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Data Analytics in Information Sharing and Resource Dependency: Enhancing Accounting Systems[1]

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Keywords: Knowledge-sharing theory, use of data analytics, interdependence, sharing of digital information, effectiveness of accounting information systems.

JEL Codes: M40, M41, M49

Abstract: In the context of advances in blockchain technologies, a growing number of organizations are prioritizing the strategic use of data analytics to achieve sustainable performance. The conversion of big data into a digital format, coupled with its cross-departmental sharing for a comprehensive assessment of market dynamics, has precipitated a heightened interdependence among departments. Therefore, necessitating a greater reliance on the information generated by accounting systems. This study reveals the interplay among the use of data analytics, digital information sharing, and the effectiveness of accounting systems, in the context of knowledge sharing theory, and resource dependency theory. The results indicate that the use of data analytics improves accounting system effectiveness by reinforcing digital information sharing and fostering interdepartmental interdependence.

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[1] It is declared that this article has been prepared in accordance with research and publication ethics principles.

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Araştırma Makalesi *Açık Erişim*

Bilgi Paylaşımı ve Kaynak Bağımlılığı Bağlamında Veri Analitikleri: Muhasebe Sistemlerinin Geliştirilmesi

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Anahtar Kelimeler: Bilgi paylaşım teorisi, veri analitiklerinin kullanımı, karşılıklı bağımlılık, dijital bilginin paylaşımı, muhasebe bilgi sisteminin etkinliği

JEL Kodları: M40, M41, M49

Öz: Blok zinciri teknolojisindeki gelişmeler bağlamında, giderek artan sayıda organizasyon sürdürülebilir performans elde etmek için veri analitiğinin stratejik kullanımına öncelik vermektedir. Büyük verinin dijital formata dönüştürülmesi ve piyasa dinamiklerinin kapsamlı bir şekilde değerlendirilmesi için departmanlar arası bilgi paylaşımı, departmanlar arasında artan bir karşılıklı bağımlılığı tetiklemiş ve dolayısıyla muhasebe sistemleri tarafından üretilen bilgilere daha fazla güvenilmesini zorunlu kılmıştır. Bu çalışma, bilgi paylaşımı teorisi ile kaynak bağımlılığı teorisi bağlamında veri analitiğinin kullanımı, dijital bilgi paylaşımı ve muhasebe sistemlerinin etkinliği arasındaki etkileşimi ortaya koymaktadır. Sonuçlar, veri analitiğinin kullanımının dijital bilgi paylaşımını güçlendirerek ve departmanlar arası bağımlılığı teşvik ettiğini ve muhasebe sisteminin etkinliğini artırdığını göstermektedir.

1. Introduction

The effectiveness of contemporary organizations depends on strong coordination and information sharing among their sub-units. Organizational system paradigms, such as resource dependence theory (Cheng, 1983) and the role-system perspective (Puranam et al., 2012), emphasize the importance of interdependence and information flow. The advent of digitalization and the proliferation of big data (BD) have led to a pivotal change in the definition of internal information sharing and interdependence, which directly affects the effectiveness of organizations (Pugliese et al., 2014). The Information Sharing Theory is a fundamental aspect of the exchange of convenient data within an organization. This exchange, or "sharing," of information is predicated on the premise that it facilitates improved communication and collaboration among the relevant parties (Franke & Hiebl, 2023). This proactive approach allows organizations to respond promptly to emerging issues by assisting in reducing risks and increasing transparency.

The accounting systems are also experiencing this shift. The spread of digital information provides the opportunity for better quality and efficiency, not just within accounting but also across other sub-systems by adapting to improved coordination and information sharing. In this context, data analytics (DA) becomes an essential tool for the exchange of digital information. Organizations are heavily investing in DA tools that enable access to large volumes and fast streams of data from outside sources. The DA involves generating information that helps companies share and combine insights from raw data analysis in both internal and external environments (Raguseo & Vitari, 2018). The use of DA creates a more informed environment for stakeholders by giving them access to actionable insights. This alignment of information across various levels of the organization not only improves the accuracy of financial reports but also strengthens accountability within teams (Theodorakopoulos et al., 2024).

To interpret the causal relationships between digital information flow and accounting practices, it is necessary to examine the DA paradigm through the lens of knowledge sharing theory. However, many organizations face a significant obstacle in the form of the substantial investment required for advanced DA tools, including text mining, cluster analysis, machine learning, dashboards, and neural network while aiming to utilize these capabilities effectively (Abdelhalim & Hassan, 2025). Despite these challenges, making use of such sophisticated tools could lead to substantial improvements in economic and social outcomes in the medium to long term (Widén-Wulff & Ginman, 2004). The integration of a standard accounting system with DA applications allows organizations to perform visually and statistically advanced multidimensional analysis, thereby streamlining the vertical and horizontal flows of accounting information (Lehner et al., 2022).

The arrival of the Internet has led to an enhanced interdependence and information sharing between intra-organization units, as it has enabled the generation of various and complex data sets (Razak et al., 2016). Data generated through digital platforms—such as customer feedback and e-commerce product reviews—has heightened expectations regarding the performance of accounting systems. This trend emphasizes the need for efficient process management, resource sharing, and collaboration between units to achieve broader business goals (Vera - Mun˜ oz et al., 2006). DA is applied across many business areas, including supply chain management, performance improvement, business process reengineering, marketing, finance, and accounting (Müller et al., 2018). By enabling richer learning and strategic progress in competitive

environments, implementing DA improves the operational efficiency of individual business units and increases information dependency (Jiang, 2024).

This study explores the causal link among the effectiveness of accounting systems, digital information sharing, and DA use. It delves into the role of interdependence from the perspectives of knowledge sharing theory and source dependence theory. While previous research has mainly examined how DA impacts the efficiency of individual business units and overall information dependency, a clear understanding of how interdependence moderates these relationships—and how it can be accurately measured in accounting systems—remains elusive.

This research aspires to fill this gap through clarification of how the DA influences both accounting system effectiveness and digital information sharing within organizations. Therefore, the study will seek the following key questions:

RQ1: To what extent does the use of DA contribute to the effectiveness of accounting systems?

RQ2: What is the moderating role of the interdepartmental dependence on the impact of the use of data analytics on both digital information sharing and the effectiveness of accounting systems?

RQ3: What is the relationship between digital information sharing and the effectiveness of accounting systems?

The objective of the study is to ascertain the impact of DA practices on the performance of accounting systems. The expected insights should offer significant value for organizations that are seeking to develop more effective digital transformation strategies for their accounting functions. Additionally, these findings are likely to enhance the theoretical understanding of accounting information systems and provide practical guidance for practitioners navigating the ongoing digital transformation.

Section 2 offers a comprehensive review of existing research related to DA, digital information sharing, accounting system efficiency, and interdependence, framed within the principles of knowledge sharing theory and resource dependence theory. Section 3 meticulously outlines the research methodology, encompassing the utilization of measurement tools, the execution of reliability and validity analyses, and the derivation of empirical results from Partial Least Squares (PLS) analysis.

