Journal of Information Systems Engineering and Management
2023, 8(4), 23796
e-ISSN: 2468-4376
https://www.jisem-journal.com/
Research Article

The Impact of Industrial Internet and the Digital Economy on the Management and Development of Manufacturing Information Systems Triggering Digitization as IoT and Artificial Intelligence

Zoujian Li[1], Zifei Li[2], Yuheng Ren[3*]

[1] Master, Rotating Executive President, Golden Home Living Co.,Ltd. Xiamen, China
[2] Senior Economist, Senior Vice President, Golden Home Living Co.,Ltd. Xiamen, China
[3] Professor, Doctoral Supervisor, Director of Jianpan Kunlu IoT Technology Research Institute, Executive Director of Digital Industry College, Jimei University, Xiamen, China
* **Corresponding Author:** 86031120@qq.com

Citation: Li, Z. [Zoujian], Li, Z. [Zifei], & Ren, Y. (2023). The Impact of Industrial Internet and the Digital Economy on the Management and Development of Manufacturing Information Systems Triggering Digitization as IoT and Artificial Intelligence. *Journal of Information Systems Engineering and Management*, 8(4), 23796. https://doi.org/10.55267/iadt.07.14038

ARTICLE INFO

Received: 21 Aug 2023
Accepted: 26 Oct 2023

ABSTRACT

Technology adoption is crucial to organizational performance in the fast-changing digital world. Due to their potential to boost efficiency, productivity, and competitiveness, disruptive technologies including data analytics, the Internet of Things (IoT), and information system integration have received attention. This study examined how IoT adoption, data analytics, and information system integration affect organizational efficiency, productivity, and competitive advantage. The study also examined how cybersecurity, cloud infrastructure, and organizational culture mediate the technology-adoption-performance relationship. Quantitative research was conducted using Amos. A diverse sampling of enterprises provided data. Structural equation modelling (SEM) examined direct and indirect impacts by analyzing variable connections. IoT usage, data analytics, and information system integration improved organizational efficiency, productivity, and competitive edge. The study also showed that cybersecurity and cloud infrastructure mediate technology adoption and organizational results. Organizational culture moderated the effect of technology adoption on performance. This study added to the technology adoption literature by examining how IoT adoption, data analytics capabilities, and information system integration affect organizational efficiency, productivity, and competitive advantage. Cybersecurity, cloud infrastructure as mediators and organizational culture as a moderator helped us understand technology adoption and performance results.

Keywords: Information System Integration, Technology Adoption, Internet of Things (IoT), Organizational Efficiency, Cloud Infrastructure.

INTRODUCTION

The twenty-first century has seen a major technological change, altered the global economic scene and required firms to embrace innovative solutions in order to maintain a competitive edge. The adoption of technology has become a significant catalyst for enhancing organizational productivity, efficiency, and competitive advantage within the current era of digital transformation (Olan et al., 2022). The data analytics capabilities, Internet of Things (IoT), and information system integration have garnered significant attention as disruptive technologies. Zagrouba & Alhajri (2021) state that the increasing use of IoT leads to use advanced technologies. Furthermore, data analytics capabilities enable firms to glean important insights from massive amounts of data, exposing patterns, trends, and untapped opportunities. Integrating data analytics into organizational processes encourages evidence-based decision-making and increases an organization's ability to respond strategically to changing market needs (Bayrak, 2021). What makes the IoT stand out is that it helps people to be free from the place (Almrezeq et al., 2020). Furthermore, information system integration is critical in ensuring a continuous flow of information throughout an organization's numerous departments and functions (Madonsela, 2020). Information system integration eliminates data silos and gives a comprehensive view of corporate activities by combining different systems such as enterprise resource planning, customer relationship management, and supply chain management. This improves decision-making and resource optimization by facilitating effective coordination, reducing redundancy, and streamlining workflows.

While embracing technology promises to have transformative effects, its effective application requires a strong focus on cybersecurity measures. The hazards related to data breaches and cyber-attacks change along with technology (Bahassi, Edddermoug, Mansour, & Mohamed, 2022). To protect sensitive information, preserve consumer trust, and defend the organization's brand, it is essential to implement comprehensive cybersecurity procedures. A strong cybersecurity framework makes sure the company is resilient to potential attacks and establishes a safe environment for the privacy, availability, and integrity of data and information (Barry, Jona, & Soderstrom, 2022). Additionally, a key enabler of technology adoption is the integration of cloud infrastructure. Cloud computing gives businesses scalable and affordable access to a variety of computing resources, such as processing speed, storage capacity, and software programs (Stephanakis, Chochliouros, Sfakianakis, Shirazi, & Hutchison, 2019). Enterprises may more easily handle, store, and analyze data in real-time by using cloud-based solutions, which also give them the scalability and agility they need to quickly respond to market changes and customer demands. Businesses may maximize their technology investments thanks to the cloud's ability to support technology adoption, which also increases their capacity for experimentation and creativity with cutting-edge digital solutions.

Organizational culture emerges as a critical predictor of successful technology adoption and recognition of its potential impact on organizational outcomes. A positive and innovative business culture provides a climate conducive to technology adoption, cybersecurity protocol adherence, and effective cloud infrastructure utilization (Abu Bakar, Mat Razali, Wook, Ismail, & Tengku Sembok, 2021). A risk-averse or resistant culture, on the other hand, may stymie technology adoption efforts and limit the organization's capacity to realize the full potential of these disruptive technologies. Despite the obvious potential advantages of adopting new technology, the literature is sadly lacking in a thorough examination of the combined effects of data analytics capabilities, IoT deployment, and information system integration on organizational productivity, efficiency, and competitive advantage.

As a result, the purpose of this study is to fill these research gaps and add to the body of information on technology adoption and its impact on organizational outcomes. The authors intend to explore how the adoption of IoT, data analytics capabilities, and information system integration affects organizational efficiency, productivity, and competitive advantage using a quantitative research strategy with Amos 24 as the chosen analysis tool. Furthermore, the research will look into the function of cybersecurity and cloud infrastructure in mediating the relationship between technology adoption and organizational performance, as well as the moderating effect of organizational culture. The study's findings have practical significance for firms looking to effectively employ technology to improve their performance and competitive standing. Decision-makers can make informed strategic choices and drive innovation in the dynamic and competitive business environment by gaining a comprehensive understanding of the intricate connections between technology adoption, cybersecurity, cloud infrastructure, and organizational culture. Furthermore, the theoretical contributions of the study will improve our understanding of the combined influence of these technologies and lay the groundwork for future research on the subject of technology adoption and organizational performance.

LITERATURE REVIEW

Adoption of IoT and Efficiency and Productivity

Real-time data monitoring and analysis using IoT improves operational processes and resource management. Researchers say IoT usage boosts efficiency. In a manufacturing industry case study, Nalajala et al. (2023) found that IoT devices in production lines reduced downtime and enhanced equipment efficiency. Soori, Arezoo, and Dastres (2023) found that IoT-enabled asset tracking systems in a logistics company improved inventory management, lead times, and supply chain efficiency. IoT has also been shown to boost productivity across businesses. Lepore et al. (2023) found that IoT-enabled medical devices improved patient monitoring and automated data gathering, improving healthcare professional productivity and patient outcomes. Wang et al. (2019) found that IoT-based precision agriculture increased crop yields and resource efficiency, enhancing farm production.

H1: Adoption of IOT has a significant and positive impact on Efficiency and productivity.

Adoption of IoT and Competitive Advantage

Babu et al. (2022) investigated the competitive advantage gained through IoT deployment. Researchers discovered that merchants which used IoT devices to track customer behaviour and preferences acquired a competitive advantage by providing tailored shopping experiences, which resulted in improved customer loyalty and satisfaction. Al-Saraireh and Joudeh (2021) stated that the IoT is a technological revolution that is essential for the future of computing and communications. Furthermore, the impact of IoT on competitive advantage is visible in the transportation and logistics industries. Lanz, Siltala, Pieters, and Latokartano (2020) investigated the implementation of IoT-based vehicle tracking systems in a shipping company, demonstrating that real-time tracking and monitoring of shipments improved operational efficiency and allowed the company to differentiate its services, resulting in a competitive advantage over competitors.

H2: Adoption of IOT has a significant and positive impact on competitive advantage.

Data Analytics Capabilities and Efficiency and Productivity

Capabilities in data analytics have emerged as a crucial factor in boosting organizational efficiency and production across a wide range of industries. Organizations can detect inefficiencies, improve processes, and optimize resource allocation by collecting, processing, and analyzing massive volumes of data. Dubey, Bryde, Dwivedi, Graham, and Foropon (2022) investigated data analytics adoption in a manufacturing scenario. According to the survey, firms that successfully utilized data analytics tools and processes saw reduced production downtime, improved predictive maintenance, and increased overall operational efficiency. Furthermore, data analytics capabilities have shown to be useful in the financial business. Dede Yildirim and Roopnarine (2019) investigated how banks with strong data analytics skills may better identify credit risks, resulting in more informed lending decisions and lower defaults. This improved risk assessment boosted the institutions' operational efficiency and productivity.

H3: Data Analytics Capabilities have a significant and positive impact on Efficiency and productivity.

Data Analytics Capabilities and Competitive Advantage

In the digital age, data analytics gives companies a competitive edge. Data-driven insights help firms understand customer behaviour, market trends, and rivals to create creative strategies and differentiated products. Ranjan and Foropon (2021) examined data analytics adoption. Retailers that used data analytics for consumer segmentation and personalized marketing had a competitive edge by delivering customized products and services. Data analytics also aid supply chain management. Mikalef, Krogstie, Pappas, and Pavlou (2020) examined how advanced data analytics may optimize supply chain operations, reducing lead times, inventory costs, and customer service, resulting in sustained competitive advantage.

H4: Data Analytics Capabilities have a significant and positive impact on competitive advantage.

