

# Virtual Cloud Computing Lab: A Way for MSMEs in Increasing Firm Performance

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**Abstract** – This research aims to develop a business diversification strategy through a virtual cloud computing lab to reduce the risk of bankruptcy of SMEs. The method used in this research is mixed research in collaboration with quantitative and qualitative approaches to develop products and find out how much people accept the products developed. To see the acceptance of the developed website, the researcher used the technology acceptance model (TAM model). After forming a good model, a partial test (t-test) is carried out for decision-making. Based on the findings of data analysis, it was found that existing micro, small, and medium enterprises (MSMEs) lacked information and media to assist them in diversifying their business. Based on these needs, a website for MSMEs has been developed that has been validated and obtained results in the "good" category. Researchers conducted tests for the acceptance of websites developed with structural perceived usefulness, perceived ease of use, intention to use, and actual use with results showing the "good" category. From these results, it can be concluded that the website developed has a good reception in supporting MSMEs to reduce the risk of bankruptcy.

**Keywords** – Business diversification, bankruptcy risk, TAM, virtual cloud computing lab, MSMEs.

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## 1. Introduction

Rural areas in Indonesia have been identified as the main focus of national development, aiming to enhance the well-being of individuals and harness their potential for economic growth. The implementation of Law Number 6 of 2014 on rural areas has provided opportunities for each rural area to independently develop and manage its resources to improve community welfare. The concept of rural potential is associated with the strength, capabilities, and resources, whether natural or human, that exist within each rural area [1]. By developing these potentials, rural areas can empower their economies and improve the overall welfare of their communities [2]. To assess the impact of rural potential on the economy, the Gini ratio is commonly used as a measurement tool. According to data from the Indonesian Central Statistics Agency, the Gini ratio in rural areas increased from 0.315 in September 2019 to 0.317 in March 2020 [3]. A higher Gini ratio signifies greater economic inequality between the affluent and the less privileged within the area. This highlights the need to intensify efforts in optimizing the economic potential of rural areas. One approach to increasing the income of rural areas is by empowering their micro, small, and medium enterprises (MSMEs) [4], [5].

Despite the government's expectations and efforts to promote MSMEs, these businesses often struggle to achieve optimal results. The lack of product innovation in MSMEs is frequently cited as a significant factor contributing to their decline and eventual bankruptcy. However, product innovation plays a crucial role in expanding business opportunities and reducing the risks faced by MSMEs [6]. This aligns with the findings of Mammen *et al.* [7] emphasized that product diversification can mitigate business risks. Numerous literature studies have examined diversification as a strategy for business growth and competitiveness [8].

Engaging in different business lines provides organizations with greater market power through competition in multiple markets [9] and helps mitigate risks [10].

Recognizing the pressing need for innovation in rural MSMEs, researchers acknowledge the importance of implementing information technology to support these businesses [11]. Furthermore, the availability of internet access, which is becoming more evenly distributed in rural areas, has opened up opportunities for utilizing technology in rural settings. The establishment of a rural digital ecosystem, facilitated by internet access, has been successfully implemented in various regions across Indonesia [12]. The adoption of information technology has become crucial in driving development in rural areas [13]. Additionally, the COVID-19 pandemic has accelerated the need for rural communities to quickly adapt to evolving technologies, including in rural areas. However, challenges persist in terms of internet access and readiness among rural communities to embrace technology [14].

To address these challenges and facilitate rapid Internet adoption in rural communities, researchers have developed a virtual cloud computing lab specifically tailored for MSMEs, leveraging the concept of the Internet of Things (IoT) [15]. This virtual cloud computing lab serves as a platform for rural communities, particularly those under the auspices of MSMEs, to gain insights and knowledge that can be applied to business innovation in rural areas [16]. By utilizing the virtual cloud computing lab, village community members engaged in MSMEs can engage in business simulations as a learning medium. This allows them to enhance their understanding and minimize the occurrence of bankruptcy, which has been a recurring challenge in rural MSMEs. The virtual cloud computing lab is expected to stimulate business innovation among MSMEs and enhance the competencies of rural personnel [17]. The objective of this study is to explore the feasibility and implementation of such innovations and technologies specifically tailored for rural communities, taking into account their unique attributes and competencies compared to urban areas. Through this research, the aim is to provide appropriate design and implementation strategies for fostering innovation and technology adoption among rural MSMEs.