2. Theoretical Background

2.1. Use of Data Analytics, Accounting, and Sharing of Digital Information

Resource Dependence Theory (RDT) and Knowledge Sharing Theory are integrated in this study to explain the role of data analytics in accounting systems. According to RDT, organizations use data analytics as a strategic resource to reduce environmental uncertainty and manage external dependencies (Jiang et al., 2023). However, possessing these tools alone is not sufficient; Knowledge Sharing Theory suggests that real value arises from the sharing and collaboration of these resources within the organization through digital information. In this context, the theories provide different but mutually supportive answers to the question of why organizations collaborate.

RDT emphasizes that organizations are strategically dependent on internal and external resources and need collaboration and alliances to manage this dependence. For this collaboration and these alliances to be effective, mechanisms are needed that enable the efficient and rapid sharing of information. Therefore, Knowledge Sharing Theory details the mechanisms and tools for ensuring the information sharing necessary for the effectiveness of alliances, thus enabling the system to function effectively within alliances formed by resource dependence (Öztürk & Bağış, 2025). Resource dependency conceptualizes why businesses need data analytics, while information sharing discusses how this need is operationalized within the organization and affects the balance of power among decision-makers.

Trinh (2026) states that data analytics increases efficiency in process management in small businesses and provides accountants with more information for decision-making, which is a significant contribution to the transition economy. In the contemporary business landscape, information technology (IT) assumes a central role in generating and disseminating critical information that informs decision-making processes (Deng et al., 2023). IT facilitates support for all stages of organizational workflows (Vitari & Raguseo, 2020). The progression of technology has transformed the dynamics of information sharing within organizations, transitioning from traditional methods to digital formats. This transformation has enabled the utilization of a diverse array of communication channels, techniques, and tools. Recent advancements in enterprise IT architectures, particularly those emerging within the framework of Industry 4.0, integrate machine-to-machine communication alongside enhanced data security and storage solutions. Such innovations have been instrumental in the evolution of DA tools, which have increasingly digitalized the process of information sharing (Tan et al., 2017).

Organizations are increasingly allocating resources to DA owing to its substantial potential for generating significant business value (De Silva et al., 2025). These investments are strategically aimed at attaining a sustainable competitive advantage by leveraging the distinct information assets that DA offers. In this regard, accounting systems that are enhanced through DA have a pivotal role in promoting innovation and facilitating the development of auditing performance (Li & Juma'h, 2022). Such systems harness digital insights that contribute to economic value through informed management decisions, which are critical for effective governance and control (Choi, 2020). Mukherjee et al. (2025) state that data analytics enhance the holistic and strategic functionality of accounting.

Furthermore, according to Xu and He (2024), particularly in uncertain competitive environments, organizations are obligated to collect and utilize data that facilitates detailed analysis of market dynamics within the supply chain process. By deepening their knowledge through digital information acquired via DA tools, organizations can enable more precise forecasts and situational analysis. The implementation of DA empowers decision-makers with access to more robust and versatile data (Rialti et al., 2019). This research investigates the transformational, informational, strategic, and transactional dimensions of business value derived from DA, as articulated by Raguseo and Vitari (2018) in the frame of the resource dependence theory and knowledge sharing theory. The informational dimension of DA is distinctively characterized by its feature to get prompt and convenient access to data in a preferred format. The DA possesses significant potential to substantially reinforce both the operational and strategic effectiveness of organizations. Moreover, it contributes to improved accounting performance by facilitating the integration and analysis of substantial volumes of data within accounting processes, which are fundamentally structured as information systems.

The accounting function serves as a vital element within an organization's information-sharing ecosystem (Saleh et al., 2023). Organizations with highly skilled personnel effectively leverage advanced digital information-sharing mechanisms to accurately evaluate internal and external opportunities and threats, which consequently results in more informed decision-making (Kembro et al., 2017). Conversely, the accounting systems generate comprehensive evaluations and analysis of corporate performance, which are contingent upon the information support it receives from other departments, thereby illustrating the intrinsic interdependence between accounting functions and other organizational units (Al-Okaily, 2025).

2.2. The Knowledge Sharing Theory, Interdependence, and Accounting Systems

This study employs the framework of knowledge sharing theory, which claims that information systems must be thoroughly crafted to meet the demands for control, coordination, and decision-making processes (Daft & Lengel, 1986). Within this theoretical framework, the effectiveness of an organization's accounting unit is contingent upon its capacity to fulfill the information processing requirements and expectations of other departments or subunits (Trivellas et al., 2015). This critical function, when analyzed through the lens of resource dependence theory, emerges directly from interdepartmental interdependence (Grabner et al., 2022).

Organizational interdependence profoundly influences the expectations placed upon the accounting system, and thereby it significantly impacts the overall organizational effectiveness. Interdependence, a fundamental phenomenon inherent in all organizations, is defined as the reliance of individual employees, teams, or work units on one another to complete various stages of collaborative work (Raveendran et al., 2020). The Resource Dependence Theory (RDT) offers a conceptual approach for comprehending the interdependence among organizational subdivisions. It distinguishes itself from interdependence theory, which mainly focuses on interpersonal social relationships. While interdependence theory explains dependency in personal interactions, RDT, on the other hand, emphasizes how organizations rely on economic, technological, knowledge, and human resources, and how these interdependencies influence internal structures and relationships within the organizations.

Interdependence is a strategic positioning that explains why relationships between units are established. Information dependency, on the other hand, refers to the process inputs that reduce and manage uncertainty within this strategic positioning. In this context, information dependency constitutes the set of inputs that enable the handling and processing of inputs within the systematic framework created by the interdependence mechanism of units (Hung et al., 2024). From the RDT perspective, independence determines the symmetry of the power balance between units and within the organization, while information dependency is the set of tools and inputs that determine whether this power balance is asymmetrical or symmetrical. The unit with more information takes an asymmetrical advantage, achieving a more advantageous strategic position in the interdependent relationship.

Since interdependence is reciprocal, it creates a risk area within the organization. Informational dependency is the operational-level reflection of this risk. If there are interruptions in the flow of information, the risk level increases, and the losses caused by asymmetrical information become greater. If the flow of information is continuous, interdependence will not disappear, but the level of risk will reach a manageable level.

Prior research has predominantly focused on task interdependence; however, with the advent of information technologies, this concept has evolved to include a broader range of dimensions. Contemporary literature delineates interdependence from three primary perspectives: (i) task, (ii) goal, (iii) knowledge, and (iv) information. Mia and Goyal (1991), contended that interdependence could exert both direct and indirect effects on accounting system performance, represented as both knowledge interdependence and goal interdependence. Nevertheless, the intricate relationship between goal and knowledge interdependence necessitates a reexamination and redefinition of knowledge interdependence (Choi, 2020). Some scholars argue that task and goal interdependence merit greater emphasis, as they are more concrete and quantifiable than knowledge interdependence, the abstract nature of which presents challenges for empirical operationalization.