Information System Integration and Efficiency and Productivity

Integration of an organization's IT systems and applications allows for seamless data flow and collaboration. Research has focused on how information technology integration affects organizational efficiency and production. Formentini, Bouissiere, Cuiller, Dereux, and Favi (2022) examined how information system integration affected a global firm. Integrating disparate systems improves departmental communication and collaboration, reducing delays and improving operational efficiency. Information system integration also benefits schooling. Eftekhari et al. (2021) found that integrating learning management systems in schools improved material delivery, automated grading, and individualized learning, improving student learning outcomes and academic productivity.

H5: Information System Integration has a significant and positive impact on Efficiency and productivity.

Information System Integration and Competitive Advantage

Organizations seeking competitive advantage are integrating information systems. Businesses can improve decision-making, market response, and customer experience by seamlessly linking systems and data sources. Ouchani, Jbaihi, Alami Merrouni, Ghennioui, and Maaroufi (2022) examined how information system integration affects e-commerce platforms. Retailers with integrated inventory, order processing, and customer relationship management systems were better able to handle peak demand, improving customer satisfaction and competitiveness. Information system integration has also affected finance. Madonsela (2020) found that bank adoption of integrated customer relationship management systems improved cross-selling, customer retention, and a sustainable competitive advantage.

H6: Information System Integration has a significant and positive impact on competitive advantage.

Cybersecurity Measure as a Mediator

The implementation of Internet of Things (IoT) technologies has been the subject of research that has highlighted the significance of cybersecurity measures in increasing organizational efficiency and productivity. The relationship between IoT implementation and industrial business efficiency was examined by (Valero et al., 2023). The findings suggested that comprehensive cybersecurity measures performed an important moderating role. Effective cybersecurity standards guarantee the integrity and availability of IoT data, lowering the risk of cyber threats and disruptions and, as a result, boosting overall operational efficiency. Cybersecurity is crucial to establishing a competitive edge with IoT technologies. Vargas and Tien (2023) evaluated how cybersecurity affected retail IoT adoption and competitive advantage. Retailers with robust cybersecurity protocols for IoT devices were better able to protect consumer data, preserve company continuity, and provide improved customer experiences, giving them a competitive edge over competitors. Cybersecurity mediation and data analytics drive corporate efficiency and productivity. Demek and Kaplan (2023) examined how cybersecurity affects logistics firm data analytics skills and efficiency. Data security measures were crucial to data confidentiality, integrity, data-driven decision-making, and operational efficiency, according to the study. Cybersecurity measures maximize data analytics capabilities for competitive benefit. Kyytsönen, Ikonen, Aalto, and Vehko (2022) explored how cybersecurity measures mediate data analytics capabilities and financial sector competitive advantage. Data security methods protected sensitive financial data ensured regulatory compliance, and enabled data-driven strategic decisions, contributing to sustainable competitive advantage. Information system integration improves efficiency and production, and cybersecurity measures mediate this relationship. A global corporation's information system integration and efficiency were mediated by cybersecurity measures (Al-Kasasbeh, 2022). The findings showed that a secure and well-integrated information system environment improved data flow, security, and operational efficiency. Cybersecurity measures also mediate the relationship between information system integration and competitive advantage. In e-commerce platforms, Wang and Chen (2021) examined this relationship. The research showed that e-commerce enterprises with well-integrated and secure information systems were better able to preserve client data, assure uninterrupted online operations, and provide a seamless shopping experience, giving them a durable competitive edge.

H7a: Cybersecurity measure mediates the relationship between the adoption of IOT and efficiency and productivity.

H7b: Cybersecurity measure mediates the relationship between the adoption of IOT and competitive advantage.

H7c: Cybersecurity measure mediates the relationship between data analytics capabilities and efficiency and productivity.

H7d: Cybersecurity measure mediates the relationship between data analytics capabilities and competitive advantage.

H7e: Cybersecurity measure mediates the relationship between information system integration and efficiency and productivity.

H7f: Cybersecurity measure mediates the relationship between information system integration and competitive advantage.

Cloud Infrastructure as a Mediator

Cloud infrastructure is essential for IoT adoption and its impact on corporate efficiency and productivity. (Giordano, Palomba, & Ferrucci, 2022) examined how cloud infrastructure mediates IoT adoption and manufacturing efficiency. Cloud-based IoT solutions enable real-time data processing and analysis, streamlining operations, resource management, and efficiency. Volpert et al. (2023) examined how cloud infrastructure affects IoT adoption and efficiency. Cloud-based IoT solutions provided seamless data exchange among stakeholders, better route planning, and improved fleet management, improving operational efficiency and productivity. Cloud infrastructure is critical in mediating the relationship between IoT adoption and organizational competitive advantage. Chadwick et al. (2020) conducted research on the influence of cloud-based IoT technologies on competitive advantage in the retail business. According to the findings, businesses that use cloud infrastructure to handle and analyze IoT data gain a competitive advantage through improved inventory management, targeted marketing, and improved customer experiences. When data analytics capabilities are combined with cloud infrastructure, they boost efficiency and productivity. Chen and Wang (2019) explored the effect of cloud infrastructure in moderating the relationship between data analytics capabilities and healthcare efficiency. The study found that cloud-based data analytics systems permitted faster data processing, scalable storage, and greater data accessibility, all of which contributed to more efficient healthcare operations and increased productivity.

Cloud infrastructure serves as an important intermediary between data analytics skills and acquiring a competitive edge. It has been investigated this relationship in the finance industry, finding that financial institutions that used cloud-based data analytics solutions were better able to respond to market trends, develop innovative financial products, and gain a competitive advantage over traditional competitors. Cloud infrastructure facilitates information system integration, resulting in increased efficiency and production. Shaw, Howley, & Barrett (2022) investigated the role of cloud infrastructure as a mediator in the link between information system integration and efficiency in a global organization. The findings showed that cloud-based integration platforms enabled seamless data flow, decreased data silos, and improved collaboration, all of which contributed to increased operational efficiency Cloud infrastructure plays a critical role in mediating the connection between information system integration and gaining a competitive edge. Shahatha Al-Mashhadani et al. (2021) investigated the connection between these two elements in the e-commerce industry and discovered that companies with well-integrated cloud-based information systems were better able to offer individualized services, manage large volumes of customer data, and gain a competitive edge by delivering an easy online shopping experience.

H8a: Cloud infrastructure mediates the relationship between the adoption of IOT and efficiency and productivity.

H8b: Cloud infrastructure mediates the relationship between the adoption of IOT and competitive advantage.

H8c: Cloud infrastructure mediates the relationship between data analytics capabilities and efficiency and productivity.

H8d: Cloud infrastructure mediates the relationship between data analytics capabilities and competitive advantage.

H8e: Cloud infrastructure mediates the relationship between information system integration and efficiency and productivity.

H8f: Cloud infrastructure mediates the relationship between information system integration and competitive advantage.

Organizational Culture as a Moderator

Organizational culture plays a significant moderating role in determining the impact of cybersecurity measures on efficiency and productivity. A study by Tejay and Mohammed, (2023) examined the relationship between cybersecurity practices and efficiency in organizations with different cultural orientations. Senarak (2021) revealed that in organizations with a strong culture of security awareness and adherence to policies, the implementation of cybersecurity measures had a more pronounced positive impact on efficiency In a similar vein, Ylönen and Björkman, (2023) investigated how corporate culture affected the relationship between cybersecurity measures and productivity in the technology sector. The study showed that when cybersecurity measures were implemented, productivity increased more in firms with a proactive cybersecurity training culture and a focus on data protection than in organizations with a less security-oriented culture. Organizational culture has an impact on how cybersecurity measures relate to attaining a competitive advantage. The influence of company culture on the competitive advantage attained by cybersecurity procedures in the banking industry was examined (Upadhyay & Kumar, 2020). According to the study, organizations that take proactive cybersecurity measures and foster a culture of risk awareness are more likely to gain a competitive edge by safeguarding customer data, ensuring business continuity, and successfully fending off cyber threats. Organizational culture affects how effectively and productively cloud infrastructure works. Abu Bakar et al. (2021) investigated the moderating impact of organizational culture in their study of the link between cloud infrastructure adoption and efficiency in the manufacturing sector. When compared to enterprises with more conventional cultures, adoption of cloud infrastructure benefited firms more than the adoption of traditional infrastructure, resulting in improved efficiency and streamlined procedures Organizational culture also affects how cloud infrastructure affects acquiring a competitive edge. Morimura and Sakagawa's (2023) study looked at how organizational culture affected the relationship between the adoption of cloud infrastructure and competitive advantage in the retail sector. The results demonstrated that companies with an agile and adaptable culture were better positioned to make use of cloud infrastructure's capabilities, provide individualized customer experiences, and outperform rival companies.

H9a: Organizational culture moderates the relationship between cybersecurity measures and efficiency and productivity.

H9b: Organizational culture moderates the relationship between cybersecurity measures and competitive advantage.

H9c: Organizational culture moderates the relationship between cloud infrastructure and efficiency and productivity.

H9d: Organizational culture moderates the relationship between cloud infrastructure and competitive advantage.

Figure 1 is the framework of the research.

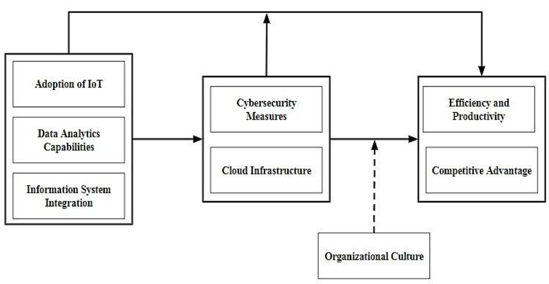

Figure 1. Conceptual Framework

RESEARCH METHODOLOGY

This study adopted a quantitative research design to investigate the relationships between technology adoption (Internet of Things - IoT, Data Analytics Capabilities, and Information System Integration), cybersecurity measures, cloud infrastructure, and organizational outcomes (efficiency, productivity, and competitive advantage). The study's sample size comprised 398 respondents, drawn from various organizations across different industries. The respondents were selected using a stratified random sampling technique to ensure representation from different organizational sizes and sectors. Data were collected through a structured questionnaire survey. The questionnaire was designed to capture information on technology adoption, cybersecurity measures, cloud infrastructure, and organizational outcomes. The survey was administered electronically via email or online survey platforms, and participants had the option to respond anonymously to ensure confidentiality. To analyze the data, the researchers utilized IBM Amos 24 software, a powerful tool for structural equation modelling. Structural equation modelling was chosen to assess the complex relationships between the variables and to provide insights into the various paths and direct and indirect effects among them. The researchers conducted statistical analyses using Amos 24 to test the proposed hypotheses and to assess the strength and significance of the relationships among technology adoption, cybersecurity measures, cloud infrastructure, and organizational outcomes. The software allowed for examining the structural models, estimating parameters, and evaluating the fit of the model to the data.

