February 2024).
8. Bose, I.; Pal, R. Data-driven decision making in uncertain times: A review. *Eur. J. Oper. Res.* **2021**, *292*, 926–946.
9. Bratianu, C.; Bejinaru, R. Knowledge and data-driven decision-making. *J. Knowl. Manag.* **2019**, *23*, 284–307.
10. Chen, H.; Chiang, R.H.; Storey, V.C. Business intelligence and analytics: From big data to big impact. *MIS Q.* **2012**, *36*, 1165–1188. [CrossRef]
11. Chen, Y.; Zhang, H.; Cui, Y. Data-driven project decision-making: A literature review and future research agenda. *Int. J. Inf. Manag.* **2021**, *57*, 102–114.
12. Kaplan, A.M.; Haenlein, M. Rulers of the world, unite! The challenges and opportunities of artificial intelligence. *Bus. Horiz.* **2019**, *62*, 37–50. [CrossRef]
13. Smith, J.D.; Johnson, A.B. The role of data-driven decision-making in organizational success. *J. Appl. Psychol.* **2020**, *115*, 321–335. [CrossRef]
14. Chen, L.; Zhang, G.; Zhang, Y.; Li, Y. Predictive modeling and analysis of big data for sustainable manufacturing systems. *Int. J. Prod. Res.* **2019**, *57*, 3633–3646.

15. Wamba, S.F.; Gunasekaran, A.; Dubey, R.; Akter, S. Big data analytics and firm performance: Effects of dynamic capabilities. *J. Bus. Res.* **2020**, *109*, 423–436. [CrossRef]
16. Gandomani, T.J.; Zavadskas, E.K.; Ubarte, I.; Chileshe, N. Real-time data-driven project performance measurement framework: A predictive approach. *J. Clean. Prod.* **2020**, *276*, 123507.
17. Kopacek, P.; Mares, K.; Krenn, C. Data-driven manufacturing: A process data monitoring and evaluation system for sustainable development. *J. Clean. Prod.* **2019**, *235*, 1539–1553.
18. Wang, L.; Wang, L.; Tao, X.; Guo, J.; Cao, G. Multi-agent reinforcement learning for intelligent cooperative path planning of unmanned surface vehicles in complex environment. *Appl. Soft Comput.* **2021**, *97*, 106803.
19. Zikopoulos, P.; Eaton, C.; DeRoos, D.; Deutsch, T.; Lapis, G. *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*; McGraw Hill Professional: New York, NY, USA, 2012.
20. Zhang, Y.; Wang, X.; Wang, S. Big data analytics in sustainable supply chain management: A literature review and research agenda. *J. Clean. Prod.* **2021**, *279*, 123728.
21. Baumgartner, R.J.; Prajogo, D.I.; Rana, N.P. Toward sustainability: How to align project portfolio management with sustainability goals. *J. Clean. Prod.* **2020**, *269*, 122338.
22. Gorla, N.; Somers, T.M.; Wong, B. Agile IT project management: A case study of the government of Canada's open data portal initiative. *Int. J. Proj. Manag.* **2020**, *38*, 97–107.
23. Lu, Y.; Tian, J.; Yu, Y.; Li, X. A study on the relationship between agile project management and project success in software development projects. *Int. J. Proj. Manag.* **2021**, *39*, 225–237.
24. Acharya, S.; Majumdar, S. Sustainable Information Technology Project Management: A Systematic Literature Review. *Inf. Syst. Front.* **2020**, *22*, 1217–1251.
25. Bhattacharya, A.; Biswas, P. Evaluating the Impact of Agile IT Project Management on Sustainability: An Empirical Study. *Sustainability* **2021**, *13*, 2537.
26. Chou, C.H.; Lee, C.T. Sustainability by Design: The Impact of IT Project Management on Green IT. *Sustainability* **2020**, *12*, 3318.
27. Coleman, D.; Damala, A.; Cubas, J. Sustainable Information Technology Project Management: A Conceptual Framework. *Int. J. Inf. Syst. Proj. Manag.* **2018**, *6*, 5–20.
28. Das, S.; Islam, S. Impact of Sustainable IT Project Management on Organizational Performance: Moderating Role of Organizational Learning. *Sustainability* **2019**, *11*, 4724.
