INTERNATIONAL JOURNAL OF SOCIAL AND MANAGEMENT STUDIES (IJOSMAS)
Volume: 05 No. 04 (2024) https://www.ijosmas.org e-ISSN: 2775-0809

Driving Information Security Innovation with Sustainable IT Capabilities

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Abstract -- *This study explores the relationship between sustainable IT capabilities and ISM Assimilation in organizations. By focusing on three key Sustainable IT Capabilities, namely IT Infrastructure, IT Business Spanning Capability, and IT Proactive Stance, this study investigates how these three capabilities influence the integration of ISM practices in an organizational context. Data collected from 157 upper management level employees at several companies in Indonesia that implemented ISM were analyzed using structural equation modeling. The data were analyzed with SEM PLS and SmartPLS 4.0 software. The results showed a positive influence of sustainable IT capabilities on ISM Assimilation. So the three factors of sustainable IT capabilities, namely: IT Infrastructure, I T Business Spanning Capability, and IT Proactive Stance have a positive effect on ISM Assimilation. These findings provide valuable insights for organizational leaders and business owners to develop sustainable IT strategies that enhance information security and promote the assimilation of ISM practices for sustainable asset management.*

Keywords*: ISM Assimilation, IT Business Spanning Capability, IT Infrastructure, IT Proactive Stance, Sustainable IT Capabilities.*

I. INTRODUCTION

Several businesses today rely heavily on information technology (IT) as an essential tool to ensure productivity and efficiency across their activities. However, as the use of IT increases, the problem of addressing security risks - which is the possibility that certain threats can damage an organization's systems - to information and systems is increasing (Hashim et al., 2022). With the rapidly developing Internet technology, it is easy to obtain sophisticated hacking technologies. In addition, information leaks, which target not only individuals but also organizations, occur frequently. Although the adoption of various information technologies has resulted in higher productivity and efficiency, companies are constantly exposed to security risks, which potentially threaten the sustainability of the organization (Kim et al., 2020).

In addition, as the organization's data and information infrastructure becomes more sophisticated, the variety of data and information is also increasing, so the need for efficient management of these resources becomes the main goal of enterprise and IT management activities. Security management as a response to the ever-increasing proportion of data privacy issues and confidential data leakage has emerged as one of the main objectives of enterprise and IT management activities (Widodo et al., 2022)

Key issues to be addressed in management. Therefore, the demand for information security management (ISM) that includes various activities to protect organizational information from various risks and ensure business continuity and opportunities is gradually increasing (Szydłowska & Swacha, 2024). Therefore, companies are focusing on ISM to maintain a higher level of business continuity. This is because security risk, which is the risk of loss of integrity, privacy, or accessibility of information in any form due to ineffective management or unplanned events, is likely to cause enormous losses, both tangible and intangible, such as decreased corporate brand value, decreased corporate credibility, and financial losses.

As awareness of the potential risks to an organization's assets increases, investment in ISM is on the rise, and several approaches have evolved to mitigate those risks, depending on the scope of application. In this regard, Bishop (2003) states that IT security relies on three elements: confidentiality, integrity and availability. In general, the assessment of information security has led to extensive research into these three elements. Moreover, due to the proliferation of IT, the goal of information security itself is described as securing the three elements of information (Kim et al., 2020). However, an organization's information systems may be exposed to security risks due to technical failures, system vulnerabilities, human error, or external factors. It is important to prepare in advance a management base to prevent such risks and even act after an accident occurs. This means that an enterprise-wide security management policy and system introduction are crucial for sustainable security management.

However, most of the existing research on organizational information security focuses on the technical aspects, but few address the organizational aspects which limits the ability to explain the internal strategies of companies in terms of information security. Some researchers state that research on information security should not be limited to the technical part alone because various security risks arise from users using technology in an organization (Choi et al., 2018; Szydłowska & Swacha, 2024). Thus, it is necessary to consider information security as a social and organizational issue because not only security-related issues change over time, but also most IT operations are performed by humans.

Based on the research rationale, and the important implications for and limitations of ISM in existing research, the main objective of this study is to propose and verify a research model that explains the effects of the three dimensions of Sustainable IT Capabilities consisting of IT Infrastructure (ITI), IT Business Spanning organizational ISM assimilation for sustainable asset management in organizations.