## 2. Literature Review

Diversification is a commonly employed strategy in business, particularly among companies operating in multiple industrial sectors [18].

It involves seeking new markets or products to achieve business growth and gain a competitive advantage [19]. The strategy focuses on managing and selecting different business groups to enhance operational activities, efficiency, and strength [20]. Diversification can be pursued through vertical diversification (expanding activities from upstream to downstream) or horizontal diversification (introducing new products related to existing ones or entering new markets) [21]. Various models have been developed to understand and analyze the factors influencing the acceptance of technology, such as the theory of planned behavior (TPB), reasoned action (TRA), and technology acceptance model (TAM) [22]. TAM, derived from TRA, suggests that individuals' attitudes and behaviors are influenced by their perceptions and reactions [23]. In TAM, two key factors influencing the acceptance of information systems are perceived usefulness and perceived ease of use. Both factors are crucial in shaping individuals' intentions to engage with technology and derive benefits from it. The TAM model provides a theoretical framework to explain how users perceive and utilize information technology [16].

A virtual cloud computing lab offers numerous advantages, such as resource sharing, cost, and time savings. In education, it provides students with the opportunity to study subjects extensively and carry out experiments that may be impractical or hazardous in a physical laboratory [17]. Additionally, advanced instructors can assist remote users in real time. This development aligns with the revolution of blended learning in education, which aims to provide students with convenient options for accessing learning materials. The Internet of Things (IoT) is a concept that leverages evolving internet technology to enable direct interaction between humans and physical objects, allowing data transmission and real-time remote control [24]. IoT can be defined as the ability of objects to transfer data through the Internet without human-to-human or human-to-computer interaction [15]. Commonly used IoT hardware technologies include radio frequency identification (RFID), wireless sensor network (WSN), and nanotechnology. Cameras, fire sensors, smoke sensors, gas sensors, and temperature sensors are examples of IoT hardware, while information processing and security technologies are part of the software components. The IoT architecture consists of a perception layer, network layer, and application layer [25].

## 3. Methodology

This research will combine two types of methods, namely quantitative and qualitative methods simultaneously.

To develop a virtual computing lab, modifications of the research and development and TAM methods are used. In this study, researchers used the TAM model of instruments from Davis, Venkatesh, and Morris [28]. TAM is a research model that analyzes the acceptance of a technology.

The TAM theory describes individual goals in using a technology, because of its usefulness and the convenience provided by this technology. TAM theory is the influence of external factors such as training, and system characteristics [29]. The research model and framework of this research is in the following:

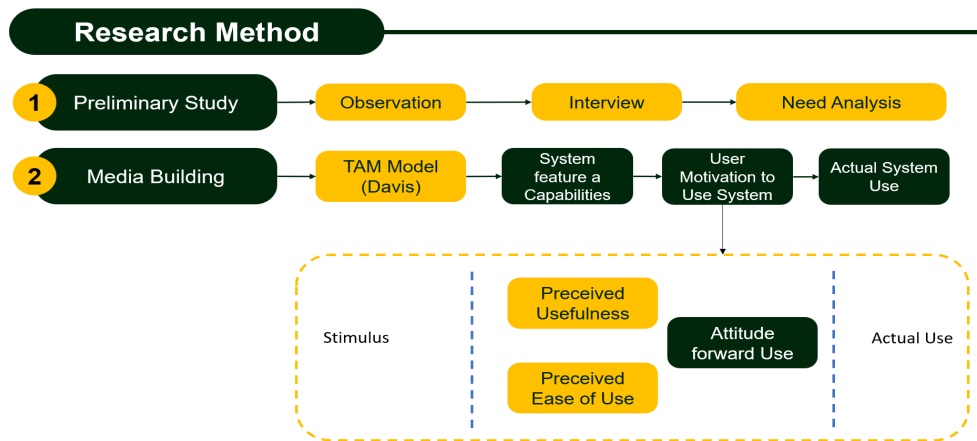


Figure 1. Research design

In the early stages of this research, the researchers begin to start research activities by conducting a preliminary study based on observations and interviews to analyze the problems or needs that are currently needed. After detecting the needs, the next step is building media to solve the existing problem. In building media, this research data is collected using the TAM model from Davis. Because this research is quantitative and qualitative, this research then focuses more on measuring the use and elaboration after use to discover the implications of this research.

This research was carried out in several rural areas in Malang; however, the researchers had an initial pilot project for the validation process for the chosen rural areas, namely Poncokusumo. The research process took the form of interviews and distributing questionnaires or structured questionnaires previously prepared by the researchers when conducting the research.

The population taken in rural communities related to MSMEs. Furthermore, the selected sample or respondents are chosen by the use of a purposive sampling technique. The purposive sampling technique is the determination of sampling by considering certain criteria [30]. This consideration is based on research objectives or research interests. The criteria indicated are rural communities and the ability to use at least a smartphone directed at business digitization. However, the medium development requires two IT experts to determine whether the medium developed is appropriate.

The data collection techniques of this research are defined in the following.

- a. Questionnaire. The type of questionnaire in this study was a closed or structured questionnaire so that respondents were more focused on answering the questions presented.
- b. Interview. The interview technique is used to find out more about the respondents. Interview respondents are people who have also filled out the questionnaire. In this research, this interview aims to dig deeper into information about the acceptance of virtual cloud computing labs.

Structural equalization model (SEM) is a statistical model that provides approximate calculations of the strength of the hypothetical relationship between variables in a theoretical model, either directly or through intervening or moderating variables [31]. Meanwhile, Legate *et al.* [32] stated that structural equation modeling can test a series of dependency relationships simultaneously. SEM analysis has several statistical tests as a basis for assumptions and ensures the model used is statistically fit. The data in this research is analyzed utilizing SPSS software.

The criteria used in the partial test include the following:

- a. If probability  $< 0.05$  and  $> 1.67$  then  $h_0$  is accepted, it means that there is a significant effect of X on Y.
- b. If probability  $> 0.05$  and  $< 1.67$  then  $h_0$  is rejected, which means that there is no significant effect of X on Y.

## 4. Results and Discussion

This section explores the development and implementation of a virtual cloud computing lab tailored for micro, small, and medium enterprises (MSMEs). It aims to address the fundamental needs of these enterprises, focusing on cost-effectiveness, scalability, and ease of use. The lab's development highlights the creation of an accessible platform providing essential cloud services, while the assessment of technology acceptance reveals a positive reception among MSMEs.

### 4.1. Fundamental Need Analysis for MSME's

The findings of the preliminary research are aimed at determining the specific characteristics of MSMEs' needs in reducing the risk of bankruptcy. Through collaborative discussions and analysis involving MSME actors and experts in the business sector, several key issues have been identified. Firstly, it has been observed that MSMEs face a low level of business innovation and diversification. This implies that there is a need for platforms that facilitate knowledge-sharing and business mentoring. By providing media for sharing experiences and expertise, MSMEs can learn from successful practices and expand their business operations.

The results of previous studies have also shed light on the challenges faced by MSMEs about their needs. Previous research has indicated that MSMEs often struggle with limited access to financial resources, which hampers their ability to invest in innovation, technology adoption, and marketing initiatives [33], [34]. This lack of financial resources is often exacerbated by difficulties in accessing loans or credit from financial institutions. Furthermore, previous studies have shown that MSMEs face difficulties in obtaining relevant market information and conducting market research [35]. This hampers their ability to identify customer demands, understand market trends, and develop effective marketing strategies. The absence of accurate market information also contributes to a lack of business diversification and innovation.