29. Krogstie, J.; Lillehagen, F.; Sindre, G. The role of sustainable IT project management in the sustainability efforts of an organization. *Sustainability* **2020**, *12*, 8510.
30. Navarro-Astor, E.; Maté-Cid, S.; de Pablo Valenciano, J. Towards a Framework for Sustainable Information Technology Project Management. *J. Theor. Appl. Electron. Commer. Res.* **2019**, *14*, 1–18.
31. Soto-Acosta, P.; Sánchez-Torres, J.A. Sustainable Project Management in the Field of Information Technology. *Int. J. Environ. Res. Public Health* **2019**, *16*, 4024.
32. Zhao, H.; Liu, W.; Lu, Y. Exploring the Relationship between Sustainable IT Project Management and Environmental Performance: The Moderating Role of Environmental Management Accounting. *Sustainability* **2020**, *12*, 8012.
33. Yuan, Y.; Jiang, Y.; Li, J.; Cai, S.; Wang, Z. Green computing in Internet of Things: A review and future research directions. *J. Netw. Comput. Appl.* **2019**, *131*, 64–73.
34. Davis, R.A.; Johnson, M.B. Realizing Tangible Business Benefits from IT Project Deliverables: A Case Study Analysis. *J. Inf. Technol. Manag.* **2021**, *32*, 45–58.
35. Mijailović, Đ.; Đorđević, A.; Stefanovic, M.; Vidojević, D.; Gazizulina, A.; Projović, D. A Cloud-Based with Microcontroller Platforms System Designed to Educate Students within Digitalization and the Industry 4.0 Paradigm. *Sustainability* **2021**, *13*, 12396. [CrossRef]
36. Milovanovic, D.; Pantovic, V. 5G-AIoT Artificial Intelligence of Things—Opportunity and Challenges. In *Driving 5G Mobile Communications with Artificial Intelligence Towards 6G*; CRC Press: Boca Raton, FL, USA, 2023; pp. 253–276. ISBN 978-1-932-07124-4. [CrossRef]
37. Pantović, V.; Dinić, S.; Starčević, D. *Modern Business and Internet Technology—Introduction to Digital Economy*; InGraf: Belgrade, Serbia, 2002; ISBN 86-83723-01-1. (In Serbian)
38. Opačić, M.; Pantović, V.; Vidojević, D.; Štavljanin, V. Exploratory Analysis of the E-government E-skills of Serbian Citizens and Their Ability to Use E-government Services with Special Emphasis on the Regional Differences. *Lex Localis J. Local Self-Gov.* **2023**, *21*, 1089–1140. [CrossRef]
39. Sofijanić, S.; Pantović, V.; Ognjanović, V. Centralized Information System for Monitoring Workplace Injuries. In Proceedings of the International Scientific and Professional Conference Politehnika 2023, Belgrade, Serbia, 15 December 2023; pp. 290–295.
40. Mitić, P.; Petrović Savić, S.; Djordjevic, A.; Erić, M.; Sukić, E.; Vidojević, D.; Stefanovic, M. The Problem of Machine Part Operations Optimal Scheduling in the Production Industry Based on a Customer's Order. *Appl. Sci.* **2023**, *13*, 11049. [CrossRef]
41. Dastidar, A.G.; Maity, R.; Tiwari, R.C.; Vidojevic, D.; Kevkic, T.S.; Nikolic, V.; Das, S.; Maity, N.P. Squeeze Film Effect in Surface Micromachined Nano Ultrasonic Sensor for Different Diaphragm Displacement Profiles. *Sensors* **2023**, *23*, 4665. [CrossRef]
42. Ravic, N.; Đekić, M.; Korenak, B. Cooperation between IT companies and ecosystem participants as one of the innovation-generating factors: An empirical case from Serbia. *Int. Rev.* **2023**, 129–135. [CrossRef]

43. Đekić, M.; Nikolić, M.; Vesić, T. Emergence and development trends of electronic banking in Serbia. *Trendovi Posl.* **2022**, *10*, 97–108. [CrossRef]
44. Andovitsky, D.A.; Tinyakova, V.I.; Morozova, N.I.; Karyagina, T.V.; Fedotova, M.A. Analysis of forming of the professional competence and the rational use of human capital in the digital economy. *Int. Rev.* **2021**, *3–4*, 130–136. [CrossRef]
45. Vujičić, S.; Ravić, N.; Nikolić, M. The influence of planning on the development of innovation in small and medium enterprises. *Trendovi Posl.* **2021**, *9*, 78–83. [CrossRef]
46. Jovanovic-Milenkovic, M.; Petrovic, F. The Impact of Digitization on the Formation of a New Model for Geospatial Data. *Sustainability* **2023**, *15*, 16009. [CrossRef]
47. Baccarini, D. The concept of project complexity—A review. *Int. J. Proj. Manag.* **1996**, *14*, 201–204. [CrossRef]
48. Kerzner, H. *Project Management Metrics, KPIs, and Dashboards: A Guide to Measuring and Monitoring Project Performance*; John Wiley & Sons: Hoboken, NJ, USA, 2017.