IT infrastructure reflects the diversity and harmonization of IT components needed to support business applications. An established organizational IT infrastructure not only provides an integrated platform for the integration and standardization of data and processes, but also enables accurate and timely information collection and information sharing (Kim et al., 2020). In addition, an organization's IT infrastructure enables real-time and comprehensive information sharing to facilitate efficient decision-making. This real-time access to information supports the expansion of the environmental footprint to collect, track, and distribute information for changing customer needs, competitors, technology, or regulatory developments. An integrated IT infrastructure provides a platform for creating digital choices to support companies to access, integrate and develop knowledge and increase the richness and reach of their processes and knowledge. For example, IT infrastructure forms a network through which members in a company can share data and information to manage knowledge. Through this network, it is possible to simultaneously adopt various IT-enabled approaches, such as automatically modifying and storing shared and reused knowledge through databases. A sophisticated IT infrastructure enables internal assessments to cope with changes in market demand or supply disruptions and frequent or unexpected rapid changes.

IT infrastructure plays a key role in enterprise-wide applications, databases, and collaborative systems to work quickly, intensively, and innovatively; change processes quickly; and provide the best support initiatives for demand. Underlining the importance of IT infrastructure as a sustainable enterprise technology asset, Kim et al. (2020) suggested a link between IT infrastructure and IT assimilation to enhance ISM sustainability. In other words, a mature IT infrastructure enables organizations to develop a higher level of technical knowledge, which promotes innovation and better IT assimilation. In addition, it is stated that IT infrastructure strengthens the ability and willingness of business managers to form innovative IT applications, which creates corresponding advantages in managing information security. ISM develops a higher level of security knowledge based on a mature IT infrastructure and enhances the ability and willingness of business managers to promote better assimilation of ISM to improve the sustainability of organizational information security.

Another sustainable IT capability is IT business reachability, which refers to an organization's ability to plan and develop IT resources that reinforce and support the objectives of business activities. This ability to connect with IT creates synergies between an organization's IT and business partnerships, allowing them to craft effective IT strategies that are combined with organizational decisions. In addition, close interaction and collaboration between IT and business fosters long-term maturity in terms of trust and respect that encourages knowledge sharing and exchange between IT and managers. This shared knowledge not only affects the organization's IT usage, IT assimilation, and the level of IT-business alliance, but also enables the organization to focus more on the strategic use of IT for ongoing ISM.

The synergy between IT and business activities enables fast, efficient, and innovative responses in ISM, as well as redesigning business processes and information systems to improve the continuity of protection of organizational information resources. Kim et al. (2020) state that IT-related strategies are beneficial for innovative and rapid process changes. During uncertain times, such as ISM, the organization's ongoing IT and business relationships are particularly useful for informal and impromptu decision-making. In other words, close collaboration between IT and business enables business processes to be flexible and responsive. Therefore, the synergy between IT and the organization's business enables fast and efficient decision-making on ISM and effective security management strategies to facilitate the assimilation of security management within the organization.

IT proactive attitude refers to the characteristics of companies in seeking methods for R&D in IT resources to exploit and create business opportunities. Companies that seek a comprehensive understanding of critical IT innovations tend to identify, select, and implement IT innovations after considering the probability that they will be appropriate. Companies have the ability to foresee uncertainties about the benefits of using innovations and the costs of developing innovations, and are cautious when testing potential new IT innovations. In addition, companies can predict related changes due to the sophisticated nature of IT, and they get the opportunity to be more creative with emerging technologies. IT's proactive attitude allows companies to quickly seize opportunities and get ahead of market opportunities.

The proactive performance of IT, the sustainable capacity of the organization, enables continuous learning and renewal of IT, thereby enhancing the organization's ability to quickly change processes to adapt to

changes and promote the significance and awareness of ISM. Kim et al. (2020) argue that companies with a high IT proactive attitude can thoroughly manage the introduction, assimilation, and performance of IT innovations, and avoid falling into a fixed technical rigidity. In addition, companies can seize suitable opportunities by reusing or adapting existing IT resources for rapid innovation and radical business activities. In other words, IT's proactive stance can increase ISM awareness among organizational members through preemptive activities to protect the organization's information resources, thereby enhancing sustainability (Suhartono & Asbari, 2024).