The second issues that exist are MSMEs exhibit a low level of adaptation to technology and the Internet. This highlights the necessity for media channels that offer simple access to technology. By providing user-friendly digital platforms and training programs, MSMEs can enhance their technological capabilities, enabling them to leverage the benefits of digital tools and online presence. Furthermore, there is a recognized need for media support to assist MSMEs in marketing their products. This entails creating platforms or channels that enable effective product promotion, reaching a wider audience, and attracting potential customers. By utilizing targeted

marketing strategies and leveraging digital media resources, MSMEs can enhance their visibility and increase their customer base.

Additionally, it has been identified that MSMEs lack connections to external markets for disseminating their business products. To address this issue, guidance and media resources are necessary to facilitate broad and strategic product marketing. By providing guidance on market expansion, establishing networking opportunities, and utilizing various media channels, MSMEs can tap into new markets and reach potential customers outside their immediate vicinity. Based on the identification of these problems, it can be concluded that existing MSMEs lack sufficient information and media resources to support their business diversification efforts. This underscores the fundamental need to develop digital media platforms that cater specifically to the needs of MSMEs. By providing accessible and tailored digital media tools, MSMEs can overcome the aforementioned challenges and thrive in an increasingly competitive business landscape.

Additionally, previous research has highlighted the importance of capacity-building initiatives for MSMEs [36], [37]. Many small and medium-sized enterprises lack the necessary skills and knowledge to effectively manage their businesses, develop growth strategies, and adapt to changing market conditions. Training programs, business mentoring, and educational resources have been identified as crucial elements in addressing these capacity gaps. By considering the findings of previous research, alongside the outcomes of the current needs analysis, it becomes evident that MSMEs require comprehensive support in various areas. This includes access to financial resources, provision of market information, technological assistance, business training, and mentoring. Developing digital media platforms tailored to the specific needs of MSMEs can serve as a valuable tool in addressing these challenges and supporting their growth and sustainability.

### 4.2. Virtual Cloud Computing Lab Development

The issues identified in the initial study serve as the foundation for the development of a virtual computing lab aimed at mitigating the risk of bankruptcy for MSMEs. The virtual cloud computing lab takes the form of a user-friendly website, specifically designed to cater to the needs of rural MSMEs, ensuring proximity and easy accessibility. The website operates on the fundamental principle of integrating learning platforms that are essential for MSMEs with gamification methods, enabling MSME actors to engage in business simulations [38], [39], [40].

This approach allows MSMEs to reduce the occurrence of trial and error in real-world business scenarios, thus minimizing the risk of bankruptcy resulting from significant financial losses.

Within this website, two key parties interact to support MSME business simulations: 1) MSME actors and 2) business and entrepreneurship experts. The integration of these two parties facilitates the exchange of information and the formulation of business diversification strategies that align with the unique characteristics of each MSME's business [33], [41]. The website itself presents an integrated interface that combines both the learning resources

and the business simulation features. This holistic approach provides MSMEs with a comprehensive platform to enhance their business knowledge, practice decision-making skills, and simulate various business scenarios in a controlled environment. By providing MSMEs with access to this virtual computing lab, the aim is to empower them with the necessary tools, knowledge, and strategies to navigate their business challenges effectively. Ultimately, the goal is to reduce the risk of bankruptcy and foster the growth and sustainability of MSMEs in an increasingly competitive business landscape.