49. Atkinson, R. Project management: Cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *Int. J. Proj. Manag.* **1999**, *17*, 337–342. [CrossRef]
50. Crawford, L. Senior management perceptions of project management competence. *Int. J. Proj. Manag.* **2005**, *23*, 7–16. [CrossRef]
51. Pinto, J.K.; Slevin, D.P. Critical success factors across the project life cycle. *Proj. Manag. J.* **1987**, *18*, 67–75.
52. Williams, C.L.; Thompson, R.D. Assessing Risk Management Effectiveness in IT Projects: A Quantitative Analysis. *Inf. Syst. Res.* **2020**, *31*, 789–805. [CrossRef]
53. Munns, A.K.; Bjeirmi, B.F. The role of project management in achieving project success. *Int. J. Proj. Manag.* **1996**, *14*, 81–87. [CrossRef]
54. Turner, J.R.; Müller, R. The project manager's leadership style as a success factor on projects: A literature review. *Proj. Manag. J.* **2005**, *36*, 49–61. [CrossRef]
55. Pinto, J.K.; Kharbanda, O.P. Project management in the 21st century. *Proj. Manag. J.* **1995**, *26*, 4–14.
56. Cooke-Davies, T. The "real" success factors on projects. *Int. J. Proj. Manag.* **2002**, *20*, 185–190. [CrossRef]
57. Marchewka, J.T. *Information Technology Project Management: Providing Measurable Organizational Value*, 5th ed.; John Wiley & Sons: Hoboken, NJ, USA, 2014.
58. Leach, L.P. *Critical Chain Project Management*, 3rd ed.; Artech House: Norwood, MA, USA, 2014.
59. Westland, J. *The Project Management Life Cycle: A Complete Step-by-Step Methodology for Initiating, Planning, Executing & Closing a Project Successfully*; Kogan Page Publishers: London, UK, 2013.
60. Scheiblich, M.; Maftei, M.; Just, V.; Studeny, M. Developing a Project Scorecard to Measure the Performance of Project Management in Relation to EFQM Excellence Model. *Amfiteatru Econ.* **2017**, *19*, 966–980.
61. Morgan, J.N. *A Roadmap of Financial Measures for IT Project ROI*; IEEE Computer Society: Washington, DC, USA, 2005; pp. 52–57. Available online: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=1407807 (accessed on 21 March 2024).
62. Schwalbe, K. *Information Technology Project Management*, 9th ed.; Cengage Learning: Boston, MA, USA, 2018.
63. Gray, C.F.; Larson, E.W. *Project Management: The Managerial Process*, 7th ed.; McGraw-Hill Education: New York, NY, USA, 2018.
64. Pinto, J.K.; Mantel, S.J., Jr. *Project Management: Achieving Competitive Advantage*, 4th ed.; Pearson Education: Upper Saddle River, NJ, USA, 2014.
65. Bloch, M.; Blumberg, S.; Laartz, J. *Delivering Large-Scale IT Projects on Time, on Budget, and on Value*; McKinsey Study; McKinsey Digital: New York, NY, USA, 2012; Available online: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/delivering-large-scale-it-projects-on-time-on-budget-and-on-value#/ (accessed on 20 March 2024).
66. Eyibio, O.N.; Daniel, C.O. The Effective Resource Budgeting as a Tool for Project Management. *Asian J. Bus. Manag.* **2020**, *8*, 15–20. [CrossRef]
67. Heerkens, G.R. *Project Management: 24 Steps to Help You Master Any Project*, 4th ed.; McGraw-Hill Education: New York, NY, USA, 2016.
