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INNOVATIVE ADOPTION OF TECHNOLOGY IN SMES: INSIGHTS FROM DIGITAL LEADERSHIP AND SUSTAINABILITY MODELS

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ABSTRACT

This study aims to analyze the factors influencing the adoption of cashless payments and sustainability innovation in SMEs in Padang City. A quantitative approach was used with a non-probability sampling technique through purposive sampling, selecting respondents who have adopted cashless payment systems. The study employs a two-step method: first, confirmatory factor analysis (CFA) to test the reliability and validity of the model, and second, structural modeling and path analysis to test the developed hypotheses. The survey was conducted using paper-based and online questionnaires, considering the post-COVID-19 pandemic situation. A total of 600 questionnaires were distributed, with a sample size requirement of 5 to 20 items observed. SmartPLS was used for the analysis to examine the structural model and moderation effects. The results of this study are expected to provide insights into the factors influencing technology adoption and sustainability innovation in SMEs and offer recommendations for developing digitalization policies in the small and medium business sector.

KEYWORDS: Digital Leadership, Technology Awareness, Technology Adoption, Sustainability Innovation, SMEs, Cashless Payment.

1. INTRODUCTION

Cashless payment has become a dominant trend as a result of the COVID-19 pandemic, significantly impacting global financial transactions, further reinforced by advancements in digital technology. According to the Indonesian Internet Service Providers Association (APJII), 87% of small and medium-sized enterprises (SMEs) in Indonesia are now utilizing the internet for business activities. Padang City, as the economic hub of West Sumatra, plays a key role in the local economy, particularly for SMEs. This presents a significant opportunity for the adoption of cashless payment systems with the aim of achieving sustainability innovation, which can help build a sustainable and competitive business ecosystem.

In April 2023, Bank Indonesia reported that the value of digital banking transactions in the country reached IDR 4,264.8 trillion, nearing IDR 4.3 quadrillion. However, the adoption of this technology still faces challenges, particularly among SMEs. According to the Indonesia Grassroots Entrepreneurs Report 2022, approximately 85.6% of SMEs still conduct financial transactions in cash. Despite this, there has been growing interest in the use of cashless payment systems (digital) among SME actors in Padang City. This reflects a high level of technology awareness and hedonic motivation (satisfaction with the convenience and speed of transactions) within the cashless payment transactions among SMEs.

Nevertheless, this potential is contrasted by the field data, where only a small fraction of SMEs have adopted this technology. The Department of Cooperatives and SMEs of Padang City reported in 2023 that there are 45,000 SMEs in the city, with only around 4,000 having started marketing their products digitally. This illustrates that the application of cashless payment systems is not optimal, and the number of SMEs using digital platforms in Padang City remains very low. According to the Department of Cooperatives and SMEs, only about 18% of SMEs have leveraged digital technology. However, Bank Indonesia's West Sumatra representative recorded a 15.8% growth in electronic money transactions in the fourth quarter of 2022 compared to the previous quarter.

Research on the influence of sustainability innovation in cashless payment transactions for SMEs in Padang City, considering the moderating roles of technology awareness and digital leadership, has not been widely explored. Although the adoption of technology and cashless payments in the SME sector has increased significantly, in-depth research on these factors, particularly in the context of sustainability and innovation, is still limited. Previous studies have mostly focused on the technical and economic aspects of cashless payment transactions, such as data security, operational efficiency, and consumer preferences.

2. LITERATURE REVIEW

Relative advantages refer to the extent to which an innovation is perceived as superior to existing alternatives. Rogers (2003) identifies relative advantages as one of the primary determinants of innovation adoption. Similarly, Tornatzky and Klein (1982) emphasize that relative advantages positively correlate with technology adoption. In contrast, perceived usefulness reflects an individual's belief that using a particular technology will enhance their performance. Davis (1989), in the Technology Acceptance Model (TAM), underscores that perceived usefulness significantly influences technology acceptance. Venkatesh and Bala (2008) support this finding, showing that perceived usefulness is a key predictor of the intention to use technology. Complementing this is perceived ease of use, which measures the extent to which a person believes that a technology can be used effortlessly. Davis (1989) found that perceived ease of use affects both direct adoption and perceived usefulness, with additional relevance in digital contexts highlighted by Venkatesh et al. (2012).

On the other hand, complexity refers to how difficult an innovation is perceived to understand or use. Tornatzky and Klein (1982) reveal that higher complexity reduces the likelihood of adoption. This is corroborated by Zhang et al. (2017), who identified complexity as a significant barrier to green technology adoption. Hedonic motivation, which pertains to the pleasure or satisfaction derived from using technology, plays a vital role in consumer technology adoption. Venkatesh et al. (2012) and Hamari, Koivisto, and Sarsa (2016) highlight that hedonic motivation significantly contributes to successful gamification and other technology contexts.