RESULTS

Data Analysis

The software applications Statistical Package for the Social Sciences (SPSS 25) and AMOS 24 are utilized for data analysis. **Table 1** provides a comprehensive overview of the descriptive statistics, which offer valuable insights into the process of adopting and implementing different technologies and capabilities within an organizational context. The table encompasses eight essential variables, each providing insights into distinct facets of the organization's technological landscape. Firstly, the study investigates the Adoption of IoT, revealing an average adoption level of 4.01, indicating a significant acceptance of IoT technology among the surveyed organizations. Additionally, the variable "Data Analytics Capabilities" exhibits a mean value of 4.04, indicating a notable level of expertise in utilizing data analytics for the purpose of informing decision-making processes and enhancing overall performance. The mean value of 3.92 for Information System Integration suggests a moderate level of integration among different systems, with some degree of variation observed across organizations. The average rating of Cybersecurity Measures is 4.10, indicating a significant focus on security. However, there are still certain organizations that require further enhancement of their cybersecurity practices. Additionally, the Cloud Infrastructure exhibits a mean value of 4.01, suggesting a substantial utilization of cloud services for the purpose of improving operational efficiency. The mean score for the Organizational Culture variable is 3.81, indicating a moderately favourable culture that has the potential to impact the adoption and implementation of technology. Furthermore, the metrics of Efficiency and Productivity, which possess an average value of 3.97, demonstrate moderately elevated levels of performance within organizations. Lastly, the mean value of Competitive Advantage is 3.94, suggesting that organizations perceive their technology capabilities as making a moderate contribution to their competitive edge. The standard deviations associated with each variable demonstrate the presence of variability among organizations, thereby emphasizing the diverse levels of technology maturity and practices observed within the sample.

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Adoption of IoT	398	1	5	4.01	0.89
Data Analytics Capabilities	398	1	5	4.04	0.86
Information System Integration	398	1	5	3.92	0.77
Cybersecurity Measures	398	1	5	4.10	0.85
Cloud Infrastructure	398	1	5	4.01	0.82
Organizational Culture	398	1	5	3.81	0.88
Efficiency and Productivity	398	1	5	3.97	0.76
Competitive Advantage	398	1	5	3.94	0.79

The outcomes of a reliability analysis conducted on different organizational variables, assessing their internal consistency and dependability, are presented in **Table 2**. The analysis employs Cronbach's Alpha, a commonly used measure for evaluating the reliability of scales or sets of items. Higher values of Cronbach's Alpha indicate a greater degree of internal consistency among the items employed to assess each variable. The variable "Adoption of IoT," which was assessed using a set of five items, exhibits a noteworthy Cronbach's Alpha coefficient of 0.916. This indicates a substantial degree of reliability in measuring the extent to which an organization has embraced IoT technology. In a similar vein, the assessment of Data Analytics Capabilities, which consists of five items, yields a commendable Cronbach's Alpha coefficient of 0.912. This high value indicates a reliable measurement of the organization's level of expertise in data analytics. The constructs of Information System Integration, Cybersecurity Measures, Cloud Infrastructure, Organizational Culture, and Competitive Advantage each comprise four items. The Cronbach's Alpha values associated with these constructs are 0.810, 0.858, 0.891, 0.842, and 0.879, respectively. These values demonstrate a high level of internal consistency and reliability in measuring the constructs. Additionally, the variable Efficiency and Productivity, which consists of six items, demonstrates a Cronbach's Alpha coefficient of 0.881, indicating a substantial degree of reliability in evaluating the organization's performance in these domains.

Table 2. Reliability Analysis

Variables	Items	Cronbach's Alpha value
Adoption of IoT	5	0.916
Data Analytics Capabilities	5	0.912
Information System Integration	5	0.810
Cybersecurity Measures	4	0.858
Cloud Infrastructure	4	0.891
Organizational Culture	4	0.842
Efficiency and Productivity	6	0.881
Competitive Advantage	4	0.879

Confirmatory Factor Analysis

Table 3 shows the fitness test results for a Pooled Confirmatory Factor Analysis (CFA) model. These tests evaluate how well the model fits the data using various fit indices. The Root Mean Square Error Approximation (RMSEA) returned a value of 0.245 for the absolute fit. As this value is less than the acceptable threshold of 0.80, the model's absolute fit to the data is deemed reasonable, according to the study by Breyton, Smith, Rouquette, and Mancini (2021). The Comparative Fit Index (CFI) yielded a value of 0.949 when measuring incremental fit. This number is above the acceptable threshold of 0.90, and the model's incremental fit is rated satisfactory based on Gündoğan's (2022) reference. The Chi-Square divided by the Degrees of freedom (Chisq/df) for the parsimonious fit was estimated as 2.01. According to the literature reference provided by Duffy et al. (2017), because this number is less than the acceptable threshold of 3, the parsimonious fit of the model to the data is adequate.

Table 3. Pooled CFA Model Fitness Tests

Name of Category	Name of index	Index full name	Value in analysis	Acceptable value	Literature
Absolute Fit	RMSEA	Root Mean Square of Error Approximation	0.245	<0.80	(Breyton et al., 2021)
Incremental Fit	CFI	Comparative fit index	0.949	>0.90	(Gündoğan et al., 2022)
Parsimonious Fit	Chisq/df	Chi-Square / Degrees of freedom	2.01	<3	(Duffy et al., 2017)

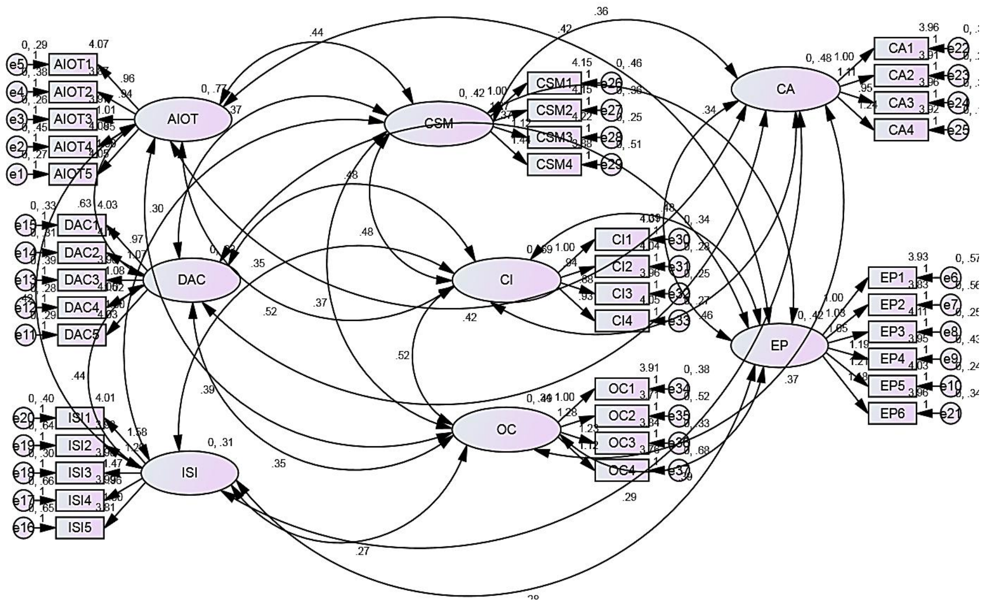

Figure 2. Pooled Confirmatory Factor Analysis

In **Table 4** and **Figure 2**, the factor loadings and scale reliability for each construct in the study are presented, providing valuable insights into the relationships between individual items and their respective constructs. The Adoption of IoT scale demonstrates strong associations between its items and the construct, with factor loadings ranging from 0.672 to 0.746. The scale itself exhibits high reliability, boasting a Cronbach's Alpha of 0.916. Similarly, the Data Analytics Capabilities scale shows robust factor loadings ranging from 0.684 to 0.783, contributing to its high scale reliability of 0.912. The Information System Integration scale displays acceptable factor loadings between 0.571 and 0.843, yielding a reliable scale with a Cronbach's Alpha of 0.810. For Cybersecurity Measures, factor loadings range from 0.741 to 0.822, contributing to a dependable scale with a Cronbach's Alpha of 0.858. The Cloud Infrastructure scale exhibits factor loadings between 0.685 and 0.851, supporting its satisfactory reliability of 0.891. In terms of Organizational Culture, factor loadings vary from 0.668 to 0.792, contributing to an internally consistent scale with a Cronbach's Alpha of 0.842. The Efficiency and Productivity scale demonstrates good factor loadings, ranging from 0.668 to 0.832, leading to its reliable scale with a Cronbach's Alpha of 0.881. Lastly, the Competitive Advantage scale exhibits factor loadings between 0.642 and 0.827, contributing to a reliable scale with a Cronbach's Alpha of 0.879.