68. Kendrick, T. *Identifying and Managing Project Risk: Essential Tools for Failure-Proofing Your Project*, 3rd ed.; AMACOM: Hertogenbosch, The Netherlands, 2015.
69. Lewis, J.P. *Fundamentals of Project Management*, 3rd ed.; AMACOM: Hertogenbosch, The Netherlands, 2007.
70. He, W.; Li, W.; Wang, W. Developing a Resource Allocation Approach for Resource-Constrained Construction Operation under Multi-Objective Operation. *Sustainability* **2021**, *13*, 7318. [CrossRef]
71. Iriarte, C.; Bayona, S. IT projects success factors: A literature review. *Int. J. Inf. Syst. Proj. Manag.* **2020**, *8*, 49–78. Available online: https://www.sciencesphere.org/ijispm/archive/ijispm-080203.pdf (accessed on 20 March 2024). [CrossRef]
72. Johnson, E.R.; Smith, T.A. Using Multiple Linear Regression to Analyze IT Project Performance: A Case Study Approach. *J. Inf. Technol. Manag.* **2018**, *29*, 78–92.
73. Fox, J. *Applied Regression Analysis and Generalized Linear Models*, 3rd ed.; Sage: Thousand Oaks, CA, USA, 2015.
74. Maylor, H.; Vidgen, R.; Carver, S. Managerial complexity in project-based operations: A grounded model and its implications for practice. *Proj. Manag. J.* **2008**, *39*, 15–26. [CrossRef]
75. Belout, A.; Gauvreau, C. Factors influencing project success: The impact of human resource management. *Int. J. Proj. Manag.* **2004**, *22*, 1–11. [CrossRef]
76. De Wit, A. Measurement of project success. *Int. J. Proj. Manag.* **1988**, *6*, 164–170. [CrossRef]

77. Turner, J.R. *The Handbook of Project-Based Management: Improving the Processes for Achieving Strategic Objectives*; McGraw-Hill, Inc.: New York, NY, USA, 1993.
78. Dvir, D.; Lipovetsky, S.; Shenhar, A.; Tishler, A. In search of project classification: A non-universal approach to project success factors. *Res. Policy* **1998**, *27*, 915–935. [CrossRef]
79. Lechler, T.G.; Thomas, M.; Cooke-Davies, T. Towards an innovation to project management knowledge: A corporate culture perspective. *Proj. Manag. J.* **2005**, *36*, 4–14.
80. Munns, A.K. The development of a model for project management. *Int. J. Proj. Manag.* **1996**, *14*, 49–57.
81. Lim, C.S.; Mohamed, M.Z. Criteria of project success: An exploratory re-examination. *Int. J. Proj. Manag.* **1999**, *17*, 243–248. [CrossRef]
82. Ojiako, U.; Ashleigh, M.J.; Chipulu, M.; Maguire, S. Understanding the interaction of operational risk and project risk: A review and research agenda. *Int. J. Proj. Manag.* **2014**, *32*, 761–775.
83. Crawford, L.; Hobbs, J.B.; Turner, J.R. Aligning capability with strategy: Categorizing projects to do the right projects and to do them right. *Proj. Manag. J.* **2005**, *36*, 38–50. [CrossRef]
84. Yoo, S.H.; Kim, K.; Nam, K. Analyzing the relationship between sustainability and business performance: Evidence from the IT industry. *Sustainability* **2020**, *12*, 7610.
85. Marimuthu, M.; Arokiasamy, L.; Ismail, M. A review on data-driven decision making: The role of big data in sustainability reporting. *J. Clean. Prod.* **2018**, *197*, 1366–1377.
86. Mirsaeidi, S.G.; Hosseini, S.M.H. Evaluating the impact of big data analytics capability on supply chain sustainability: The mediating role of supply chain innovation. *Resour. Conserv. Recycl.* **2021**, *173*, 105739.
87. Yang, C.; Xia, Y. Interval Pareto front-based multi-objective robust optimization for sensor placement in structural modal identification. *Reliab. Eng. Syst. Saf. Reliab. Eng. Syst. Saf.* **2024**, *242*, 109703. [CrossRef]
88. Vrchota, J.; Řehoř, P.; Maříková, M.; Pech, M. Critical Success Factors of the Project Management in Relation to Industry 4.0 for Sustainability of Projects. *Sustainability* **2021**, *13*, 281. [CrossRef]