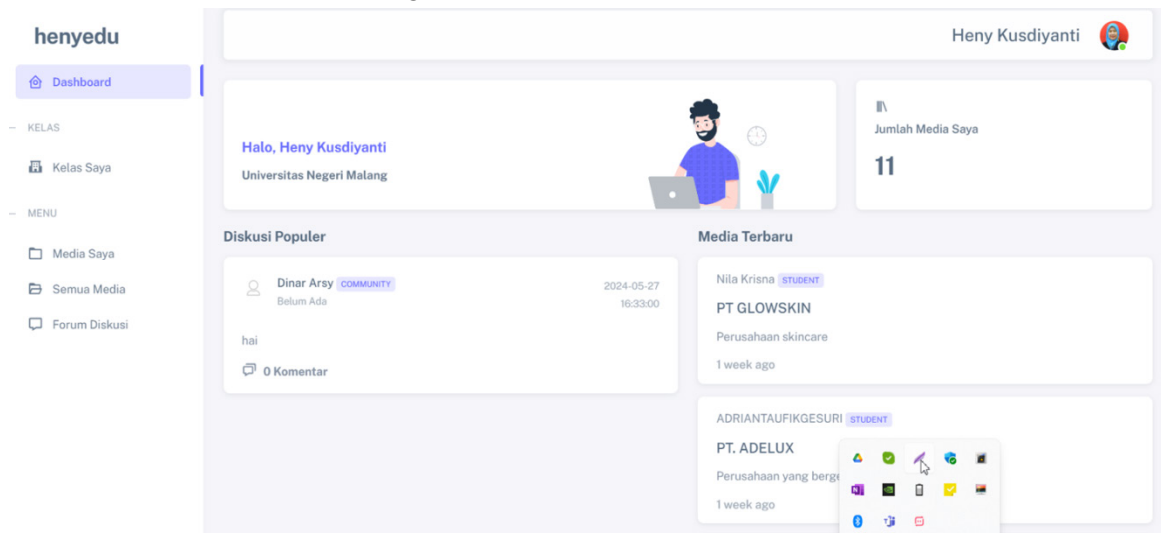


Figure 2. Dashboard of HenyEdu.com view

The business simulation website offers several advantages to its users. Firstly, it is user-friendly, providing a seamless experience for users to access essential information materials. The website is thoughtfully organized, allowing users to easily navigate through its content. On the main page, users can readily find common MSME bankruptcy issues, along with the latest articles and posts from other users. Secondly, the website is responsive, ensuring that users can adjust the display according to the device they are using. This responsiveness enhances the accessibility and user experience across different platforms. Thirdly, the website is accountable, providing users with the ability to assess their performance through evaluations conducted after completing the business simulations. Additionally, users can easily access feedback provided by other users, enabling them to learn from others' experiences. Furthermore, the website is transparent, allowing users to stay updated with the latest information shared by other users. This transparency fosters a collaborative and dynamic environment where users can share insights and stay informed. Lastly, the website is reliable, offering trustworthy and up-to-date information contributed by users. The content on the website undergoes regular updates and validation, ensuring its accuracy and relevance.

Previous research provides supporting evidence for the advantages offered by the business simulation website. Studies have consistently shown that user-friendly interfaces enhance user satisfaction and engagement, leading to improved information processing and task performance [42]. The well-organized structure of the website aligns with the principles of effective website design, which emphasize clear navigation and easy access to relevant content [43], [44]. The responsiveness of the website to different devices is in line with the growing trend of mobile and multi-platform usage. Research has indicated that responsive web design positively affects user experience, as it enables seamless interactions and adaptability across various devices [45], [46].

The accountability feature, allowing users to evaluate their performance and access feedback from others, aligns with the principles of self-assessment and social learning. Prior studies have highlighted the benefits of self-assessment in improving learning outcomes and self-regulation [47], [48], while social learning theories emphasize the importance of feedback and collaborative learning in enhancing skills and knowledge acquisition [49], [50], [51].

Transparency and information sharing among users are supported by research on online communities and social media platforms. Studies have shown that transparent information exchange fosters trust, knowledge sharing, and a sense of belonging within communities [52], [53]. This collaborative environment can enhance user engagement and promote collective learning. The reliability of the website's information ensured through regular updates and validation processes, is essential for establishing credibility and trustworthiness. Research has emphasized the significance of accurate and up-to-date information in decision-making processes and user satisfaction [54], [55]. Collectively, these findings from previous research support the advantages offered by the

business simulation website, confirming the importance of user-friendly interfaces, responsiveness, accountability, transparency, and reliable information in enhancing user experience and learning outcomes.