The speed, accuracy, and accessibility of information flows represent pivotal determinants of the effectiveness of modern accounting functions (Spraakman et al., 2021). Consequently, a comprehensive analysis of information dependency is increasingly fundamental for enhancing organizational effectiveness. The interaction between information sharing and interdependence influences the effectiveness of accounting systems. In this context, DA acts as an intermediary variable, helping to improve accounting processes. The DA utilized by organizations has been demonstrated to facilitate enhanced decision-making capabilities and operational efficiency. Consequently, this has led to an augmentation in the overall impact of interdependent relationships within knowledge sharing processes (Tan et al., 2017).

2.3. Research Model

This research has a theoretical model stating that the effectiveness of accounting systems is affected by the sharing of digital information generated using DA tools within the framework of interdependence. Furthermore, it underscores the role of mutual dependence as a crucial regulatory variable within this dynamic relationship. The structural relations articulated in the model are constructed based on contemporary insights derived from the existing body of literature. Substantial consensus exists among scholars regarding the proposition that the application of DA engenders four fundamental business values at the organizational level: Transformational, Processive, Strategic, and Informational (Vitari & Raguseo, 2020). These values are integral to refining the overall performance and strategic positioning of organizations in an increasingly data-driven landscape.

Within organizational frameworks encompasses two primary sub-dimensions: data change and cooperation (Müller et al., 2018). The construct of independence is further characterized into three interrelated components: task dependence, information dependence, and goal dependence (Chenhall & Morris, 1986). As summarized by Nicolaou (2000), the effectiveness of accounting systems can be evaluated through two distinct sub-dimensions.

The accounting system has undergone a substantial transformation, considering the recent advancements in blockchain technology. It exceeds its conventional role of merely providing information (Jiang, 2024). Stakeholders now presume outputs that are not only visually appealing but also digitally enriched, as a result, facilitating multidimensional assessments of accounting data. This paradigm shift in the accounting function has consequently fostered an increased reliance on DA (Bedford, 2020). Moreover, concerns regarding information security and storage have prompted organizations to enhance the digitalization of their information-sharing processes. Appelbaum et al. (2017) state that accounting systems leverage DA

more effectively to adapt to the evolving information ecosystem. Organizations that successfully integrate DA into their operations can significantly improve the efficacy of both information management and accounting systems. For organizations that are intent on maintaining competitiveness and responsiveness in a rapidly changing environment, there is a pressing need to align with technological advancements (Bose et al., 2023).

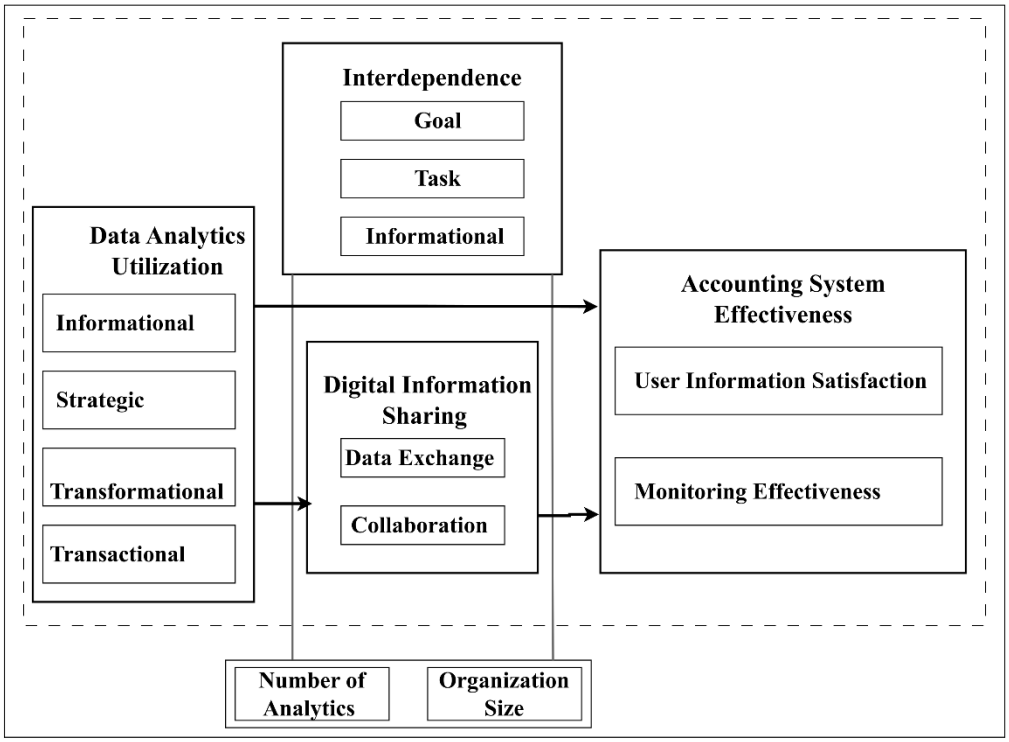

Figure 1. Research Model
Source: Generated by Author

The dissemination of information serves as a crucial corporate resource that significantly influences a firm's innovation capacity and competitive edge (Lin, 2007). When data is processed efficiently, it facilitates accurate insights that underpin the digital transformation of enterprises, therefore, positioning them competitively in the marketplace (Ardito et al., 2019). The implementation of DA has been shown to positively impact the operational effectiveness of these accounting systems thanks to the strategic, processing, and transformative insights provided by accounting systems to decision-makers (Franke & Hiebl, 2023). The exertion of large datasets, which are recognized as intangible resources, allows organizations to analyze customer behavior patterns toward products and services—insights that traditional data analysis may overlook (Albergaria & Jabbour, 2020).

Furthermore, the application of artificial intelligence (AI) and analytical tools allows organizations to garner comprehensive insights and interpretations of past, present, and future events (De Mauro et al., 2016). Through DA, accounting systems are empowered to receive and integrate data and may transform them into actionable insights. Consequently, it is inclined to aid in fostering enhanced information sharing among employees within the accounting framework and strengthen the overall functionality of accounting information (Coman et al., 2022).

As stated by Nielsen (2015) that is imperative for management accountants to competently oversee substantial quantities of data and utilise BD as a fundamental input in future decision-making processes. This encompasses the anticipation of uncertainties and associated risks. Consequently, the prevalent adoption of DA by accounting professionals facilitates access to innovative insights. The processing of voluminous datasets of sales, accrual cycles, billing and collection processes, and customer information supports continuous updates that boost accounting system efficiency within organizations (Cockrell et al., 2018). The implementation of DA has been shown to promote increased reliance on information and the subsequent dissemination of information throughout the organization. In the context of knowledge-sharing theory, this causal structure reduces power imbalances and information asymmetry within the organization and makes resource dependency sustainable.

H1: The utilization of DA, enabling companies to extract information with processing, transformative, and strategic value, directly influences the effectiveness of the accounting system.

A substantial corpus of empirical analysis indicates that organisational digitalisation and information sharing have a positive effect on information management performance and overall corporate excellence (Widén-Wulff & Ginman, 2004). Interdependency is known to increase through the act of information sharing. This concept is further delineated as the facilitation of a seamless data flow between disparate organizational units (Nguyen et al., 2022). The collaborative sharing of information, rooted in mutual dependence among employees, is critical for effective data collection and analysis. It enhances system activity, thereby bolstering organisational performance (Beersma et al., 2013).