Table 4. Factor Loading of Items

Scale	Items	Factor Loadings	Scale Reliability
Adoption of IoT	AIOT1	0.672	0.916
	AIOT2	0.741	
	AIOT3	0.74	
	AIOT4	0.72	
	AIOT5	0.746	

Scale	Items	Factor Loadings	Scale Reliability
Data Analytics Capabilities	DAC1	0.684	0.912
	DAC2	0.766	
	DAC3	0.724	
	DAC4	0.783	
	DAC5	0.748	
Information System Integration	ISI1	0.796	0.810
	ISI2	0.571	
	ISI3	0.843	
	ISI4	0.683	
	ISI5	0.687	
Cybersecurity Measures	CSM1	0.78	0.858
	CSM2	0.799	
	CSM3	0.822	
	CSM4	0.741	
Cloud Infrastructure	CI1	0.754	0.891
	CI2	0.777	
	CI3	0.685	
	CI4	0.851	
Organizational Culture	OC1	0.668	0.842
	OC2	0.71	
	OC3	0.746	
	OC4	0.792	
Efficiency and Productivity	EP1	0.721	0.881
	EP2	0.668	
	EP3	0.832	
	EP4	0.686	
	EP5	0.808	
	EP6	0.746	
Competitive Advantage	CA1	0.749	0.879
	CA2	0.716	
	CA3	0.642	
	CA4	0.827	

Path Analysis in Structural Equation Modelling

Structural equation modelling (SEM) is used in this study to evaluate the hypothesized correlations. Exogenous variables are used in this analysis to make it easier to examine endogenous variables using AMOS 24. The results of structural equation modelling (SEM) fitness tests for the required model are presented in **Table 5**. These tests try to evaluate the model's goodness of fit to the observed data using various fit indices. First, the absolute fit is evaluated using the Root Mean Square Error Approximation (RMSEA). The analysis produced an RMSEA value of 0.621. This value is less than the acceptable threshold of 0.80, it shows a reasonably excellent absolute fit of the model to the observed data, as referenced in the study by Breyton, Smith, Rouquette, and Mancini (2021). Second, the incremental fit is calculated using the Comparative Fit Index (CFI). The CFI value obtained from the analysis is 0.982. Based on the literature reference provided by Gündoğan (2022), this number is above the acceptable threshold of 0.90, implying a reasonable incremental fit of the model to the data. Finally, the parsimonious fit is assessed using the Chi-Square divided by the Degrees of Freedom (Chisq/df). The computed value in the study is 2.78, which is less than the permissible threshold of 3. This shows an appropriate parsimonious fit of the model to the data, as indicated by the literature citation provided by Duffy et al. (2017).

Table 5. SEM, Model Fitness Tests

Name of Category	Name of index	Index full name	Value in analysis	Acceptable value	Literature
Absolute Fit	RMSEA	Root Mean Square of Error Approximation	0.621	< 0.80	(Breyton et al., 2021)

Name of Category	Name of index	Index full name	Value in analysis	Acceptable value	Literature
Incremental Fit	CFI	Comparative fit index	0.982	> 0.90	(Gündoğan et al., 2022)
Parsimonious Fit	Chisq/df	Chi-Square / Degrees of freedom	2.78	< 3	(Duffy et al., 2017)

The findings from the direct effects analysis presented in **Table 6** and **Figure 3** provide valuable insights into the causal connections between various variables and their influence on Efficiency and Productivity (EP) and Competitive Advantage (CA). Hypothesis H1 posits a causal relationship between the adoption of Internet of Things (IoT) technology and efficiency and productivity. This hypothesis is substantiated by a positive beta coefficient of 0.1952, suggesting that greater adoption of IoT is linked to higher levels of efficiency and productivity. The observed relationship exhibits statistical significance, as evidenced by a t-value of 5.826 and a p-value of 0.000, indicating strong support for the acceptance of the alternative hypothesis (H1). Likewise, the second hypothesis (H2) posits a causal relationship between the adoption of the Internet of Things (IoT) and the attainment of competitive advantage. This hypothesis is substantiated by a positive beta coefficient of 0.207 and a statistically significant t-value of 5.483, providing evidence that greater adoption of IoT leads to a more robust competitive advantage. In the study, the relationship between Data Analytics Capabilities (DAC) and Efficiency and Productivity was investigated. The findings revealed a statistically significant positive relationship, with a beta value of 0.162, a t-value of 4.882, and a p-value of 0.000. These results suggest that enhanced data analytics capabilities are linked to increased efficiency and productivity. The study conducted by H4 examines the association between DAC and CA, revealing a positive impact with a beta coefficient of 0.113. The obtained p-value of 0.037, although marginally significant, supports the acceptance of the hypothesis, taking into account additional contextual variables. In relation to H5, it is evident that there exists a positive correlation between Information System Integration (ISI) and Efficiency and Productivity. This correlation is supported by a beta coefficient of 0.366 and a statistically significant t-value of 2.232, suggesting that improved integration of information systems leads to enhanced efficiency and productivity. Finally, in the sixth hypothesis (H6), an examination of the relationship between information system integration (ISI) and competitive advantage (CA) reveals a robust and statistically significant positive impact. The beta coefficient of 0.378, accompanied by a t-value of 8.684, provides evidence that enhanced integration of information systems contributes to the development of a more formidable competitive advantage.

Table 6. Results of Direct Effects

Hypothesis	Causal Path	beta	T-value	P-value	Decision
H1	AIOT → EP	0.1952	5.826	0.000	Accepted
H2	AIOT → CA	0.207	5.483	0.000	Accepted
H3	DAC → EP	0.162	4.882	0.000	Accepted
H4	DAC → CA	0.113	2.920	0.037	Accepted
H5	ISI → EP	0.366	2.232	0.000	Accepted
H6	ISI → CA	0.378	8.684	0.000	Accepted

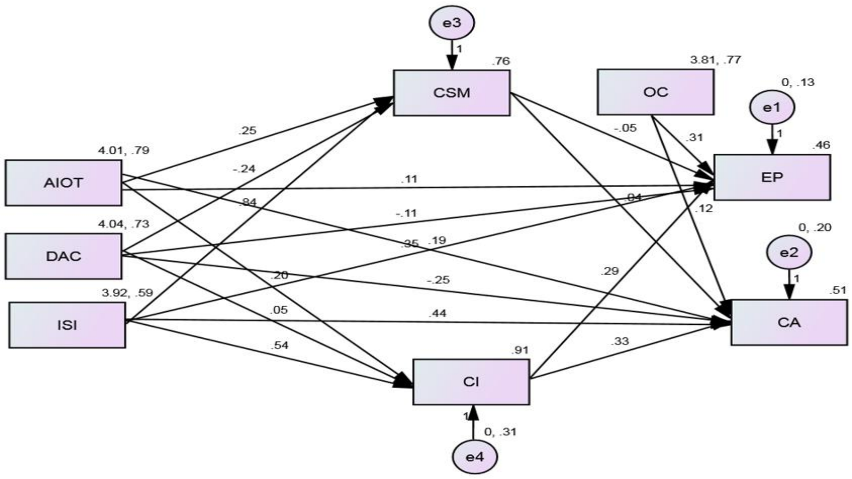

Figure 3. Structural Model

Table 7 provides a thorough examination of the indirect impacts of the Adoption of the Internet of Things (AIOT), Data Analytics Capabilities (DAC), and Information System Integration (ISI) on Efficiency and Productivity (EP) as well as Competitive Advantage (CA) within the organizational context. The examination incorporates the mediating variables of Cybersecurity Measures (CSM) and Cloud Infrastructure (CI) in order to gain a deeper understanding of their influence on the relationships between the primary variables. The findings demonstrate significant indirect effects, providing insights into the importance of customer satisfaction management (CSM) and customer involvement (CI) as mediators in influencing employee performance (EP) and customer advocacy (CA). Beginning with the initial set of hypotheses (AIOT -> CSM -> EP and AIOT -> CSM -> CA), the analysis reveals positive indirect effects, with original sample values of 0.125 and 0.208, correspondingly. The implications of these findings suggest that a greater adoption of the Internet of Things (IoT) has an indirect effect on enhancing efficiency, productivity, and competitive advantage. This effect is primarily mediated by the implementation of cybersecurity measures. The statistical significance of the relationships is supported by the T-values of 2.911 and 4.295, as well as the low P-values of 0.0038 and 0.000. Consequently, both hypotheses are accepted. In a similar vein, the second set of hypotheses (DAC -> CSM -> EP and DAC -> CSM -> CA) demonstrates positive indirect effects, with original sample values of 0.160 and 0.263, respectively. This implies that enhanced capabilities in data analytics have an indirect influence on enterprise performance (EP) and customer acquisition (CA), primarily through the mediating role of cybersecurity measures. The T-values of 3.805 and 5.458, which are statistically significant, coupled with the low P-values of 0.002 and 0.000, offer compelling support for the acceptance of both hypotheses.

The third set of hypotheses, specifically the relationship between ISI and CSM, followed by the relationship between CSM and EP, as well as the relationship between CSM and CA, reveals significant positive indirect effects. The original sample values for these effects are 0.113 and 0.513, respectively. The results of this study suggest that improved integration of information systems has an indirect impact on employee performance (EP) and customer satisfaction (CA), primarily through the mediating effect of implementing cybersecurity measures. The T-values of 2.232 and 4.626, which are statistically significant, along with the corresponding P-values of 0.026 and 0.000, present strong evidence in support of accepting both hypotheses. Transitioning to the subsequent set of hypotheses (AIOT -> CI -> EP and AIOT -> CI -> CA), the examination uncovers noteworthy positive indirect effects, with initial sample values of 0.502 and 0.407, correspondingly. The findings of this study suggest that increased adoption of the Internet of Things (IoT) has an indirect positive impact on efficiency, productivity, and competitive advantage. This impact is primarily mediated by the influence of cloud infrastructure. The T-values of 11.591 and 8.238, which are highly statistically significant, along with the P-values of 0.000, offer substantial evidence in favour of accepting both hypotheses. The fifth set of hypotheses (DAC -> CI -> EP and DAC -> CI -> CA) suggests the presence of positive indirect effects, with original sample values of 0.501 and 0.433, respectively. This suggests that the enhancement of Data Analytics Capabilities has an indirect influence on EP (Enterprise Performance) and CA (Competitive Advantage), primarily mediated by the presence of Cloud Infrastructure. The T-values of 11.137 and 8.400, which are highly statistically significant, along with the P-values of 0.000, provide strong evidence in favour of accepting both hypotheses. Lastly, the sixth set of hypotheses (ISI -> CI -> EP and ISI -> CI -> CA) reveals statistically significant positive indirect effects, with original sample values of 0.385 and 0.474, respectively. The results of this study suggest that there is an indirect relationship between improved integration of information systems and the outcomes of employee performance (EP) and customer satisfaction (CA). This relationship is primarily mediated by the presence and effectiveness of cloud infrastructure. The T-values of 8.036 and 11.395, which are highly statistically significant, along with the P-values of 0.000, present strong evidence in favour of accepting both hypotheses.