Based on the theoretical study and the explanation above, the researchers proposed a research model according to Figure 1 and developed the following research hypothesis:

H1: IT Infrastructure will have a positive effect on ISM Assimilation.
H2: IT Business Spanning Capability will have a positive effect on ISM Assimilation.
H3: IT Proactive Stance will have a positive effect on ISM Assimilation.

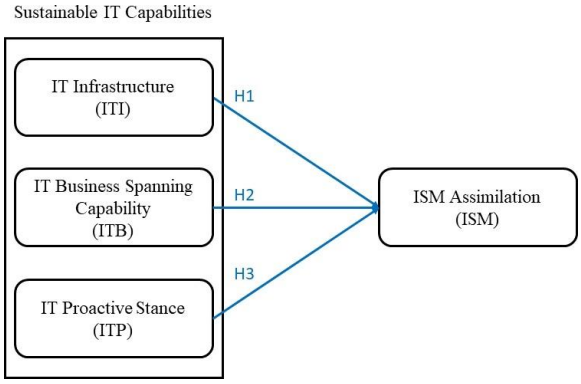

Figure 1. Research Model

II. RESEARCH METHODS

In the first part of the survey, the purpose of the study was explained and guidelines were given for completion. In the second section, respondents were asked to provide information about themselves. In the third section, a five-point Likert scale (1-5) was used to describe the main research questions. The first point indicates "strongly disagree", and the fifth point indicates "strongly agree". To measure IT infrastructure, there are three components used (ITI1-ITI3), the ability to bind IT business (ITB1-ITB3), IT proactive attitude (ITP1-ITP3), and ISM recognition (ISM1-ISM6). All of these items were modified from existing ones (Kim et al., 2020).

Covariance-based approaches (CB-SEM) and variance-based partial least squares techniques (PLS-SEM) are the two most widely used statistical techniques in Structural Equation Modeling SEM (Sarstedt et al., 2014). However, many fields such as strategic management, marketing, and management information systems now use PLS-SEM (Hair et al., 2012). The main cause of the increased use of this method is the ability of PLS-SEM to handle modeling problems that often occur in the social sciences, such as unusual data characteristics (such as non-normal data) and highly complex models. To test the research hypothesis, PLS-SEM was used due to the advantages of this method. SmartPLS software 4.0 was used to test both the outer and inner models. Tests were conducted on the outer model to ensure measurement validity and reliability, and tests were conducted on the inner model to examine the introduced hypotheses.

According to Creswell & Creswell (2017), a quantitative approach is most appropriate if the research objective is to determine the relationship of influence between the variables under study. Quantitative research, which uses various statistical tools, is suitable for testing theories and hypotheses (Hair et al., 2012). Therefore, the hypotheses made were tested in this study through the survey method. Therefore, a questionnaire was used to collect the required data. The questionnaires were sent via email to management-level employees of several companies in Indonesia that implement various information security technologies. 500 questionnaires were distributed and 162 responses (32.4%) were returned. Of the 162 respondents, 157 valid questionnaires were returned. This number was used in this study.

III. RESULTS AND DISCUSSION

Results

There were a total of 157 supervisors and managers from several companies in Indonesia who participated in this study consisted of females (36.3%) and males (63.7%). Convergent and discriminant validity

were tested in the measurement model. However, composite reliability values and Cronbach's alpha were used to evaluate construct reliability. If all indicators of the PLS model meet the requirements of convergent validity, discriminant validity, and reliability tests, the PLS analysis results can be used to test the research hypotheses. The loading factor value of each indicator compared to its construct is used to test convergent validity. Factor weights of 0.7 or more in most references are considered to have sufficient validation to explain latent constructs (Chin W, 1998; Flury et al., 1988; Ghozali, 2017). In this study, the minimum acceptable factor load is 0.7, and the AVE value of each construct must be more than 0.5 (Ghozali, 2017). After SmartPLS 4.0 processing is carried out, all indicators have a factor load value of more than 0.7 and an AVE value of more than 0.5. Figure 2 shows a suitable or valid model for this study. Therefore, the convergent validity of this research model has met the requirements (Ghozali, 2007). Table 2 and Figure 2 show the loading values, Cronbach's alpha, composite reliability, and AVE for each construct.