The efficacy of information systems—measured by their contributions to corporate performance—largely hinges upon user satisfaction and the positive perceptions of system usability (Voss & Brettel, 2014). As posited by Seddon and Yip (1992), technical upgrades and appropriate resource allocation serve as fundamental elements for facilitating information sharing. In this regard, DA tools, representing a sophisticated evolution of traditional information technologies, act as enablers of digital information sharing (Jassem, 2024). Considering the principles of cooperation and alliance inherent in RDT, data analytics enhances the efficiency of systems and information flow by reducing uncertainty in the market dynamics. When digital information sharing is harmonized with collaboration between subunits, it can lead to enhanced system activity and improved information quality. Consequently, we propose an additional hypothesis:

H2: The use of DA enhances the acquisition of strategic information, processing capabilities, and transformational work values, significantly improving data exchange between departments and facilitating digital information sharing through increased cooperation.

The theory of information sharing underscores that organizations can achieve long-term competitive advantages by leveraging the knowledge and expertise of their employees (Vera ‐ Mun˜ oz et al., 2006). Additionally, as societal expectations and stakeholder demands for greater transparency and digital information rise, these trends are reflected in accounting systems, facilitating enhanced digital information sharing (Hassan & Maelah, 2021). Furthermore, stakeholders' growing sensitivity to environmental issues further impacts the modifications in the content and structure of accounting systems. Enhanced digital information sharing not only bolsters the ability of accounting systems to address environmental and social concerns but also improves the quality of the output generated, given that information constitutes the fundamental input in accounting applications (Theodorakopoulos et al., 2024).

Duh et al. (2020), assert that information sharing among auditors positively affects both control quality and team performance. This digital capability permits accounting professionals to collaborate in virtual teams without being constrained by time or geographical boundaries (Voss & Brettel, 2014). Organizations that champion advanced information sharing practices witness an increase in employee knowledge and productivity (Widén-Wulff & Ginman, 2004). In the knowledge-sharing theory lens, DA tools positively impact the technological maturity curve of accounting departments and may mitigate strategic uncertainty by enabling more accurate use of information. Consequently, it can be declared that digital information sharing affects the effectiveness of accounting systems in both direct and indirect ways:

H3: Digital information sharing, which enhances data exchange and cooperation among accounting personnel, directly impacts the effectiveness of the accounting system.

H4: Digital information sharing mediates the relationship between the implementation of DA and the activity of the accounting system.

Chenhall and Morris (1986) have identified a robust correlation between the design of accounting systems and the degree of interdependence among departments within organizations. The degree of interdependence between departments can range from low to high. In scenarios characterized by low interdependence, departments operate independently before passing tasks to subsequent units (Gerdin, 2005). Conversely, in contexts marked by high interdependence, the success and performance of each department hinge upon effective collaboration and data exchange with others (Bailey et al., 2010). The impact of DA on accounting systems is contingent upon the existing level of interdependence; high interdependence is likely to amplify the volume of data processed within the accounting system and encourage more extensive utilization of corporate DA (Appelbaum et al., 2017). This increased collaboration can promote the development of inter-departmental data exchange. Hence, mutual dependence serves a regulatory role in the nexus between DA and accounting systems. RDT suggests that technology-focused interdepartmental networks can contribute to increased knowledge exchange. Interdependence fosters the need for knowledge exchange, shifts power dynamics, and necessitates an increase in symmetrical knowledge within the organization.

H5A: The direct effect of DA on digital information sharing is significantly amplified by interdependence.

H5B: The direct effect of DA on the effectiveness of the accounting system is significantly amplified by interdependence.

H5C: The direct effect of digital information sharing on accounting system activity is significantly amplified by interdependence.

This theoretical framework argues that the intricate relationship between technology, information sharing, and departmental interdependence within the context of accounting systems ultimately contributes to improved organizational effectiveness.

A multi-group analysis was performed to seek the direct impacts outlined in the model that exhibit variations based on organizational size and the number of data analysis tools utilized. According to Henseler et al. (2016), examining the number of these variables allows for a detailed evaluation of model coefficients for predefined sub-groups. In this light, the following hypotheses will be rigorously tested:

H6A: It is hypothesized that the path coefficient corresponding to the relationship between DA and accounting system activity will exhibit significant variation contingent upon the size of the organization.

H6B: It is proposed that the path coefficient depicting the relationship between DA and digital information sharing will vary significantly based on organizational size.

H6C: It is anticipated that the path coefficient concerning the linkage between digital information sharing and accounting system activity will change significantly as a function of organizational size.

H7A: It is posited that the path coefficient representing the relationship between DA and accounting system activity will demonstrate significant variation in accordance with the number of DA tools employed.

H7B: It is suggested that the path coefficient relating DA to digital information sharing will exhibit statistically significant differences depending on the number of DA tools utilized.

H7C: It is expected that the path coefficient concerning the relationship between digital information sharing and accounting system activity will change significantly based on the number of DA tools in use.

3. Method

An integrated research methodology was employed to discern the structural interactions within the research model derived from the theoretical framework. The initial section of the survey encompassed questions for identifying the fundamental characteristics of the participating organizations, as well as the DA tools they currently employ. The subsequent section incorporated items about a DA usage scale, an interdependence scale, a digital information sharing scale, and an accounting system effectiveness scale.

Given the absence of a consensus on the definition of efficiency within the accounting function, it is often preferable to utilize multiple indicators to assess efficiency (Seddon & Yip, 1992). The satisfaction of stakeholders regarding the perceived quality of information produced by the information system is regarded as an indicator of system effectiveness. In the study, a fourteen-item scale adapted from Nicolaou (2000) was employed to evaluate accounting system effectiveness. (Müller (2018) has been adopted as the scale for the measurement of digital information sharing. The scale for interdependence and DA usage was developed by the authors of this study. Responses were recorded on a scale from 1 to 5, ranging from "strongly disagree" to "strongly agree." Organization size (measured by the number of employees) and the number of analytical tools utilized by the company were considered control variables. Research data was gathered through a questionnaire sent to a total of 1620 experts affiliated with the accounting departments of organizations using their corporate email addresses. In the questionnaire, respondents' knowledge of DA and access to the necessary DA tools within their organizations have been assessed. Initially, we collected responses from 91 participants. However, after a rigorous data cleaning process that included incomplete questionnaires and responses with a significant amount of missing data, a final sample of 64 participants was obtained for analysis.