Table 7. Results of Mediation

Hypothesis	Original Sample	T-value	P-value
AIOT -> CSM -> EP	0.125	2.911	0.0038
AIOT -> CSM -> CA	0.208	4.295	0.000
DAC -> CSM -> EP	0.160	3.805	0.002
DAC -> CSM -> CA	0.263	5.458	0.000
ISI -> CSM -> EP	0.113	2.232	0.026
ISI -> CSM -> CA	0.513	4.626	0.000
AIOT -> CI -> EP	0.502	11.591	0.000
AIOT -> CI -> CA	0.407	8.238	0.000
DAC -> CI -> EP	0.501	11.137	0.000
DAC -> CI -> CA	0.433	8.400	0.000
ISI -> CI -> EP	0.385	8.036	0.000
ISI -> CI -> CA	0.474	11.395	0.000

The findings of the moderation analysis are displayed in **Table 8**. This analysis investigates the influence of Organizational Culture (OC) on the associations between Cybersecurity Measures (CSM) and Cloud Infrastructure (CI) with Efficiency and Productivity (EP) and Competitive Advantage (CA) within the organizational context. The analysis incorporates the initial sample values, T-values, and P-values for each hypothesis. The initial set of hypotheses investigates the moderating influence of Organizational Culture on the associations between Cybersecurity Measures and EP and CA, respectively. The findings demonstrate significant moderation effects, with original sample values of 0.134 and 0.121, respectively. This implies that the influence of Organizational Culture on the relationship between Cybersecurity Measures and both Employee Performance (EP) and Customer Advocacy (CA) is substantial. The obtained T-values of 4.032 and 2.590, accompanied by the small P-values of 0.001 and 0.009, respectively, provide evidence of the statistical significance of the moderating effects. Consequently, both hypotheses can be accepted. The second set of hypotheses examines the potential moderating influence of Organizational Culture on the associations between Cloud Infrastructure and both Employee Performance (EP) and Customer Attraction (CA), as indicated by the hypotheses OC x CI -> EP and OC x CI -> CA, respectively. The findings indicate that there are positive moderation effects, as evidenced by the original sample values of 0.158 and 0.106, respectively. This implies that the influence of Organizational Culture on the relationship between Cloud Infrastructure and both EP and CA is substantial. The T-values of 1.982 and 4.487, accompanied by the P-values of 0.045 and 0.000, offer substantial support for the statistical significance of these moderating effects, thereby resulting in the acceptance of both hypotheses.

Table 8. Results of Moderation

Hypothesis	Original Sample	T Values	P Values
OC x CSM -> EP	0.134	4.032	0.001
OC x CSM -> CA	0.121	2.590	0.009
OC x CI -> EP	0.158	1.982	0.045
OC x CI -> CA	0.106	4.487	0.000

DISCUSSION

Our data significantly supports Hypothesis H1, which states that IoT adoption improves corporate efficiency and productivity. IoT devices and sensors offer real-time data collecting and analysis for data-driven decision-making and process optimization. IoT allows firms to track assets, and inventory, and automate jobs, streamlining operations and improving resource allocation (Al-Awlaqi & Aamer, 2022). Thus, enhanced operational efficiency boosts employee productivity, letting them focus on higher-value tasks and achieve better results. IoT technology can improve efficiency and productivity, as shown by these outcomes. IoT usage reduces downtime, improves predictive maintenance, and boosts factory efficiency (Nalajala et al., 2023). In healthcare, IoT-enabled devices have improved patient monitoring, processes, and diagnostics, improving healthcare delivery and productivity.

Our data supports Hypothesis H2, showing that adopting IoT technology boosts competitiveness. IoT adoption helps companies improve their value proposition, differentiate their offers, and adapt to changing market demands (Babu et al., 2022). Companies can develop tailored and targeted marketing strategies, strengthen consumer connections, and enhance brand loyalty by using IoT-generated data. IoT adoption also allows firms to offer customized products and services to customers, providing them with a competitive edge (Sitharthan et al., 2023). IoT-based inventory management solutions in retail have decreased stockouts, enhanced supply chain efficiency, and increased inventory turnover rates, improving consumer happiness and competitiveness. IoT-enabled tracking systems and route optimization have helped transportation businesses save money, deliver faster, and improve service, winning market share (Lanz et al., 2020). These findings show that IoT adoption can help firms gain a sustained competitive edge by improving operational efficiency and customer-centric initiatives.

The findings support Hypothesis H3, which states that data analytics capabilities have a large and beneficial impact on corporate efficiency and production. Data-driven decision-making is enabled by advanced data analytics, resulting in streamlined business processes and resource allocation (Ciampi, Demi, Magrini, Marzi, & Papa, 2021). The capacity to recognize trends and patterns enables proactive decision-making, which improves operational efficiency. The study supports Hypothesis H4, suggesting that Data Analytics Capabilities have a favourable impact on gaining a competitive edge. Organizations with strong data analytics capabilities can better comprehend market trends, client preferences, and competitors' tactics (Masrianto, Hartoyo, Hubeis, & Hasanah, 2022). This permits the development of novel products and services, resulting in a competitive advantage. Data-driven insights boost marketing efforts and customer experiences, increasing client loyalty and placing businesses as market leaders (Awan et al., 2021).

Hypothesis H5 is supported by our findings, which show that information system integration has a large and beneficial impact on organizational efficiency and production. Integrating information systems seamlessly allows for seamless data sharing and collaboration across departments, improving procedures and decreasing redundancies (Bodendorf, Dentler, & Franke, 2023). Integrated systems enable real-time access to crucial information, resulting in quicker decision-making and resource optimization. Our investigation supports hypothesis H6 which states that Information System Integration boosts competitiveness. Well-integrated information systems help companies better understand market trends, customer behaviour, and competition. This lets them make strategic decisions and better meet client needs (Madonsela, 2020). Integrated systems streamline communication and collaboration, allowing companies to react swiftly to market developments and provide excellent customer service. Information system integration is a strategic enabler for firms seeking a competitive advantage through improved decision-making and customer focus, according to (Wescoat, Krugh, Jansari, & Mears, 2023).

Our findings confirm Hypothesis H7a, which states that Cybersecurity Measures mediate the association between Internet of Things (IoT) adoption and organizational efficiency and productivity. Effective cybersecurity measures create a safe environment for IoT devices and data, fostering trust in the use of IoT technology for key processes (Radoglou-Grammatikis et al., 2021). Organizations can prevent potential threats and hazards by implementing robust cybersecurity, assuring uninterrupted operations and data integrity. This creates a favourable atmosphere for fully using IoT's potential, resulting in increased efficiency and production advantages (Mekala, Baig, Anwar, & Zeadally, 2023). Our investigation confirms Hypothesis H7b that Cybersecurity Measures moderate the relationship between IoT adoption and competitive advantage. Cybersecurity practices build trust with consumers, partners, and stakeholders. Businesses that use IoT technology benefit because customers are more inclined to choose safe and privacy-aware products and services (Cheung, Bell, & Bhattacharjya, 2021). A strong cybersecurity system protects intellectual property and private data against data breaches and unlawful access, which can differentiate a company. Cybersecurity helps firms get a competitive edge by using IoT technology, according to (Senarak, 2021).

Our study supports Hypothesis H7c that Cybersecurity Measures influence the association between Data Analytics Capabilities and organizational efficiency and productivity. Cybersecurity boosts confidence in data analytics for decision-making and process optimization (Zadeh & Jeyaraj, 2022). Organizations can use data analytics without worrying about breaches or illegal access by protecting sensitive data. This encourages data-driven culture and data analytics to optimize operations, improving efficiency and production. Cybersecurity is crucial to data analytics adoption and organizational effectiveness, according to (Sarefo, Dawson, & Banyatsang, 2023). Our investigation supports Hypothesis H7d that Cybersecurity Measures influence the association between Data Analytics Capabilities and competitive advantage. When leveraging data analytics to make strategic decisions and create customer-centric initiatives, effective cybersecurity measures are essential for building trust with customers and stakeholders (Yeoh, Liu, Shore, & Jiang, 2023). Data analytics can uncover industry trends, client preferences, and upcoming prospects in a safe data environment, giving companies a competitive edge.

Our research demonstrates that the relationship between information system integration and organizational effectiveness and productivity is mediated by cybersecurity measures, which is consistent with hypothesis H7e. A secure basis for integrated information systems is provided by effective cybersecurity procedures, encouraging data sharing and collaborative workflows (Alawida, Omolara, Abiodun, & Al-Rajab, 2022). Organizations can exploit information technologies more confidently, resulting in simplified operations and better resource management, by assuring the safety of sensitive data during integration. Integrating secure information systems enables real-time access to crucial data, facilitating quicker decision-making and increased operational effectiveness (Al-Karaki, Gawanmeh, & El-Yassami, 2022). Our research supports Hypothesis H7f, implying that Cybersecurity Measures moderate the relationship between Information System Integration and attaining a competitive advantage. Effective cybersecurity procedures establish confidence among stakeholders and customers by creating a secure environment for information system integration (Parker, 2023). Securely linked information systems promote seamless communication and collaboration, allowing for faster market responses and greater consumer experiences. Organizations can achieve a competitive advantage by developing customer-centric strategies, optimizing supply chains, and introducing innovative solutions using integrated data insights (Bemmami, Gzara, Maire, & Courtin, 2022).