To assess the validity of the platform, the results of its development were tested by both IT experts and MSME users. The evaluation indicators reflect the platform's feasibility, following the criteria outlined by Branch [56]. Based on these tests, the virtual computing lab, HenyEdu.com, achieved a validity score of 80.75% from IT experts and 73% from MSME users. These scores demonstrate the effectiveness and acceptance of the platform among both technical experts and its target users

Table 1. Validity test results for the medium

No	IT Experts			User		
	Aspect	Percentage	Result	Aspects	Percentage	Result
1	Interaction Usability	80%	Good	Software	75%	Good
2	Accessibility	85%	Good	Learning	79%	Good
3	Reusability	79%	Good	Visual	85%	Good
4	Standards Compliance	79%	Good	Communication		
<b>Average</b>		<b>80.75%</b>	<b>Good</b>	<b>Average</b>	<b>79.6%</b>	<b>Good</b>

The "good" score obtained from the evaluation indicates that the results are favorable, suggesting that the overall recognition process can proceed. This positive outcome reinforces the feasibility and effectiveness of HenyEdu.com in providing valuable benefits to MSMEs, specifically in reducing the risk of bankruptcy through business simulations.

#### 4.3. Acceptance of Technology for Virtual Cloud Computing Lab

In this phase of the research, the primary objective is to examine the correlations between perceived

usefulness, perceived ease of use, intention to use, and actual use. To gather data for this analysis, researchers administered questionnaires directly to respondents and conducted socialization activities from August 10th to August 14th, 2022. The questionnaires were completed by a total of 108 participants representing diverse industries in Malang Regency and Probolinggo Regency. These respondents were drawn from seven distinct sectors. The subsequent section presents the results derived from the convergent validity assessment that was performed.

Table 2. Convergent validity results

Variable	Item	Loading	AVE	CR	Cronbach Alpha
Actual Use	ATS 1	0.812	0.748	0.899	0.837
	ATS 2	0.898			
	ATS 3	0.883			
Intention to Use	IU1	0.951	0.908	0.952	0.898
	IU2	0.954			
Perceived Ease of Use	PEU1	0.926	0.790	0.937	0.912
	PEU2	0.911			
	PEU3	0.902			
	PEU4	0.811			
Perceived Usefulness	PU1	0.807	0.670	0.890	0.837
	PU2	0.821			
	PU3	0.865			
	PU4	0.779			

In the reliability assessment of the technology acceptance model (TAM) test, convergent validity testing is employed. This involves evaluating the outer loading of items, with a cutoff point set at  $>0.5$ . Additionally, the composite reliability (CR) is assessed, with a cutoff point of  $>0.7$ , and the average variance extracted (AVE) is examined, with a cutoff point of  $>0.5$  [57]. Based on the criteria, all items in the construct of this study are found to meet the established thresholds, indicating that the construct possesses both qualitative validity and reliability. The subsequent step involves hypothesis testing to determine whether HenyEdu.com significantly influences perceived usefulness, perceived ease of use, intention to use, and actual use.

This TAM model research focuses on investigating technology acceptance in the context of

actual technology use among MSMEs. The findings of this study reveal that perceived usefulness has a significant influence on intention to use. This suggests that when SMEs are provided with a website like HenyEdu.com that offers usefulness and benefits, they are more likely to express an intention to use the platform. This finding aligns with previous research conducted by Grover *et al.* [29], which suggests that perceived ease of use is the strongest predictor of intention to use. It indicates that the greater the benefits offered by this platform, the more likely MSME actors are to have the intention to utilize the platform. This finding is consistent with the technology acceptance model, which explains user acceptance of a technology platform in relation to their activities [58], [27]. The results of the hypothesis test are presented in the table below.