Discriminant validity ensures that each idea derived from each latent variable is not the same as ideas derived from other latent variables. The model provides discriminant validity if the squared AVE value of each exogenous construct-or the value on the diagonal-exceeds the correlation between that construct and other constructs-or the value below the diagonal (Ghozali, 2017). The test results show that using the AVE squared value, namely by by looking at the Fornell-Larcker Criterion Value (Table 3). The results of the discriminant validity test in Table 3 show that all constructs have an AVE square root value above the correlation value with other latent constructs through the Fornell-Larcker criterion, so it can be concluded that the model has met discriminant validity. (Fornell & Larcker, 1981).

Next, a collinearity evaluation is conducted to ascertain whether there is a collinearity problem in the model. This requires the VIF collinearity statistic of each construct, and a VIF value below 5 indicates that there is collinearity (Hair et al., 2014). Table 4 shows that the results of the structural model show VIF values below Table 3. This indicates that there is no multicollinearity problem in this research model.

One way to determine construct reliability is to look at the combined reliability and Cronbach's alpha value of each construct. The recommended combined value of reliability and Cronbach's alpha is more than 0.7 (Ghozali, 2017). The reliability test results shown in Table 2 show that all constructs have their respective reliability and Cronbach's alpha values greater than 0.7. In conclusion, all constructs have met the reliability requirements.

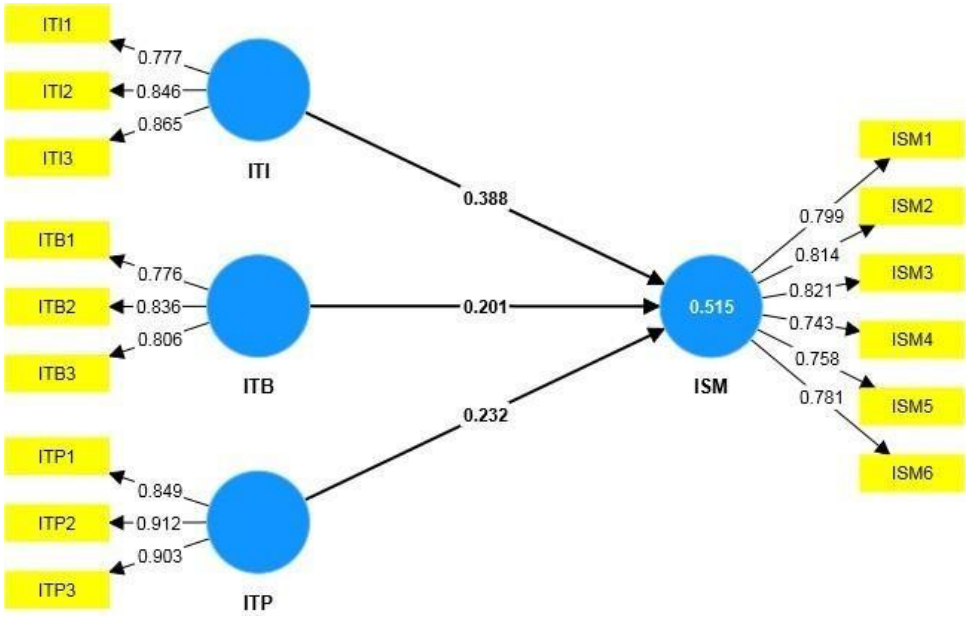

Figure 2. Valid Research Model

Table 1. Items Outer Loadings

Items	ISM	ITB	ITI	ITP
ISM1	0.799			
ISM2	0.814			
ISM3	0.821			
ISM4	0.743			
ISM5	0.758			
ISM6	0.781			
ITB1		0.776		

Items	ISM	ITB	ITI	ITP
ITB2		0.836		
ITB3		0.806		
ITI1			0.777	
ITI2			0.846	
ITI3			0.865	
ITP1				0.849
ITP2				0.912
ITP3				0.903

Table 2. Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE)

Variables	Cronbach's Alpha	Composite Reliability (Rho_A)	Composite Reliability (Rho_C)	AVE
ISM	0.877	0.887	0.907	0.619
ITB	0.731	0.731	0.848	0.651
ITI	0.773	0.777	0.869	0.689
ITP	0.866	0.866	0.918	0.789

Table 3. Discriminant Validity - Fornell-Larcker Criterion

Items	ISM	ITB	ITI	ITP
ISM	0.787			
ITB	0.635	0.807		
ITI	0.669	0.781	0.830	
ITP	0.552	0.563	0.533	0.888

Table 4. Collinearity (VIF)