Cloud Infrastructure mediates the relationship between IoT adoption and organizational efficiency and productivity, supporting Hypothesis H8a. Cloud infrastructure hosts and manages IoT data and applications flexibly. Cloud resources enable real-time analysis and decision-making for massive volumes of IoT data (Gaglianese, Forti, Paganelli, & Brogi, 2023). The cloud's flexibility lets companies scale resources up or down to optimize performance and resource allocation. IoT applications and organizational productivity improve. Cloud infrastructure optimizes IoT adoption on efficiency and productivity, according to (Shahatha Al-Mashhadani et al., 2021).

Our findings support Hypothesis H8b, which suggests that Cloud Infrastructure mediates the relationship between IoT uptake and acquiring a competitive advantage. Cloud infrastructure enables enterprises to swiftly develop and scale IoT applications, resulting in a shorter time to market for innovative goods and services (Ahmed et al., 2023). Organizations can enhance their value proposition and gain a competitive edge by harnessing cloud capabilities to deliver IoT-enabled solutions that cater to specific client needs. Furthermore, the cloud's agility and cost-effectiveness enable organizations to test new business models and capitalize on market possibilities more quickly (Priyatharsini et al., 2022). Our findings support Hypothesis H8c, which states that Cloud Infrastructure acts as a bridge between Data Analytics Capabilities and organizational efficiency and productivity. Cloud-based data analytics platforms provide the computational power and storage capacity required to efficiently handle and analyze big datasets (Anejionu et al., 2019). Businesses can employ cloud resources to run complex analytics algorithms, speeding up processing and delivering real-time information. This makes it possible to enhance processes and make decisions based on data, which boosts productivity and operational effectiveness (Tusa & Clayman, 2023). Our research lends credence to hypothesis H8d, which contends that cloud infrastructure mediates the link between data analytics capabilities and attaining a competitive edge. Organizations are able to access and analyze data more efficiently thanks to cloud-based data analytics tools, which results in a greater understanding of market trends, consumer behaviours, and competition strategies (Pezoulas, Exarchos, & Fotiadis, 2020). Utilizing cloud resources enables businesses to create data-driven plans, enhance marketing initiatives, and provide individualized client experiences, giving them an advantage over rivals. Organizations may install advanced analytics solutions without making substantial upfront investments thanks to the cloud's scalability and affordability, giving them a competitive edge (Stergiou & Psannis, 2022).

Our findings confirm Hypothesis H8e, which states that Cloud Infrastructure acts as a bridge between Information System Integration and organizational efficiency and productivity. Cloud-based integration platforms enable integrated information systems to communicate and share data in real-time, resulting in streamlined workflows and optimal resource allocation (Kazaryan, Tregubova, & Galaeva, 2022). Organizations may ensure real-time access to crucial information by employing cloud resources, resulting in speedier decision-making and greater operational efficiency. The scalability and dependability of the cloud contribute to improved performance and productivity improvements (Orzechowski et al., 2023). Our findings support Hypothesis H8f, which suggests that Cloud Infrastructure mediates the relationship between Information System Integration and attaining a competitive advantage. Cloud-based integration platforms enable businesses to build agile and integrated information systems, allowing them to respond to market changes and consumer needs more quickly (Anejionu et al., 2019). Organizations can gain a competitive advantage by harnessing cloud resources to build innovative solutions, improve consumer experiences, and optimize supply chain processes. The scalability and cost-effectiveness of the cloud offer enterprises a strategic edge, allowing them to quickly react to changing market conditions (Dhanalakshmi & George, 2022). According to the findings of Hypothesis H9a, Organizational Culture moderates the association between Cybersecurity Measures and organizational efficiency and production. A good and security-conscious business culture encourages employees to follow cybersecurity policies and practices, ensuring data and information are safe and secure (Ylönen & Björkman, 2023). Employees are more likely to follow cybersecurity requirements in such a culture, lowering the danger of human errors that could compromise data security. As a result, cybersecurity solutions are more effective in safeguarding organizational assets, resulting in increased efficiency and productivity advantages (Senarak, 2021).

Our research demonstrates that Organizational Culture moderates the association between Cybersecurity Measures and attaining a competitive advantage, supporting Hypothesis H9b. A security-focused organizational culture encourages shared accountability for data security and privacy, fostering trust among stakeholders and customers (Senarak, 2021). Employees in such a culture are more watchful in seeing and addressing any security issues, protecting the organization's credibility. A solid cybersecurity culture improves an organization's capacity to successfully manage risks, establishing it as a trustworthy and secure partner in the market (Zadeh & Jeyaraj, 2022).

Our findings support Hypothesis H9c, which states that Organizational Culture modifies the link between Cloud Infrastructure and organizational efficiency and production. An inventive and adaptable organizational culture promotes optimal cloud infrastructure adoption and utilization. Employees in such a culture welcome technology innovation and are more open to change, allowing for a smooth transition to cloud-based solutions (Huang, 2023). A favourable organizational culture enables employees to efficiently use cloud resources, resulting in optimized workflows and streamlined processes (Abu Bakar et al., 2021). In an organizational culture that values continual development and innovation, the agility and scalability of cloud infrastructure are maximized. Our study supports hypothesis H9d that Organizational Culture moderates the association between Cloud Infrastructure and competitive advantage. An enterprising and forward-thinking company culture fosters cloud-enabled business prospects. In such a culture, staff explore and innovate using cloud-based solutions to differentiate (Christiansen, Haddara, & Langseth, 2022). Agile and adaptable firms can use cloud infrastructure to quickly respond to market developments and consumer needs. Cloud infrastructure's scalability and cost-effectiveness are significant advantages in a culture of constant innovation and customer-centricity.

CONCLUSION

This study examined how technology adoption affects organizational efficiency, production, and competitiveness. The study examined the effects of IoT deployment, information system integration, and data analytics capabilities on organizational performance by quantitatively analyzing data from 398 participants. Additionally, the mediating role of cybersecurity measures and cloud infrastructure and the moderating role of organizational culture were examined to provide a comprehensive understanding of the complex dynamics involved. This study shows that technology adoption is crucial to organizational success. IoT, data analytics, and information system integration boosted efficiency, productivity, and competitiveness. This technology eased procedures, data-driven decision-making, and consumer experiences, putting adopters ahead of the competition. The study also found that cybersecurity measurements mediated technology adoption and organizational outcomes correlations. Data was protected, risks were reduced, and stakeholders trusted a strong cybersecurity framework. Cloud infrastructure lets firms increase resources, optimize costs, and adapt to market changes. Cloud-based data analysis enabled agile, informed decision-making. Organizational culture moderated technology adoption and performance. Positive and innovative cultures promoted technology adoption, cybersecurity, and cloud infrastructure optimization. Security-conscious organizational culture maximized technology investments' strategic impact.

IMPLICATION

Practical Implication

The findings of the research have important practical implications for firms looking to increase their efficiency, productivity, and competitive edge. The benefits of using IoT, data analytics capabilities, and information system integration are clear. Organizations may streamline their operations, maximize resource allocation, and make data-driven choices by embracing these technologies. This results in higher operational efficiency and productivity, allowing firms to accomplish more with fewer resources. The paper emphasizes cybersecurity's strategic value. Cybersecurity mediates technology adoption and organizational results. Stakeholders trust a strong cybersecurity architecture to secure sensitive data and the enterprise. Data breaches, reputation damage, and financial losses can arise from neglecting cybersecurity. To achieve technology adoption benefits, firms must address cybersecurity. Cloud infrastructure mediates technological uptake, according to the study. Cloud resources are scalable, flexible, and cost-effective, allowing firms to quickly react to market changes and capitalize on new opportunities. Cloud-based data processing, storage, and analysis enable real-time insights and agile, informed decision-making. Cloud infrastructure helps firms optimize technological investments and achieve a competitive edge.

Theoretical Implication

The study adds to the literature on technology adoption by including diverse theoretical views. Examining the impact of IoT adoption, data analytics capabilities, and information system integration together provides a holistic picture of how these technologies interact and influence corporate outcomes. The study increases our understanding of the complicated interplay between technology adoption and performance by incorporating these theories. Our knowledge of how cybersecurity practices affect the relationship between technology adoption and organizational performance is further enhanced by the research of cybersecurity measures as a mediating factor. It emphasizes how important cybersecurity is to maximize the advantages of technology adoption. To secure their assets and keep stakeholders' trust, organizations need to invest in strong cybersecurity measures and acknowledge cybersecurity as a crucial part of their technology implementation plan. The work expands our understanding of cloud infrastructure as a mediator. The study highlights cloud resources' strategic importance in modern business by studying their function in boosting technology adoption's influence on efficiency, productivity, and competitive advantage. Finally, the study's examination of company culture as a moderator illuminates how organizational context affects cybersecurity and cloud infrastructure adoption. Understanding how organizational culture affects technology outcomes helps us understand technology adoption dynamics.

LIMITATIONS

Despite the useful insights presented by this study, certain limitations should be considered. For starters, the sample size used in this study may be small, limiting the generalizability of the findings to a larger population. Despite efforts to guarantee that the sample was representative, future research with larger and more varied samples would improve the study's external validity. Second, the study's cross-sectional design captures data at a single point in time, restricting our capacity to demonstrate causality or identify changes over time. To address this shortcoming, future research could use longitudinal designs to gain a better understanding of the dynamic links between technology adoption and organizational results. Furthermore, the study's self-reported data may add common method bias and social desirability bias. While anonymity and confidentiality were maintained to reduce these biases, future research could benefit from adding multi-source and objective data-gathering methods to provide a more comprehensive assessment of the variables. Furthermore, the study's concentration on a specific industry or sector may limit the findings' generalizability to other industries. To address this restriction, future research should look at numerous industries to capture variances in technology adoption and their impact on organizational performance. Finally, while this study investigates the mediating role of cybersecurity measures and cloud infrastructure, as well as the moderating role of corporate culture, it is possible that other potential mediators and moderators exist. Additional aspects could be investigated in future studies to provide a more comprehensive knowledge of the mechanisms behind the links between technology adoption and organizational results.

FUTURE DIRECTIONS

First, longitudinal studies can examine how technology adoption affects efficiency, production, and competitive advantage over time. Longitudinal studies can reveal patterns and changes in technological effects. A mixed-methods approach that combines quantitative and qualitative data can help explain the complicated relationships between technology adoption and organizational success. Qualitative data adds context to quantitative conclusions.