Table 1. Items on Scales

Data Analytics Utilization Scale	
Informational	• Data analytics enable us to quickly obtain the information required for operational processes. • Data analytics produce more accurate information for the managerial decisions of our firm. • Data analytics contribute to the increase of information interdependence in our firm.
Transformational	• Data analytics are utilized for our firm to adapt to the change in the external environment. • Data analytics are useful in the change of our firm's corporate culture. • Data analytics enable us to redesign our business processes by contributing to our understanding of customer needs.
Strategic	• Data analytics are frequently utilized in our firm's strategy development processes. • Data analytics are utilized in our firm's determining our accounting and finance strategies. • Data analytics helps to develop new opinions in business process management in the firm.
Transactional	• Data analytics are frequently utilized in the control activities of our operations. • We have frequently utilized the findings obtained from data analytics tools within the firm. • We utilize data analytics to reduce operational costs in the firm. • The utilization of data analytics enhances the productivity of equipment and employees in the firm.
Interdependence Scale	
Informational	• There is an intense information interdependence between accounting and customer relationships in the organization. • There is an intense information interdependence between accounting and decision-making in the organization. • There is an intense information interdependence between accounting and marketing in the organization. • There is an intense information interdependence between accounting and e-commerce in the organization. • There is an intense information interdependence between accounting and research-development in the organization.
Task	• Communication and collaboration between departments are frequently carried out in the functional processes of our firm, such as innovation, new product development, and investment analysis. • In the use of business resources, sharing and cooperation between departments are taken into account. • Each department in our business is in dire need of support from other departments. • Managers also take into account the contribution of each department to the others in measuring department performance.
Goal	• The work of other departments significantly affects us in achieving organizational goals. • Appreciation and rewarding of our work depend on the success of other departments. • The impact of each department on the realization of organizational goals is evaluated separately by the management.

Source: Generated by Author

3.1. Ethical permissions for the study

In this study, all the rules specified in the "Directive on Scientific Research and Publication Ethics of Higher Education Institutions" were followed. None of the actions specified under the second section of the directive, "Actions Contrary to Scientific Research and Publication Ethics, have been carried out.

Ethics committee permission information

Name of the ethics review board = Istanbul Gelişim University, The Ethics Committee Chair

Date of ethical assessment decision = 29/08/2025

Ethics assessment certificate number number= 2025-16-03

4. Findings

4.1. Robustness Analysis

It was imperative to assess the dataset for common method bias and multicollinearity to verify its suitability for subsequent analysis. Various methodologies, as delineated by Hair (2014), were employed to determine common method bias, which could potentially compromise construct validity and introduce systematic error.

Table 2. Sample Demographics

Category	Frequency (N=64)	Percentage
Gender		
Female	28	30.76
Male	63	69.24
Age		
Under 28	32	35.16
Among 28-40	49	53.54
Over 40	10	10.98
Experience (Years)		
1-6	50	54.94
7-12	33	36.26
13 and Above	8	8.90
Job Title		
Manager	4	4.39
Senior Accountant	87	95.61
Organization Size (Number of Employees)		
50-249 (SMEs)	68	74.72
250 and above	23	25.28
Number of Analytics (low-high)		
Low (1-6)	77	84.61
High (7 and above)	14	15.39

Source: Generated by Author

We conducted a t-test to confirm the absence of non-response bias. As suggested in Armstrong and Overton (1977), we conducted the test for key variables like gender, number of analytics, transformational, and monitoring effectiveness variables. The t-test results show no significant difference between early and late responders ($p>0,05$ for all variables).

Moreover, we analyzed the Variance Inflation Factor (VIF) utilizing SPSS linearity diagnostics to investigate potential multicollinearity. According to Hair (2014), a VIF threshold of 3.00 is critical. Our assessments revealed that the VIF values for the Transformational, Informational, Transactional, and Strategic constructs ranged from 1.14 to 2.68, indicating a level well below the critical threshold. Similarly, the constructs pertaining to information dependency and functional dependency, those related to accounting system effectiveness and digital information sharing, yielded VIF values below 3.00. The findings outlined in Table 3 corroborate the absence of substantial correlation coefficients among the variables, thereby substantiating the hypothesis that multicollinearity did not constitute a problematic element in the present study.

Table 3. Correlations and Discriminant Validity

	Mean	SD	√AVE	TRF	INF	TRA	STR	IND	GOI	TID	USF	MNE	CLB	DEX
Transformational (TRF)	3.64	0.09	0.86											
Informational (INF)	4.02	0.16	0.88	0.54*										
Transactional (TRA)	3.29	0.12	0.80	0.61*	0.49*									
Strategic (STR)	3.61	0.04	0.83	0.44*	0.54*	0.51*								
Information Interdependence (IND)	3.55	0.67	0.89	0.68*	0.65*	0.42**	0.45*							
Goal Interdependence (GOI)	3.42	0.40	0.86	0.41**	0.60*	0.40**	0.42**	0.48**						
Task Interdependence (TID)	3.04	0.52	0.85	0.33**	0.58*	0.37**	0.40**	0.63*	0.49*					
User Information Satisfaction (USF)	3.92	0.55	0.93	0.42**	0.70*	0.39**	0.38**	0.57*	0.34**	0.49*				
Monitoring Effectiveness (MNE)	3.11	0.48	0.90	0.30**	0.39**	0.31**	0.44*	0.48*	0.51**	0.54*	0.70*			
Collaboration (CLB)	2.89	0.51	0.83	0.52*	0.53*	0.43**	0.46*	0.55*	0.50*	0.63*	0.40**	0.35**		
Data Exchange (DEX)	2.75	0.26	0.84	0.58*	0.61*	0.49**	0.43**	0.63*	0.58*	0.60*	0.37**	0.30**	0.64*	
Professional Experience (PRE)	2.76	0.10	-	0.10	0.12	0.08	0.10	0.09	0.12	0.14	0.11	0.08	0.11	0.10

***p<0.01, **p<0.05**

Source : Generated by Author

4.2. Reliability, Validity, and Factor Analysis

Confirmatory factor analysis (CFA) was executed utilizing AMOS software, a critical tool in the development of novel measurement instruments and structural validation studies (Hayes, 2017). This analytic technique is particularly beneficial as it facilitates the straightforward testing of hypotheses related to factor structures and the estimation of factor loadings, rendering it preferable to exploratory factor analysis.

The initial phase involved evaluating goodness-of-fit indices to assess the consistency and parsimony of the proposed measurement model. Concerning absolute fit indices, the results indicated a satisfactory model fit, as evidenced by the χ^2/df, GFI, and RMSEA values (χ^2/df: 2.60; GFI: 0.96; RMSEA: 0.042). Additionally, relative fit indices—CFI, IFI, and TLI—substantiate that the proposed structure adheres to the requisite model fit criteria (CFI: 0.95; IFI: 0.92; TLI: 0.92).

The evaluative framework for the model encompassed assessing convergent validity, discriminant validity, and construct reliability. The results, as illustrated in Table 5, affirm that the measurement model exhibits convergent validity, evidenced by item loadings surpassing the recommended threshold of 0.70 established (Fornell & Larcker, 1981).

A multifaceted approach was adopted for reliability analysis. Initially, reliability was exhibited through the loadings of the second-order constructs corresponding to the principal variables, each exceeding the 0.70 threshold advocated by Chin (2009). In addition, the calculated Cronbach's alpha values, which ranged from 0.79 to 0.86, surpassed the 0.70 threshold, thus confirming reliability. Lastly, composite reliability (CR) values exceeded the recommended threshold, further demonstrating the internal consistency of the constructs.