Items	ISM	ITB	ITI	ITP
ISM				
ITB	2.780			
ITI	2.652			
ITP	1.513			

Table 5. *R Square* Value

Variables	R Square	R Square Adjusted
ISM	0.515	0.514

Table 6. Hypotheses Testing

Hypotheses		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
H1	ITI -> ISM	0.388	0.388	0.037	10.590	0.000	Supported
H2	ITB -> ISM	0.201	0.203	0.041	4.864	0.000	Supported
H3	ITP -> ISM	0.232	0.231	0.030	7.826	0.000	Supported

Internal model test is another term for hypothesis testing in PLS. It involves evaluating the significance of direct and indirect effects and calculating how much influence exogenous variables have on endogenous variables. The direct effect test is required to determine the relationship between sustainable IT capabilities consisting of IT infrastructure (ITI), IT Business Spanning (ITB) capabilities, and IT Proactive Stance (ITP) capabilities with ISM assimilation. The R Square, Adjusted R Square, and significance test values were obtained by boothstrapping technique in the partial least squared (PLS) analysis model using the t-statistic test used in SmartPLS 4.0 software. The results show that hypotheses H1, H2, and H3 are all supported.

Discussion

Table 5 shows the Adjusted R Square value of ISM Assimilation (ISM) of 0.514, which indicates that the three variables in the concept of Sustainable Information Intelligence, consisting of Information Infrastructure (ITI), Corporate Information Intelligence (ITB) and Proactive Information Intelligence (ITP), can explain the ISM Assimilation variable by 51.4%, and other variables not discussed in this study by 48.6%. The initial sample value (O) shows the magnitude of the influence of the independent variable on the dependent variable. First, the magnitude of the influence of the ITI variable on ISM is 0.388, which means that each addition of one unit to the ITI variable will have a positive effect on ISM of 0.388 units, or 38.8%. Second, the magnitude of the influence of the ITB variable on ISM is 0.203, which means that each addition of one unit to the ITB variable will have a positive effect on ISM by 0.203 one unit, or 38.8%.

This study analyzes and verifies the effects of three dimensions of sustainable IT capabilities: IT infrastructure, IT business coverage capability, and IT proactive attitude on organizational ISM assimilation. The empirical results of this study support the underlying concept that each dimension of sustainable IT capability consists of reflective factors and that IT infrastructure, IT business coverage capability, and IT proactive attitude are directly related to the assimilation of ISM for sustainable asset management. The results of this study are consistent with previous research (Armstrong & Sambamurthy, 1999; Brown & Eisenhardt, 1997; Kim et al., 2020), where these IT capabilities play an important role for managers in the assimilation of ISM within the organization. In other words, an organization's continuous investment in IT infrastructure for ISM informs its members how important ISM is to the organization, thus increasing their ISM awareness. Kim et al. (2020) state that all organizations using IT are unlikely to come to fruition without continuous investment in technology. Even in ISM, IT infrastructure such as hardware, software, and networks, which are the basis for organizational members to maintain ISM continuity, are essential.

In addition, IT policies that are linked to the business will provide more effective results in ISM. Therefore, if the organization tends towards ISM and creates an environment in which information security is very important, then the organization's ISM will move in a more active and efficient direction. In this environment, organizational members naturally assimilate ISM. Hashim et al. (2022) argue that it is necessary to use IT in accordance with the vision, strategy, and information security-related activities to grow ISM. Similarly, these authors state that IT should be used strategically for business expansion. However, if organizations use technology by only considering IT performance and advantages while ignoring business linkages, it will result in high investment and low returns.

IV. CONCLUSION AND SUGGESTION

Based on the research results presented in the PDF file, it can be concluded that sustainable IT capabilities, especially in the form of IT infrastructure, IT business spanning capability, and IT proactive stance, have a positive impact on ISM assimilation in organizations. A stable IT infrastructure, IT business spanning capability, and proactive stance in IT management can increase organizational members' awareness of information security and help in integrating information security into daily activities. In addition, the balance between IT policies and technology also plays an important role in strengthening the relationship between sustainable IT capabilities and ISM assimilation. It was found that the balance between policy and technology can strengthen the effect of IT infrastructure and IT business spanning capability on ISM assimilation. However, no moderating effect of policy-technology balance was found in the relationship between IT proactive stance and ISM assimilation.