Future research could also benefit from comparison analysis across organizations of varying sizes, different industries, and geographical regions. Such comparisons would allow for an evaluation of how technology uptake and impact change across different contexts. For a more comprehensive knowledge of the underlying mechanisms, it is necessary to investigate additional potential mediators and moderators that influence the relationship between technology adoption and organizational results. Human factors including user acceptance, training, and change management can reveal the problems and opportunities of technology implementation and its impact on company performance. Investigating the long-term sustainability of technology adoption and its impact on organizational performance might reveal the lasting repercussions of these technical investments. Finally, a comparative study across countries and cultures can show how technological adoption tactics and their effects vary globally.

REFERENCES

Abu Bakar, M. R., Mat Razali, N. A., Wook, M., Ismail, M. N., & Tengku Sembok, T. M. (2021). The Mediating Role of Cloud Computing and Moderating Influence of Digital Organizational Culture Towards Enhancing SMEs Performance. https://doi.org/10.1007/978-3-030-90235-3_39/COVER

Ahmed, S. F., Alam, M. S. Bin, Hoque, M., Lameesa, A., Afrin, S., Farah, T., Kabir, M., Shafiullah, G. M., & Muyeen, S. M. (2023). Industrial Internet of Things enabled technologies, challenges, and future directions. Computers and Electrical Engineering, 110, 108847. https://doi.org/10.1016/j.compeleceng.2023.108847

Alawida, M., Omolara, A. E., Abiodun, O. I., & Al-Rajab, M. (2022). A deeper look into cybersecurity issues in the wake of Covid-19: A survey. Journal of King Saud University - Computer and Information Sciences, 34(10, Part A), 8176-8206. https://doi.org/10.1016/j.jksuci.2022.08.003

Al-Awlaqi, M. A., & Aamer, A. M. (2022). Individual entrepreneurial factors affecting adoption of circular business models: An empirical study on small businesses in a highly resource-constrained economy. Journal of Cleaner Production, 379, 134736. https://doi.org/10.1016/j.jclepro.2022.134736

Al-Karaki, J. N., Gawanmeh, A., & El-Yassami, S. (2022). GoSafe: On the practical characterization of the overall security posture of an organization information system using smart auditing and ranking. Journal of King Saud University - Computer and Information Sciences, 34(6, Part A), 3079-3095. https://doi.org/10.1016/j.jksuci.2020.09.011

Al-Kasasbeh, B. (2022). Model of the information security protection subsystem operation and method of optimization of its composition. Egyptian Informatics Journal, 23(3), 511-516. https://doi.org/10.1016/j.eij.2022.05.003

Almrezeq, N., Almadhoor, L., Alrasheed, T., Abd El-Aziz, A. A., & Nashwan, S. (2020). Design a secure IoT architecture using smart wireless networks. International Journal of Communication Networks and Information Security, 12(3), 401-410. https://doi.org/10.17762/ijcnis.v12i3.4877

Al-Saraireh, J., & Joudeh, H. (2021). An Efficient Authentication Scheme for Internet of Things. International Journal of Communication Networks and Information Security, 13(3), 416-430. https://doi.org/10.17762/ijcnis.v13i3.3422

Anejionu, O. C., Thakuriah, P. V., McHugh, A., Sun, Y., McArthur, D., Mason, P., & Walpole, R. (2019). Spatial urban data system: A cloud-enabled big data infrastructure for social and economic urban analytics. Future generation computer systems, 98, 456-473. https://doi.org/10.1016/j.future.2019.03.052

Awan, U., Shamim, S., Khan, Z., Zia, N. U., Shariq, S. M., & Khan, M. N. (2021). Big data analytics capability and decision-making: The role of data-driven insight on circular economy performance. Technological Forecasting and Social Change, 168, 120766. https://doi.org/10.1016/j.techfore.2021.120766

Babu, T., Roopa, H., Shukla, A. K., Stalin David, D., Jayadatta, S., & Rajesh, A. S. (2022). Internet of things-based automation design and organizational innovation of manufacturing enterprises. Materials Today: Proceedings, 56, 1769-1775. https://doi.org/10.1016/j.matpr.2021.10.459

Bahassi, H., Edddermoug, N., Mansour, A., & Mohamed, A. (2022). Toward an exhaustive review on Machine Learning for Cybersecurity. Procedia Computer Science, 203, 583-587. https://doi.org/10.1016/j.procs.2022.07.083

Barry, T., Jona, J., & Soderstrom, N. (2022). The impact of country institutional factors on firm disclosure: Cybersecurity disclosures in Chinese cross-listed firms. Journal of Accounting and Public Policy, 41(6), 106998. https://doi.org/10.1016/j.jaccpubpol.2022.106998

Bayrak, T. (2021). A framework for decision makers to design a business analytics platform for distributed organizations. Technology in Society, 67, 101747. https://doi.org/10.1016/j.techsoc.2021.101747

Bemmami, K. E., Gzara, L., Maire, J. L., & Courtin, C. (2022). From digital traces to competences. IFAC-PapersOnLine, 55(10), 1944-1949. https://doi.org/10.1016/j.ifacol.2022.09.683

Bodendorf, F., Dentler, S., & Franke, J. (2023). Digitally enabled supply chain integration through business and process analytics. Industrial Marketing Management, 114, 14-31. https://doi.org/10.1016/j.indmarman.2023.07.005

Chadwick, D. W., Fan, W., Costantino, G., de Lemos, R., Di Cerbo, F., Herwono, I., Manea, M., Mori, P., Sajjad, A., & Wang, X.-S. (2020). A cloud-edge based data security architecture for sharing and analysing cyber threat information. Future Generation Computer Systems, 102, 710-722. https://doi.org/10.1016/j.future.2019.06.026

Cheung, K.-F., Bell, M. G. H., & Bhattacharjya, J. (2021). Cybersecurity in logistics and supply chain management: An overview and future research directions. Transportation Research Part E: Logistics and Transportation Review, 146, 102217. https://doi.org/10.1016/j.tre.2020.102217

Christiansen, V., Haddara, M., & Langseth, M. (2022). Factors Affecting Cloud ERP Adoption Decisions in Organizations. Procedia Computer Science, 196, 255-262. https://doi.org/10.1016/j.procs.2021.12.012

Ciampi, F., Demi, S., Magrini, A., Marzi, G., & Papa, A. (2021). Exploring the impact of big data analytics capabilities on business model innovation: The mediating role of entrepreneurial orientation. Journal of Business Research, 123, 1-13. https://doi.org/10.1016/j.jbusres.2020.09.023

Dede Yildirim, E., & Roopnarine, J. L. (2019). Maternal and Paternal Cognitive Engagement and Children's Literacy Skills in 25 African Countries. Journal of Black Psychology, 45(8), 603-638. https://doi.org/10.1177/0095798419890953

Demek, K. C., & Kaplan, S. E. (2023). Cybersecurity breaches and investors' interest in the firm as an investment. International Journal of Accounting Information Systems, 49, 100616. https://doi.org/10.1016/j.accinf.2023.100616

Dhanalakshmi, G., & George, V. S. (2022). Security threats and approaches in E-Health cloud architecture system with big data strategy using cryptographic algorithms. Materials Today: Proceedings, 62, 4752-4757. https://doi.org/10.1016/j.matpr.2022.03.254

Dubey, R., Bryde, D. J., Dwivedi, Y. K., Graham, G., & Foropon, C. (2022). Impact of artificial intelligence-driven big data analytics culture on agility and resilience in humanitarian supply chain: A practice-based view. International Journal of Production Economics, 250, 108618.

https://doi.org/10.1016/j.ijpe.2022.108618

Eftekhari, M., Gheibi, M., Azizi-Toupkanloo, H., Hossein-Abadi, Z., Khraisheh, M., Fathollahi-Fard, A. M., & Tian, G. (2021). Statistical optimization, soft computing prediction, mechanistic and empirical evaluation for fundamental appraisal of copper, lead and malachite green adsorption. Journal of Industrial Information Integration, 23, 100219. https://doi.org/10.1016/j.jii.2021.100219

Formentini, G., Bouissiere, F., Cuiller, C., Dereux, P.-E., & Favi, C. (2022). Conceptual Design for Assembly methodology formalization: systems installation analysis and manufacturing information integration in the design and development of aircraft architectures. Journal of Industrial Information Integration, 26, 100327. https://doi.org/10.1016/j.jii.2022.100327

Gaglianese, M., Forti, S., Paganelli, F., & Brogi, A. (2023). Assessing and enhancing a Cloud-IoT monitoring service over federated testbeds. Future Generation Computer Systems, 147, 77-92. https://doi.org/10.1016/j.future.2023.04.026

Giordano, G., Palomba, F., & Ferrucci, F. (2022). On the use of artificial intelligence to deal with privacy in IoT systems: A systematic literature review. Journal of Systems and Software, 193, 111475. https://doi.org/10.1016/j.jss.2022.111475

Gündoğan, C., Kietzmann, P., Schmidt, T. C., & Wählisch, M. (2022). A mobility-compliant publish–subscribe system for an information-centric Internet of Things. Computer Networks, 203, 108656. https://doi.org/10.1016/j.comnet.2021.108656

Huang, J. Z. (2023). A break in the cloud: the local sociotechnical affordances underlying global internet infrastructures. Technology in Society, 74, 102319. https://doi.org/10.1016/j.techsoc.2023.102319

Kazaryan, R., Tregubova, E. B., & Galaeva, N. (2022). Aspects of assessment of the efficiency of using information modelling technology for transport infrastructure by BIM-modelling. Transportation Research Procedia, 63, 2834-2840. https://doi.org/10.1016/j.trpro.2022.06.329

Kyytsönen, M., Ikonen, J., Aalto, A.-M., & Vehko, T. (2022). The self-assessed information security skills of the Finnish population: A regression analysis. Computers & Security, 118, 102732. https://doi.org/10.1016/j.cose.2022.102732