Table 4. Goodness-of-Fit Indexes

Fitness Index	Index	Threshold
χ^2/df	2.60	<3.00
Global Fit Index (GFI)	0.96	>0.90
Root Mean Squared Error of Approximation (RMSEA)	0.042	<0.07
Comparative Fit Index (CFI)	0.95	>0.90
Incremental Fit Index (IFI)	0.92	>0.90
Tucker-Lewis Index (TLI)	0.92	>0.90
p- Value	0.022	<0.05

Source: Generated by Author

Table 5. Loadings, Reliability, and Validity

Data Analytics Utilization: Cronbach's Alpha: 0.82 CR:0.84 AVE:0.74	Factor Loads
Data analytics enables us to quickly obtain the information required for operational processes.	0.88
Data analytics generates more accurate information for the managerial decisions of our firm.	0.85
Data analytics contributes to the increase of information interdependence in our firm.	0.90
Data analytics are utilized for our firm to adapt to the change in the external environment.	0.91
Data analytics are useful in changing our firm's corporate culture.	0.82
Data analytics enable us to redesign our business processes by contributing to our understanding of customer needs.	0.88
Data analytics are frequently utilized in our firm's strategy development processes.	0.84
Data analytics are utilized in our firm's determining our accounting and finance strategies.	0.87
Data analytics helps to develop new opinion in business process management in the firm.	0.83
Data analytics are frequently utilized in the control activities of our operations.	0.90
We have frequently utilized the findings obtained from data analytics tools within the firm.	0.81
We utilize data analytics to reduce operational costs in the firm.	0.83
The utilization of data analytics enhances the productivity of equipment and employees in the firm.	0.88
Interdependence: Cronbach's Alpha: 0.83 CR:0.85 AVE:0.79	
There is an intense information interdependence between accounting and customer relationships in the organization.	0.82
There is an intense information interdependence between accounting and decision-making in the organization.	0.80
There is an intense information interdependence between accounting and marketing in the organization.	0.84
There is an intense information interdependence between accounting and e-commerce in the organization.	0.87
There is an intense information interdependence between accounting and research-development in the organization.	0.88
Communication and collaboration between departments are frequently carried out in the functional processes of our firm**,** such as innovation, new product development, and investment analysis.	0.86
In the use of business resources, sharing and cooperation between departments are taken into account.	0.90
Each department in our business is in dire need of support from other departments.	0.81
Managers also take into account the contribution of each department to the others in measuring department performance.	0.88
The work of other departments significantly affects us in achieving organizational goals.	0.84
Appreciation and rewarding of our work depend on the success of other departments.	0.85
The impact of each department in the realization of organizational goals is evaluated separately by the management.	0.82
Accounting System Effectiveness: Cronbach's Alpha: 0.86 CR:0.87 AVE:0.86	
Do you think the output is presented in a useful format?	0.91
Are you satisfied with the accuracy of the system?	0.90
Is the information clear?	0.94
Is the system accurate?	0.88
Does the system provide sufficient information?	0.87
Does the system provide up-to-date information?	0.91
Do you get the information you need in time?	0.93
Does the system provide the precise information you need?	0.92
Does the information content meet your needs?	0.84
Does the system provide reports that seem to be just about exactly what you need?	0.84
Is the system user-friendly?	0.86
Is the system easy to use?	0.90
Control reports are provided frequently on a systematic, regular basis, e.g., daily, weekly reports.	0.91
All in all, our AIS provides information useful for the ongoing monitoring of decisions and actions.	0.88
Digital Information Sharing: Cronbach's Alpha: 0.79 CR:0.81 AVE:0.70	

Using digital information sharing, we are willing to execute cost-cutting measures together with our customers.	0.89
Using digital information sharing, we are willing to set up a common quality management process with our customer.	0.84
Using digital information sharing, we are willing to set up a common error prevention and improvement process with our customers.	0.88
We are willing to digitally share planning and capacity information (e.g., needs, technical capacities).	0.80
We are willing to digitally share delivery details and inventory data (e.g., ASN, finished goods).	0.92
We are willing to digitally share production data (e.g., OEE, cycle time, scrap rate).	0.81
We are willing to digitally share process data (e.g., machine settings, machine parameters, inspection results).	0.83
We are willing to digitally share engineering information (e.g., concepts, drafts, engineering drawings).	0.85

Source: Generated by Author

4.3. Testing of Hypotheses

The evaluation of the hypotheses posited by Hair et al. (2014) was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is a variance-based approach adept at analyzing relatively small sample sizes. The resulting path coefficients from the structural model are illustrated in Figure 2, while Table 5 encapsulates a comprehensive summary of the direct, mediation, and moderation effects observed.

Although the direct effect of digital information sharing on accounting system effectiveness was found to be comparatively lower (β: 0.323; p: <0.10; R^2: 35%), it still remains statistically significant. Furthermore, the research model analyzed the mediating role of digital information sharing within the relationship between DA utilization and accounting system effectiveness. The R^2 value for the direct path from DA utilization to accounting effectiveness is 52%, whereas the R^2 value for the mediation analysis is elevated at 61%. This variance shift underscores the mediating effect of digital information sharing, as demonstrated by the coefficient (β: 0.586; p: <0.05; R^2: 61%).

Table 6. Test Results of H1 to H5 (Direct Effect, Mediation Effect, Moderation Effect)

	β	p	t	R^2	Outcome
Direct Effect					
Data Analytics Utilization → Accounting System Effectiveness	0.403	<0.05	9.906	52%	H1: Supported
Data Analytics Utilization → Digital Information Sharing	0.602	<0.01	16.522	68%	H2: Supported
Digital Information Sharing → Accounting System Effectiveness	0.323	<0.10	6.789	35%	H3: Supported
Mediation Effect					
Data Analytics Utilization →Digital Information Sharing→ Accounting System Effectiveness	0.586	<0.05	12.550	61%	H4: Supported
Moderation Effect					
(Data Analytics Utilization + Interdependence) → Digital Information Sharing	0.647	<0.05	19.003	69%	H5a: Supported
(Data Analytics Utilization + Interdependence) → Accounting System Effectiveness	0.470	<0.05	10.294	54%	H5b: Supported
(Digital Information Sharing + Interdependence) → Accounting System Effectiveness	0.121	>0.10	7.547	%22	H5c: Not Supported
χ^2/df: 2.04 RMSEA:0.057 p: 0.038					

Source: Generated by Author

Additionally, our investigation into the moderating effect of dependency revealed significant findings. Specifically, it was determined that dependency within an organization positively moderates the influence of DA utilization on digital information sharing (β: 0.647; p: <0.01; R^2: 69%). Furthermore, dependency amplifies the contribution of DA utilization to the accounting system (β: 0.470; p: <0.05; R^2: 54%). Conversely, dependency does not serve as a moderator in the relationship between digital information sharing and the accounting system (β: 0.121; p: >0.05; R^2: 22%). These results substantiate hypotheses H5a and H5b while leading to the rejection of hypothesis H5c.