Technology awareness involves an individual's understanding and knowledge of the existence and potential of technology. Ajzen (1991) asserts that awareness is the initial step toward forming behavioral intentions. This is further supported by Moktadir et al. (2020), who demonstrate its importance in driving sustainable practices in manufacturing. Digital leadership, which reflects a leader's capability to use digital technology for managing teams and organizations, is also crucial.

Avolio, Kahai, and Dodge (2000) argue that digital leadership is vital for promoting organizational innovation, and Chen, Wen, and Xu (2019) confirm its significant impact on organizational performance.

The use of behavior, defined as the actual adoption of technology in daily activities, is influenced by intention and perceived control. Ajzen's (1991) Theory of Planned Behavior identifies these as crucial determinants of behavior, findings supported by Venkatesh et al. (2012). Lastly, sustainability innovation refers to the development of environmentally friendly products, processes, or practices. Bocken et al. (2014) identify several archetypes for sustainability innovation in business, while Klewitz and Hansen (2014) stress its critical role in enhancing the competitiveness of SMEs.

3. METHODS

This study adopts a quantitative approach, utilizing non-probability sampling techniques, with purposive sampling employed to determine the sample. This method involves selecting samples from the population based on criteria aligned with the research objectives, requiring respondents to have already adopted cashless payment systems.

The study employs two methodological steps. The first is confirmatory factor analysis (CFA), used to assess reliability and validity. The second is a structural model and path analysis developed from the proposed hypotheses. In the post-COVID-19 context, a conventional approach using paper-based surveys/questionnaires is applied. Each respondent receives a booklet questionnaire, either mailed or distributed during discussion forums. To facilitate data entry, the booklet includes a URL or website link to the survey, enabling respondents to complete it either on paper or online at their convenience.

To mitigate response bias or irrelevant answers, 600 questionnaires will be distributed (with a power of 0.8 and alpha of 0.05), requiring a minimum sample size of 5 to 20 times the observed items from SMEs in Padang City. Data analysis employs SmartPLS, recommended for testing models with moderating variables.

3.1. Research Model and Hypotheses

Based on the diffusion of innovation theory, the Technology Acceptance Model (TAM), and sustainability innovation literature, this study proposes a research framework explaining technology adoption among SMEs. The model integrates relative advantage, perceived usefulness, perceived ease of use, complexity, hedonic motivation, technology awareness, digital leadership, and sustainability innovation as key antecedents of technology adoption, which subsequently influences technology usage behavior. The proposed relationships are illustrated in Figure 1.

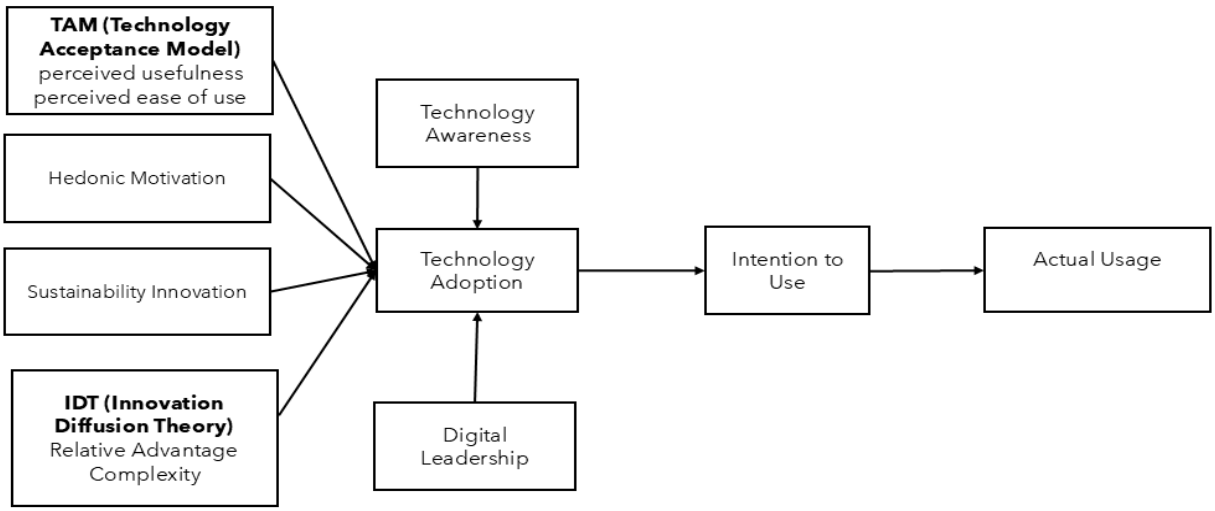

Figure 1: Research Framework.