Lanz, M., Siltala, N., Pieters, R., & Latokartano, J. (2020). Concept for distributed robotics learning environment - Increasing the access to the robotics via modularisation of systems and mobility. Procedia Manufacturing, 45, 152-157. https://doi.org/10.1016/j.promfg.2020.04.087

Lepore, D., Dolui, K., Tomashchuk, O., Shim, H., Puri, C., Li, Y., Chen, N., & Spigarelli, F. (2023). Interdisciplinary research unlocking innovative solutions in healthcare. Technovation, 120, 102511. https://doi.org/10.1016/j.technovation.2022.102511

Madonsela, N. S. (2020). Integration of the Management Information System for Competitive Positioning. Procedia Manufacturing, 43, 375-382. https://doi.org/10.1016/j.promfg.2020.02.176

Masrianto, A., Hartoyo, H., Hubeis, A. V. S., & Hasanah, N. (2022). Digital Marketing Utilization Index for Evaluating and Improving Company Digital Marketing Capability. Journal of Open Innovation: Technology, Market, and Complexity, 8(3), 153. https://doi.org/10.3390/joitmc8030153

Mekala, S. H., Baig, Z., Anwar, A., & Zeadally, S. (2023). Cybersecurity for Industrial IoT (IIoT): Threats, countermeasures, challenges and future directions. Computer Communications, 208, 294-320. https://doi.org/10.1016/j.comcom.2023.06.020

Mikalef, P., Krogstie, J., Pappas, I. O., & Pavlou, P. (2020). Exploring the relationship between big data analytics capability and competitive performance: The mediating roles of dynamic and operational capabilities. Information & Management, 57(2), 103169. https://doi.org/10.1016/j.im.2019.05.004

Morimura, F., & Sakagawa, Y. (2023). The intermediating role of big data analytics capability between responsive and proactive market orientations and firm performance in the retail industry. Journal of Retailing and Consumer Services, 71, 103193. https://doi.org/10.1016/j.jretconser.2022.103193

Nalajala, P., Gudikandhula, K., Shailaja, K., Tigadi, A., Rao, S. M., & Vijayan, D. S. (2023). Adopting internet of things for manufacturing firms business model development. The Journal of High Technology Management Research, 34(2), 100456. https://doi.org/10.1016/j.hitech.2023.100456

Olan, F., Ogiemwonyi Arakpogun, E., Suklan, J., Nakpodia, F., Damij, N., & Jayawickrama, U. (2022). Artificial intelligence and knowledge sharing: Contributing factors to organizational performance. Journal of Business Research, 145, 605-615. https://doi.org/10.1016/j.jbusres.2022.03.008

Orzechowski, M., Wrzeszcz, M., Kryza, B., Dutka, Ł., Słota, R. G., & Kitowski, J. (2023). Indexing legacy data-sets for global access and processing in multi-cloud environments. Future Generation Computer Systems, 148, 150-159. https://doi.org/10.1016/j.future.2023.05.024

Ouchani, F., Jbaihi, O., Alami Merrouni, A., Ghennioui, A., & Maaroufi, M. (2022). Geographic Information System-based Multi-Criteria Decision-Making analysis for assessing prospective locations of Pumped Hydro Energy Storage plants in Morocco: Towards efficient management of variable renewables. Journal of Energy Storage, 55, 105751. https://doi.org/10.1016/j.est.2022.105751

Parker, M. (2023). Managing threats to health data and information: toward security. In B. E. Dixon (Ed.), Health Information Exchange: Navigating and Managing a Network of Health Information Systems

(Second Edition) (pp. 149-196). Academic Press. https://doi.org/10.1016/B978-0-323-90802-3.00016-2

Pezoulas, V. C., Exarchos, T. P., & Fotiadis, D. I. (2020). Cloud infrastructures for data sharing. In Book: Medical Data Sharing, Harmonization and Analytics (pp. 185-226). Academic Press. https://doi.org/10.1016/B978-0-12-816507-2.00006-2

Priyatharsini, G. S., Babu, A. J., Kiran, M. G., Sathish Kumar, P. J., Nelson Kennedy Babu, C., & Ali, A. (2022). Self secured model for cloud based IOT systems. Measurement: Sensors, 24, 100490. https://doi.org/10.1016/j.measen.2022.100490

Radoglou-Grammatikis, P., Sarigiannidis, P., Iturbe, E., Rios, E., Martinez, S., Sarigiannidis, A., Eftathopoulos, G., Spyridis, Y., Sesis, A., Vakakis, N., Tzovaras, D., Kafetzakis, E., Giannoulakis, I., Tzifas, M., Giannakoulias, A., Angelopoulos, M., & Ramos, F. (2021). SPEAR SIEM: A Security Information and Event Management system for the Smart Grid. Computer Networks, 193, 108008. https://doi.org/10.1016/j.comnet.2021.108008

Ranjan, J., & Foropon, C. (2021). Big Data Analytics in Building the Competitive Intelligence of Organizations. International Journal of Information Management, 56, 102231. https://doi.org/10.1016/j.ijinfomgt.2020.102231

Sarefo, S., Dawson, M., & Banyatsang, M. (2023). An exploratory analysis of the cybersecurity threat landscape for Botswana. Procedia Computer Science, 219, 1012-1022. https://doi.org/10.1016/j.procs.2023.01.379

Senarak, C. (2021). Port cybersecurity and threat: A structural model for prevention and policy development. The Asian Journal of Shipping and Logistics, 37(1), 20-36. https://doi.org/10.1016/j.ajsl.2020.05.001

Shahatha Al-Mashhadani, A. F., Qureshi, M. I., Hishan, S. S., Md Saad, M. S., Vaicondam, Y., & Khan, N. (2021). Towards the development of digital manufacturing ecosystems for sustainable performance: learning from the past two decades of research. Energies, 14(10), 2945. https://doi.org/10.3390/EN14102945

Shaw, R., Howley, E., & Barrett, E. (2022). Applying Reinforcement Learning towards automating energy efficient virtual machine consolidation in cloud data centers. Information Systems, 107, 101722. https://doi.org/10.1016/j.is.2021.101722

Sitharthan, R., Vimal, S., Verma, A., Karthikeyan, M., Dhanabalan, S. S., Prabaharan, N., Rajesh, M., & Eswaran, T. (2023). Smart microgrid with the internet of things for adequate energy management and analysis. Computers and Electrical Engineering, 106, 108556. https://doi.org/10.1016/j.compeleceng.2022.108556

Soori, M., Arezoo, B., & Dastres, R. (2023). Internet of things for smart factories in industry 4.0, a review. Internet of Things and Cyber-Physical Systems, 3, 192-204. https://doi.org/10.1016/j.iotcps.2023.04.006

Stephanakis, I. M., Chochliouros, I. P., Sfakianakis, E., Shirazi, S. N., & Hutchison, D. (2019). Hybrid self-organizing feature map (SOM) for anomaly detection in cloud infrastructures using granular clustering based upon value-difference metrics. Information Sciences, 494, 247-277. https://doi.org/10.1016/j.ins.2019.03.069

Stergiou, C. L., & Psannis, K. E. (2022). Digital Twin Intelligent System for Industrial IoT-based Big Data Management and Analysis in Cloud. Virtual Reality & Intelligent Hardware, 4(4), 279-291. https://doi.org/10.1016/j.vrih.2022.05.003

Tejay, G. P. S., & Mohammed, Z. A. (2023). Cultivating security culture for information security success: A mixed-methods study based on anthropological perspective. Information & Management, 60(3), 103751. https://doi.org/10.1016/j.im.2022.103751

Tusa, F., & Clayman, S. (2023). End-to-end slices to orchestrate resources and services in the cloud-to-edge continuum. Future Generation Computer Systems, 141, 473-488. https://doi.org/10.1016/j.future.2022.11.026

Upadhyay, P., & Kumar, A. (2020). The intermediating role of organizational culture and internal analytical knowledge between the capability of big data analytics and a firm's performance. International Journal of Information Management, 52, 102100. https://doi.org/10.1016/j.ijinfomgt.2020.102100

Valero, C., Pérez, J., Solera-Cotanilla, S., Vega-Barbas, M., Suarez-Tangil, G., Alvarez-Campana, M., & López, G. (2023). Analysis of security and data control in smart personal assistants from the user's perspective. Future Generation Computer Systems, 144, 12-23. https://doi.org/10.1016/j.future.2023.02.009

Vargas, P., & Tien, I. (2023). Impacts of 5G on cyber-physical risks for interdependent connected smart critical infrastructure systems. International Journal of Critical Infrastructure Protection, 42, 100617. https://doi.org/10.1016/j.ijcip.2023.100617

Volpert, S., Eichhammer, P., Held, F., Huffert, T., Reiser, H. P., & Domaschka, J. (2023). The view on systems monitoring and its requirements from future Cloud-to-Thing applications and infrastructures. Future Generation Computer Systems, 141, 243-257. https://doi.org/10.1016/j.future.2022.11.024

Wescoat, E., Krugh, M., Jansari, V., & Mears, L. (2023). Redefining the digital triplet for surrogate system integration. Manufacturing Letters, 36, 57-61. https://doi.org/10.1016/j.mfglet.2023.03.001

Yeoh, W., Liu, M., Shore, M., & Jiang, F. (2023). Zero trust cybersecurity: Critical success factors and A maturity assessment framework. Computers & Security, 133, 103412. https://doi.org/10.1016/j.cose.2023.103412

Ylönen, M., & Björkman, K. (2023). Integrated management of safety and security (IMSS) in the nuclear industry – Organizational culture perspective. Safety Science, 166, 106236. https://doi.org/10.1016/j.ssci.2023.106236

Zadeh, A., & Jeyaraj, A. (2022). A multistate modelling approach for organizational cybersecurity exploration and exploitation. Decision Support Systems, 162, 113849. https://doi.org/10.1016/j.dss.2022.113849

Zagrouba, R., & Alhajri, R. (2021). Machine learning based attacks detection and countermeasures in IoT. International Journal of Communication Networks and Information Security, 13(2), 158-167. https://doi.org/10.17762/ijcnis.v13i2.4943