To investigate Hypotheses 6 and 7, we conducted a multi-group analysis with the goal of examining variations in direct effects based on organizational size and the number of analytical tools employed. Multi-group analysis has emerged as a powerful method for assessing structural models (Henseler et al., 2016). This analytical approach facilitated our exploration into whether the direct effects between constructs fluctuate based on organizational size and the employment of analytical tools. In alignment with the European Commission decision 2003/361/EC, organizations were stratified into two primary subgroups: small and medium-sized enterprises (SMEs), comprising those with 10 to 249 employees, and larger firms, defined as having 250 or more employees. Further classification was performed based on the frequency of DA tool usage, which resulted in the formation of high-usage and low-usage groups. The mean number of analytical tools utilized (μ: 4.21; SD: 0.341) served as the benchmark for this classification. Firms employing fewer analytical tools than average were categorized as low-use, while those exceeding the average were labeled as high-use.

Table 7. Multi-Groups: Organization Size

	β_{SMEs}	β_{large}	$\beta_{(SMEs-large)}$	Permutation p-Values	Outcome
Direct Effect					
Data Analytics Utilization → Accounting System Effectiveness	0.337	0.488	-0.151	<0.05	H6a: Supported
Data Analytics Utilization → Digital Information Sharing	0.583	0.642	-0.059	>0.10	H6b: Not supported
Digital Information Sharing → Accounting System Effectiveness	0.279	0.471	-0.082	<0.10	H6c:Supported
χ^2/df: 2.79 RMSEA:0.064 p: 0.041					

Source: Generated by Author

The path coefficients delineating the influence of DA on the accounting system reveal statistically significant disparities between SMEs and larger organizations (β(SMEs-large): -0.151, p<0.05). This result substantively supports Hypothesis 6a, which asserts that the effect of DA on the accounting system is contingent upon organizational size. In contrast, the path coefficient pertaining to the relationship between digital information sharing and DA utilization does not exhibit significant variation across different organizational sizes (β(Medium-sized-large): -0.059, p>0.05). However, the direct influence of digital information sharing on the accounting system does exhibit significant differences by organizational size (β(Medium-large): -0.082, p>0.10), and it indicates a heightened impact of digital information sharing on the accounting system within larger enterprises, thereby corroborating Hypothesis 6c. Multi-group comparisons categorized by the number of DA tools utilized are presented in Table 8.

Table 8. Multi-Groups: Number of Analytics Tools

	β_{low}	β_{high}	$\beta_{(low-high}$	Permutation p-Values	Outcome
Direct Effect					
Data Analytics Utilization → Accounting System Effectiveness	0.346	0.417	-0.071	<0.10	H7a: Supported
Data Analytics Utilization → Digital Information Sharing	0.587	0.630	-0.043	>0.10	H7b: Not Supported
Digital Information Sharing → Accounting System Effectiveness	0.301	0.330	-0.029	>0.10	H7c: Not Supported
χ^2/df: 2.15 RMSEA:0.051 p: 0.032					

Source: Generated by Author

The findings denote that the impact of DA usage on the accounting system is contingent upon the volume of analytical tools adopted by the firm (β(low-high): -0.071; p<0.10). This outcome supports Hypothesis 7a, which underscores the magnitude of tool diversity in the relationship between increased analytics usage and the accounting system. In contrast to the direct effect of DA on digital information sharing, which establishes consistency irrespective of the number of analytical tools utilized (β(low-high): -0.043; p<0.10).

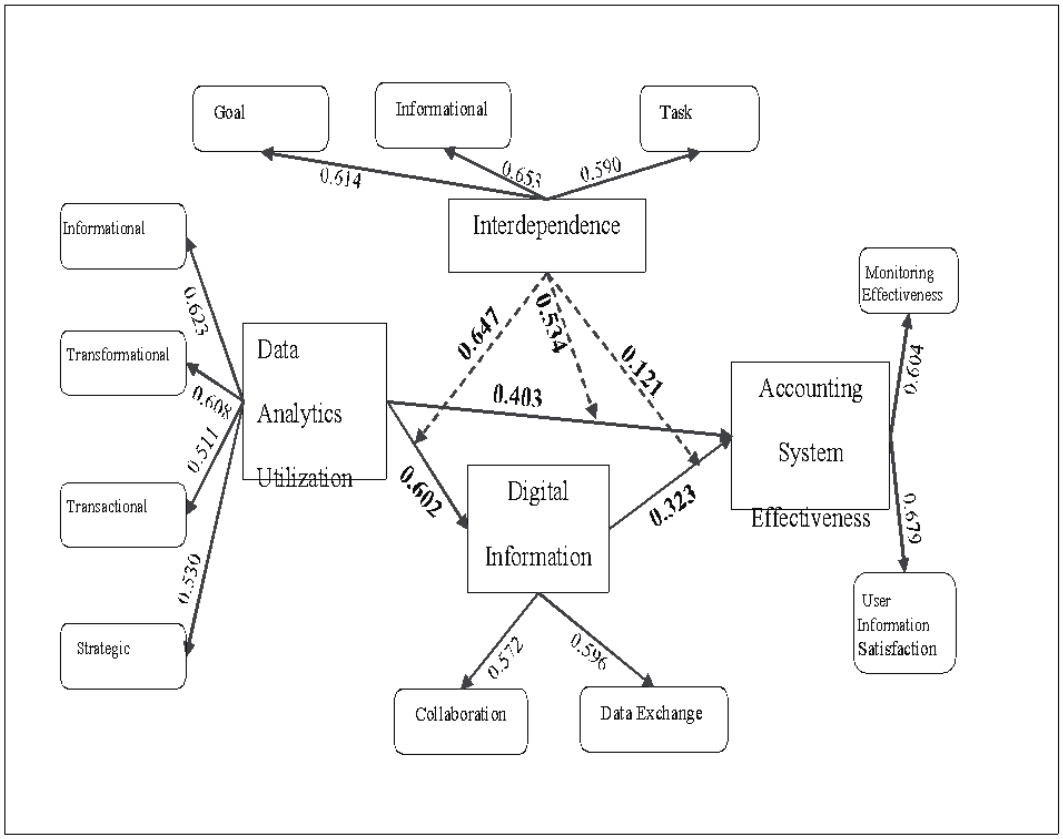

Figure 2. Tested Model,
Source: Generated by Author

Moreover, the path coefficient linking digital information sharing to the effectiveness of the accounting system remains invariant regardless of the number of analytical tools employed (β(low-high): -0.029; $p<0.10$). These results suggest that Hypotheses 7b and 7c lack empirical support.

5. Conclusions and Implications

The escalation of BD deployment has instigated a primary transformation within organizations, and it enabled the conversion of unprocessed data into significant financial assets via advanced DA tools. However, the efficacy of DA is often undermined by inadequate implementation capabilities and a limited comprehension of its financial ramifications, which significantly curtail organizations' engagement with these tools (Bose et al., 2023).