The results of this study provide meaningful insights for future research on sustainable IT capabilities and ISM, and provide important guidance for organizations to establish complementary strategies for sustainable assets. Thus, it can be concluded that paying attention to and developing sustainable IT capabilities can help organizations manage information security effectively and sustainably.

Theoretical Implications

The theoretical implications of the results of this study related to the relationship between sustainable IT capabilities and ISM assimilation are as follows: (1) Provision of Theoretical Basis: This study provides a strong theoretical basis for the factors that shape sustainable IT capabilities and influence ISM assimilation. By analyzing and verifying previous studies related to organizational RBV and information security, this research provides a better understanding of the critical factors that influence corporate decisions in ISM development and implementation. (2) Contribution to Future Research: The results of this study can be used as a theoretical foundation for future research related to ISM assimilation. The theoretical implications of this study can be an important reference to explain the factors that influence corporate decision making in information security development and implementation.

Thus, this study not only provides a better understanding of the relationship between sustainable IT capabilities and ISM assimilation, but also makes an important theoretical contribution to the development of knowledge in this area.

Practical Implications

The practical implications of the results of this study related to the relationship between sustainable IT capabilities and ISM assimilation are as follows: (1) Guidance for Executives and Managers: The results of this study provide practical guidance for executives and managers who promote ISM in organizations. They can understand that continuous investment in IT infrastructure for ISM is important to increase organizational members' awareness of information security. (2) Continuous IT Development Strategy: Organizations can use the findings of this research to develop sustainable IT strategies that strengthen information security and accelerate the ISM assimilation process. By paying attention to a balanced technology-policy, organizations can maximize the effects of ISM integration in the organization. (3) Increased Awareness of Organizational Members: Through continuous investment in IT infrastructure and continuous development of IT capabilities, organizations can increase organizational members' awareness of the importance of information security and their role in maintaining organizational information security.

As such, the results of this study provide practical implications that can assist organizations in developing effective strategies to improve information security and sustainably integrate ISM in daily activities.

Managerial and Policy Implications

The managerial and policy implications for top management and business owners of the results of this research related to the relationship between sustainable IT capabilities and ISM assimilation are as follows: (1) Focus on the Development of Sustainable IT Capabilities: Top management and business owners need to understand the importance of developing sustainable IT capabilities such as IT infrastructure, IT business spanning capability, and IT proactive stance in improving information security and integrating ISM in the organization. (2) Balance between Policy and Technology: It is important for top management and business owners to pay attention to the balance between policy and technology in IT management. By ensuring the right balance, organizations can maximize the effectiveness of ISM integration in their business activities. (3) IT Continuous Development Strategy: Top management and business owners need to develop a strategy for the continuous development of IT capabilities to support information security and ISM assimilation. This involves continued investment in IT infrastructure and development of IT business capabilities.

With these managerial and policy implications in mind, top management and business owners can lead change in their organizations to improve information security, effectively integrate ISM, and achieve sustainability in asset management.

Research Limitations

The limitations of this study related to the relationship between sustainable IT capabilities and ISM assimilation may include the following: (1) Sample Size and Generalizability: This study may have limitations in the sample size used. By using data from 157 upper management level employees across several companies, the generalizability of the findings may be limited to the broader population. More variation in the sample size and the types of organizations studied may increase the external validity of the findings. (2) Variable Measurement: Limitations may also occur in the measurement of the variables used in the study. The use of inappropriate or less valid measurement instruments can affect the accuracy of the research results. Therefore, it is important to ensure that the measurement of variables such as sustainable IT capabilities and ISM assimilation is done properly. (3) External Factors: This study may not have considered all external factors that could affect the relationship between sustainable IT capabilities and ISM assimilation. Factors such as regulatory changes, market conditions, or other environmental factors may also play a role in the influence of information security and ISM integration in organizations. (4) Time and Context: Research limitations can also be related to the time and context in which the research is conducted. Rapid changes in technology and the business environment may affect the relevance of research findings in the long term. Therefore, it is important to continuously update the research with relevant contexts and conditions.

By understanding these limitations, future research can overcome these obstacles to gain a more comprehensive understanding of the relationship between sustainable IT capabilities and ISM assimilation in the context of information security and sustainable asset management.

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