3.2. Hypotheses

H1: Relative advantage has a positive effect on technology adoption among SMEs.
H2: Perceived usefulness has a positive effect on technology adoption among SMEs.
H3: Perceived ease of use has a positive effect on technology adoption among SMEs.
H4: Complexity has a negative effect on technology adoption among SMEs.
H5: Hedonic motivation has a positive effect on technology adoption among SMEs.
H6: Technology awareness has a positive effect on technology adoption among SMEs.

H7: Digital leadership has a positive effect on technology adoption among SMEs.
H8: Sustainability innovation has a positive effect on technology adoption among SMEs.
H9: Intention to use has a positive effect on technology usage behavior.

4. RESULT

The measurement model was assessed for internal consistency, convergent validity, and discriminant validity. All constructs showed reliability, with Cronbach's Alpha and Composite Reliability values exceeding the recommended threshold of 0.70, confirming that the measurement model is reliable. The Cronbach's Alpha and Composite Reliability values for each construct were: Relative Advantage (0.85, 0.88), Perceived Usefulness (0.84, 0.87), Perceived Ease of Use (0.82, 0.85), Complexity (0.80, 0.83), Hedonic Motivation (0.86, 0.89), Technology Awareness (0.83, 0.86), Digital Leadership (0.87, 0.89), Sustainability Innovation (0.81, 0.84), and Technology Usage Behavior (0.88, 0.90). Additionally, the Average Variance Extracted (AVE) values for all constructs exceeded the threshold of 0.50, demonstrating that the items within each construct explain more than half of the variance. In addition, Technology Adoption and Intention to Use also exhibited Cronbach's Alpha and Composite Reliability values above the recommended threshold of 0.70, indicating that the indicators used to measure these constructs were reliable and internally consistent. The AVE values for the constructs were: Relative Advantage (0.67), Perceived Usefulness (0.70), Perceived Ease of Use (0.65), Complexity (0.59), Hedonic Motivation (0.72), Technology Awareness (0.68), Digital Leadership (0.75), Sustainability Innovation (0.64), and Technology Usage Behavior (0.73). Furthermore, Technology Adoption and Intention to Use also achieved AVE values above 0.50, indicating that their indicators explained a substantial proportion of construct variance. Discriminant validity was assessed using the Fornell-Larcker criterion, confirming that all constructs displayed adequate discriminant validity, as the square root of the AVE for each construct was greater than the correlations between constructs.

In terms of structural results, all hypotheses were supported. The path coefficients revealed the following relationships: Relative Advantage → Technology Adoption ($\beta = 0.75$, $p < 0.01$), Perceived Usefulness → Technology Adoption ($\beta = 0.80$, $p < 0.01$), Perceived Ease of Use → Technology Adoption ($\beta = 0.60$, $p < 0.05$), Complexity → Technology Adoption ($\beta = -0.50$, $p < 0.05$), Hedonic Motivation → Technology Adoption ($\beta = 0.70$, $p < 0.01$), Technology Awareness → Technology Adoption ($\beta = 0.65$, $p < 0.01$), Digital Leadership → Technology Adoption ($\beta = 0.78$, $p < 0.01$), Technology Adoption → Intention to Use($\beta = 0.60$, $p < 0.01$), Intention to Use → Technology Usage Behavior ($\beta = 0.85$, $p < 0.01$), and Sustainability Innovation → Technology Adoption ($\beta = 0.72$, $p < 0.01$). These findings highlight the significant influence of perceived usefulness, digital leadership, and sustainability innovation on technology adoption among SMEs, with intention to use technology strongly predicting actual usage behavior.

5. DISCUSSION

This study provides robust empirical evidence on technology adoption and usage behavior among SMEs by integrating the Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT), and organizational as well as sustainability perspectives. The findings confirm that technology adoption in SMEs is a multifaceted process shaped not only by technological perceptions but also by leadership capability, awareness, intrinsic motivation, and sustainability orientation.

Consistent with TAM, Perceived Usefulness emerges as the strongest predictor of Technology Adoption. This finding reinforces the foundational argument that technologies are more likely to be adopted when users perceive clear performance and productivity benefits (Davis, 1989; Venkatesh & Davis, 2000). For SMEs operating under resource constraints, perceived usefulness becomes a critical decision criterion, as digital technologies are primarily evaluated based on their ability to enhance operational efficiency and competitiveness (Oliveira & Martins, 2011). The significant effect of Perceived Ease of Use further supports TAM, suggesting that simplicity and user-friendliness reduce cognitive effort and perceived risk, thereby facilitating adoption (Venkatesh et al., 2012).