From the perspective of information sharing theory, the necessity of uninterrupted digital information exchange between departments has an impact on the effectiveness of accounting systems (Weigel & Hiebl, 2023). As a result, financial decision-making within organizations relies on the output generated from the accounting framework. Furthermore, the enhancement of accounting system effectiveness is intrinsically connected to the successful execution of organizational strategies. This viewpoint is corroborated by the study, which underscores that the effective implementation of DA augments operational functionality and promotes intra-organizational information sharing, ultimately leading to enhanced accounting efficiency, characterized as a unique information system. In this regard, DA emerges as a decisive facilitator for the optimization of digital information sharing capabilities.

5.1. Theoretical Implications

Through examining the impact of DA on accounting system effectiveness within the framework of interdependence and digital knowledge sharing, this research has expanded the ongoing theoretical discussion in the field of management information systems to include knowledge-sharing theory and resource dependence theory. Additionally, it clarifies the pivotal role of interdependence and digital information sharing within the accounting landscape. Furthermore, the newly developed scales for DA utilization and interdependence serve as reliable and valid measurement instruments for future empirical investigations, facilitating the operationalization and testing of these constructs across diverse contexts.

For the first time, this research articulates the role of digital information sharing and interdependence within the nexus of DA use and accounting system effectiveness. It addresses previous inconsistencies ascertained in previous studies Grabner et al. (2022) by demonstrating that interdependence enhances the positive effects of DA utilization on both digital information sharing and the effectiveness of accounting systems, and consequently, correcting a prior misconception associated with the term "reduced." Although H5c is not supported, this finding suggests that it may not yet significantly impact accounting practices due to the high investment cost required for digital information sharing tools in the context of interdependence. The result may stem from the current technological maturity level of the participants in the sample, where data analytics are still in the early stages of implementation in the Turkish market. H6b is not supported. As data analytics has only recently begun to be adopted at the enterprise level, and many accountants have only recently been able to incorporate analytics into their decision-making processes, the potential impact of data analytics on digital data sharing is not yet significant.

The findings notably advance the organizational behavior literature by illustrating the contingent nature of interdependence in fostering internal communication and coordination, particularly concerning accounting functions. By specifying how communication and interaction among internal units align with accounting exigencies, this research enhances understanding of organizational dynamics. Additionally, the results indicate that the effectiveness of DA is contingent upon organizational size, revealing that larger firms leverage DA more effectively. This finding underscores the relevance of economies of scale, which can be theoretically linked to resource dependency and the capacity for information processing, thereby contributing to the advancement of knowledge in this domain.

5.2. Managerial Implications

Practical implications for organizational leaders and managers are discussed in line with the findings. The research findings demonstrate that investing in data analytics is not merely a technological shift, but also a construct that can be used to strategically manage internal power dynamics and reduce resource dependency from a managerial perspective. Accounting departments are encouraged to integrate a broader spectrum of DA tools (e.g., text mining, machine learning, data clustering) into their existing enterprise resource planning (ERP) systems. Such integration has the potential to elevate business success by facilitating the processing of large volumes of internet-based data (Raveendran et al., 2020). Managers should critically assess the financial returns on investments made in DA, recognizing that such investments create necessary conditions for enhancing the effectiveness of accounting systems through information interdependence and digital information sharing, which together foster more accurate dissemination of information within the organization.

Highlighting the strategic role of digital information sharing tools in ensuring corporate stability and their contribution to symmetrical information flow encourages managers to advocate more for the high-tech investments required for the acquisition of these technologies. Organizations are advised to allocate dedicated resources towards DA tools that bolster information interdependence. This includes insights obtained from customer preferences, production metrics, and external market data, which enhance collaborative efforts among marketing, production, finance, and R&D departments, facilitating multi-dimensional assessments of decision-making scenarios. In the realm of digital information sharing, assessments that incorporate data from various organizational units—such as marketing, finance, research, and development—will bolster the functionality and usability of financial statements and reports generated by accounting systems. Organizations should reinforce their operations with DA tools to achieve a competitive edge in addressing historical, present, and forecasted events (Bevan et al., 2012).

The findings practically prove that the use of data analytics creates an opportunity for accountants to transition to a more regulatory phase in their job roles. This enables them to use more information when handling risks. The implementation of descriptive, predictive, and prescriptive analytics—including modeling techniques, organizations to cultivate analytical thinking skills, and execute strategic initiatives (Aryani & Rosyid, 2025). Given the critical importance of data quality in enhancing accounting efficiency, organizations must prioritize improvements in digital information sharing. DA plays a pivotal role in facilitating the filtering, cleaning, and matching of data, ultimately resulting in the generation of higher-quality accounting information (Appelbaum et al., 2017). The deployment of advanced tools, such as text mining, data aggregation, and visual graphics, empowers managers to enhance data functionality, thereby optimizing decision-making processes (Tuan et al., 2021). In this context, DA assists organizations in

establishing and implementing robust policies and strategies for data collection and management. Furthermore, it supports management in maintaining effective control and monitoring processes, enabling a comparative assessment of the accuracy of financial statements produced by the accounting system (Bose et al., 2023).

5.3. Research limitations and Future Agenda

The research data is based on participants' self-reports that may cause self-reporting bias, and they may have rated the technological competence in their own departments as relatively low or high. Furthermore, future research could utilize objective performance indicators, such as log records, system usage time, decision-making speed, and audit quality for further analysis. While the study encompassed participants from various firms, focusing on a specific industry will provide a micro-level foundation to more clearly demonstrate the sector-specific impact of data analytics. Additionally, the data analytics tools discussed in this study contained a broad definition. Since each tool and application may have a different impact on the accounting system, subsequent studies could focus on specific technologies or tools for comparison.

The future studies could greatly benefit from employing longitudinal datasets, which may clarify relationships among DA, accounting systems, and digital information sharing over extended periods. The participant pool was limited to accounting professionals within companies that are operating in Turkey, together with a small number of managers.

The larger sample size and participants from various sectors and geographic regions would improve the comparability and generalizability of the findings. Future research could delve deeply into the specific relationships between DA and each core accounting sub-function, such as control, cost management, and performance management.

Considering that the procurement and implementation of DA tools call for significant financial investment, subsequent studies should examine managerial attitudes and perceptions regarding the acquisition and use of these tools. Additionally, future research could further scrutinize the roles of DA as both a moderator and a regulator across various sectors, supported by a wide range of empirical examples. Beyond behavioral aspects, researchers are also encouraged to investigate the combined impact of DA and accounting systems on both financial and non-financial performance metrics. In conclusion, this study lays a foundational framework for understanding the evolution of the accounting function in today's business landscape and outlines strategic approaches for navigating this evolution. It is anticipated that future research endeavors will build on this foundation to provide more nuanced and comprehensive insights.

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7. Financial Support: No specific grant is provided for this research by any institution.

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9. Ethics Committee Statement and Intellectual Property Rights: This study has been prepared in accordance with the rules of scientific research and publication ethics. The research was approved by the Ethics Committee of Istanbul Gelişim University Rectorate with the decision numbered 2025-16-03 and dated 29.08.2025.

10. Data Availability: Data will be made available by the author upon reasonable request.

11. Use of Artificial Intelligence: There is no use of AI.

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