Table 3. Convergent validity results

	Path	Mean	STDEV	T statistic ( O/STDEV )	P Value	Decisions
PU -> IU	0.617	0.619	0.055	11.204	0.000	H1 is Accepted
PEU -> IU	-0.299	-0.319	0.090	3.308	0.001	H2 is Accepted
IU -> ATS	0.90	0.294	0.93	3.115	0.002	H3 is Accepted

The hypothesis testing in this study utilized path analysis, where acceptance of the hypothesis was determined by a P value  $<0.05$  and a t-statistic greater than 1.96. The results revealed significant relationships between perceived usefulness ( $\beta = 0.617$ , t-value (11.204)  $\geq 1.96$ ;  $p < 0.05$ ) and perceived ease of use ( $\beta = -0.299$ , t-value (3.308)  $\geq 1.696$ ;  $p < 0.05$ ) with intention to use. Therefore, H1 and H2 were accepted. Furthermore, the relationship between intention to use ( $\beta = 0.290$ , t-value (3.115)  $\geq 1.96$ ;  $p < 0.05$ ) had a significant effect on actual use.

Similar findings indicate that perceived ease of use significantly influences intention to use, which aligns with previous research highlighting the positive impact of convenience on technology adoption [27]. The MSMEs in the study sample perceive technology to be user-friendly, and its ease of use contributes to increased operational productivity for their businesses. The product trial results also indicate a positive response from respondents, with 80% rating the convenience of the features as "Good." This platform provides valuable resources to strengthen MSMEs and enhance business diversification, thereby reducing the risk of bankruptcy. The actual use phase focuses on measuring the realization of intention to use actual technology usage. This stage determines the acceptance of information technology by translating intention into a necessity driven by perceived benefits [26].

The test results demonstrate significant findings, indicating that the intention to use the HenyEdu website translates into increased adoption of HenyEdu technology. Acceptance of this technology signifies a means to leverage the potential of existing MSMEs effectively.

## 5. Conclusion

The analysis and findings indicate that the existing MSMEs lack the necessary information and media to support their business diversification efforts. This highlights the fundamental need to develop digital media platforms that cater to the specific requirements of these MSMEs. In response to these needs, a website has been developed and successfully validated, meeting the required criteria for further implementation. The positive outcomes of the validation process demonstrate that Henyedu.com provides significant benefits to SMEs in reducing the risk of bankruptcy through business simulations. The acceptance analysis reveals that the developed website is well-received by MSME actors, as evidenced by their perceptions of its usefulness, ease of use, intention to use, and actual usage.

Limitations of this study should be acknowledged to provide a comprehensive understanding. Firstly, the research sample only included MSMEs from specific regions, namely Malang Regency and Probolinggo Regency.



Therefore, the generalizability of the findings to other regions or industries may be limited. Secondly, the data collection relied on self-report questionnaires, which may introduce response biases or social desirability effects. Future studies could consider employing mixed-method approaches or conducting interviews to gather more in-depth insights. Additionally, the study focused on the acceptance and usage of developed platform, but did not assess the long-term impact on MSME performance or bankruptcy rates. It would be beneficial for future research to investigate the sustained effects of such digital media platforms on MSMEs' financial outcomes and overall business performance.

For future studies, it is recommended to expand the research scope by including a more diverse sample of MSMEs from various industries and regions. This would enhance the generalizability of the findings and provide a more comprehensive understanding of the impact of digital media platforms on MSMEs. Additionally, incorporating qualitative research methods, such as interviews or case studies, can offer deeper insights into the experiences and perceptions of MSME actors regarding the acceptance and usage of such platforms. Furthermore, conducting longitudinal studies to evaluate the long-term effects of digital media platforms on MSME performance and bankruptcy rates would be valuable. Finally, other potential factors, such as the role of social networks or government policies, in facilitating the adoption and effectiveness of digital media platforms for MSMEs could also be explored in future research.

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