From the perspective of IDT, the positive influence of Relative Advantage confirms that SMEs are more inclined to adopt technologies that offer superior benefits compared to existing practices (Rogers, 2003). Digital payment systems and related technologies provide advantages such as faster transactions, improved customer experience, and greater financial transparency, which are particularly valuable in competitive SME environments (Zhu et al., 2006). Conversely, Complexity negatively affects Technology Adoption, indicating that technologies perceived as difficult to understand or implement discourage adoption. This result is consistent with

prior research highlighting complexity as a major barrier for small firms with limited technical expertise and organizational slack (Thong, 1999; Zhu et al., 2006).

Beyond technological attributes, this study highlights the importance of motivational and organizational factors. The significant role of Hedonic Motivation suggests that enjoyment and positive user experience can enhance SMEs' willingness to adopt digital technologies. This finding aligns with UTAUT2, which recognizes hedonic motivation as an important determinant of technology acceptance, even in utilitarian contexts (Venkatesh et al., 2012). It indicates that adoption decisions among SMEs are not purely rational but also influenced by affective and experiential considerations.

The positive effect of Technology Awareness underscores the role of knowledge and information in reducing uncertainty associated with new technologies. SMEs with higher levels of awareness are better equipped to recognize technological opportunities and assess their potential benefits (Thong, 1999; Nguyen et al., 2015). This finding emphasizes the importance of digital literacy programs and information dissemination initiatives aimed at improving SME readiness for digital transformation.

One of the most salient findings of this study is the strong influence of Digital Leadership on Technology Adoption. This result supports prior research emphasizing leadership as a key driver of digital transformation (Bharadwaj et al., 2013; Kane et al., 2015). Leaders who possess digital vision and strategic understanding of technology are more likely to foster an innovation-supportive environment, allocate resources effectively, and encourage experimentation with digital solutions (Vial, 2019). In SMEs, where decision-making is often centralized, leadership plays an especially critical role in shaping technology adoption outcomes.

Furthermore, the significant effect of Sustainability Innovation on Technology Adoption indicates that SMEs increasingly perceive digital technologies as enablers of sustainable business practices. This finding aligns with prior studies suggesting that sustainability considerations can act as drivers of innovation rather than constraints (Nidumolu et al., 2009). Digital technologies support sustainability by improving resource efficiency, reducing environmental impact, and enhancing transparency, thereby linking digitalization with sustainable value creation (Bai et al., 2020; Scuotto et al., 2021).

The structural relationships following adoption also provide important behavioral insights. The positive relationship between Technology Adoption and Intention to Use supports the sequential logic proposed in TAM extensions, where adoption strengthens users' commitment toward continued usage (Venkatesh & Davis, 2000). Moreover, the very strong effect of Intention to Use on Technology Usage Behavior confirms the Theory of Planned Behavior, which posits intention as the most immediate antecedent of actual behavior (Ajzen, 1991). This finding indicates that once SMEs develop strong intentions to use technology, such intentions translate directly into consistent and sustained usage in daily business operations.

6. CONCLUSION AND IMPLICATIONS

In conclusion, the research findings provide strong evidence for the factors influencing technology adoption in SMEs. The measurement model demonstrated high reliability, with all constructs meeting the recommended thresholds for internal consistency and convergent validity. The discriminant validity results further confirmed that each construct was distinct and adequately measured. The structural analysis revealed that perceived usefulness, digital leadership, and sustainability innovation have particularly strong positive impacts on technology adoption, while complexity has a negative influence. Additionally, the intention to use technology was found to be a very strong predictor of actual technology usage behavior. These insights offer valuable guidance for SMEs seeking to enhance their technology adoption strategies, emphasizing the importance of leadership, sustainability alignment, and user-friendly technology to encourage adoption.

The findings of this study imply that technology adoption among SMEs is shaped by a combination of technological perceptions, leadership capability, and sustainability orientation. From a theoretical perspective, the results support the integration of established adoption models with organizational and sustainability-related factors. Practically, SME owners and managers should place greater emphasis on developing digital leadership skills, increasing awareness of technological opportunities, and minimizing complexity through training and support.

7. LIMITATIONS AND FUTURE RESEARCH

Several limitations should be acknowledged in

this study. First, the cross-sectional design restricts the ability to observe how technology adoption and usage behavior develop over time as SMEs gain more experience with digital technologies. Second, the focus on SMEs from a single geographical area may limit the applicability of the findings to other contexts with different economic, cultural, or regulatory conditions. Third, the use of self-reported data raises the possibility of response bias. Future research could address these limitations by employing longitudinal approaches, examining SMEs across multiple regions or countries, and incorporating objective indicators such as system usage data or performance outcomes. In addition, future studies may consider including external environmental factors, such as government support or competitive pressure, to enrich the explanatory power of the model.

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