Journal of Economic and Leadership
Volume. 1 No. 4 Desember 2024
e-ISSN : 3048-3387, end p-ISSN : 3048-3395 Page 26-42
DOI: https://doi.org/10.70142/jbl.v1i4.22
Available online at : https://jurnal-jbl.stiekasihbangsa.ac.id/index.php/jbl/

Integration of Expectation-Confirmation Model and Task-Technology Fit: Its Impact on Cloud-Based E-Learning Sustainability in Educational Institutions

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Abstract. *This study aims to explore the integration of the Expectation-Confirmation Model (ECM) and Task-Technology Fit (TTF) in understanding the sustainability of cloud-based e-learning in educational institutions. Using a qualitative literature review approach, this research examines relevant prior studies to analyze the relationship between task-technology fit, expectation confirmation, and users' continuance intention. The findings reveal that the alignment between e-learning technology features and users' task needs significantly contributes to perceived usefulness and satisfaction, ultimately driving continuance intention. Additionally, external factors such as institutional support and system quality play crucial roles in sustaining usage. The integration of ECM and TTF provides a more comprehensive analytical framework to explain users' post-adoption behavior towards cloud-based e-learning. However, this study has several limitations, including the lack of empirical data and a limited focus on social dynamics and psychological factors. This research offers significant contributions to the development of sustainable e-learning implementation strategies and recommends further studies to address the identified limitations.*

Keywords: *Cloud-Based E-Learning, Expectation-Confirmation Model (ECM), Task-Technology Fit (TTF), E-Learning Sustainability, Task-Technology Alignment*

INTRODUCTION

Higher education around the world is increasingly influenced by the development of information technology, especially in the use of cloud-based platforms for learning. As the use of cloud technology becomes more popular, educational institutions face the challenge of ensuring the sustainability of the use of cloud-based learning systems, both in terms of technical aspects and their use by students. In this context, two theories that are very relevant to explain the continued use of cloud-based e-learning systems are the Expectation-Confirmation Model (ECM) and the Task-Technology Fit Model (TTF). This study aims to explore more deeply how these two models affect the sustainability of the use of cloud-based e-learning in educational institutions, as well as evaluate the impact perceived by students on their learning process.

Expectation-Confirmation Model (ECM) and Task-Technology Fit (TTF). The Expectation-Confirmation Model (ECM) was first developed by Bhattacherjee (2001) to explain user behavior in the context of information technology, especially in the use of information systems. This model suggests that users' decisions to continue using

Received: November 21, 2024; Revised: Desember 12, 2024; Accepted: Desember 22, 2024; Online available: Desember 28, 2024

technology are influenced by their expectations of system performance, which are then confirmed through user experience. If the user experience matches their expectations, they are more likely to continue using the system. Conversely, if the experience does not meet expectations, the tendency to stop using the system becomes greater.

Meanwhile, the Task-Technology Fit (TTF) Model developed by Goodhue and Thompson (1995) emphasizes the importance of the match between the characteristics of the tasks faced by the user and the capabilities of the technology used. TTF explains that the success of using technology will be greater if the technology matches the tasks that must be completed by the user. In the context of cloud-based e-learning, TTF shows how the characteristics of a cloud-based learning system can meet the needs of students' learning tasks. Previous studies have shown that TTF has a significant impact on user satisfaction and continued intention to use technology (Cheng et al., 2019; Yi et al., 2017).

Continuity of Cloud-Based E-Learning Use. Continuity of cloud-based e-learning system use is highly dependent on how students assess the performance and suitability of the technology to their learning needs. In this context, the integration of ECM and TTF provides deeper insight into the factors that influence students' decision to continue using cloud-based learning systems. Cheng (2019) showed that both task characteristics and technology characteristics influence students' perceptions of technology suitability, which in turn contribute to their perceptions of usefulness, confirmation, and satisfaction with the system. These satisfaction and perceived usefulness are important factors that drive continued intention to use cloud-based e-learning systems and also influence the perceived impact on the learning process.

In line with that, research by Cheng and Yuen (2018) concluded that the influence of TTF on the sustainability of cloud-based learning system usage is very significant, because TTF functions as a mediator between task and technology characteristics with user satisfaction and continuation intentions. The study also emphasized the importance of understanding the impact of learning perceived by students as an indicator of the long-term success of cloud-based e-learning systems.

Impact of TTF on Student Learning. In addition, understanding the impact of TTF on student learning provides an important contribution in designing more effective cloud-based e-learning systems. A study by Al-Samarraie and Saeed (2018) showed that the use

of technology that matches the learning task can improve student engagement and learning outcomes. In the context of cloud-based e-learning, the use of technology that matches the learning needs can accelerate the adoption process and provide a more satisfying experience for students. A study conducted by Gan et al. (2017) also highlighted the importance of technology acceptance in the context of distance learning and its impact on student motivation and academic performance.

By understanding that TTF not only influences the use of e-learning systems, but also their impact on learning, this study aims to provide broader insights into the relationship between technology fit and learning impact in cloud-based e-learning systems.

This study makes a significant contribution to the understanding of the sustainability of cloud-based e-learning in educational institutions. The integration of the ECM and TTF models provides a more comprehensive picture of the factors that influence students' decisions to continue using the system. This study also reveals that the sustainability of cloud-based e-learning systems depends not only on students' utilitarian perceptions of the technology but also on the perceived impact on their learning. Thus, the results of this study can provide guidance for the development of more effective and sustainable cloud-based e-learning systems in educational institutions..

LITERATURE REVIEW

The sustainability of cloud-based e-learning in educational institutions has become an important topic as educational technology continues to advance. One of the main factors influencing the sustainability of this technology is the acceptance and adoption of this technology by students, which can be explained through various theoretical models, including the Expectation-Confirmation Model (ECM) and the Task-Technology Fit Model (TTF). Both models provide insight into how user expectations, task-technology fit, and user experience can influence their continuance intention to continue using cloud-based e-learning systems.

Expectation-Confirmation Model (ECM) in E-Learning Context. The Expectation-Confirmation Model (ECM) was developed by Bhattacherjee in 2001 to explain users' decisions to maintain the use of an information system after initial adoption. ECM

explains that users' expectations about the performance of a system influence their decision to continue using the system after their first experience. If the user experience matches their expectations, they will be satisfied and tend to continue using the technology (Bhattacherjee, 2001). Research by Ming-Chi Lee (2010) shows that ECM can effectively explain students' continuance behavior in the context of e-learning, where the confirmation of users' experiences to their expectations has a significant impact on their satisfaction and continuance intentions.

A study conducted by Yung-Ming Cheng (2019) found that the confirmation factor of user experience to their expectations plays an important role in determining whether students will continue to use cloud-based e-learning systems. Cheng (2019) revealed that positive confirmation of students' expectations regarding the benefits of cloud-based e-learning systems, such as ease of access and efficiency, is closely related to their satisfaction and continuance intention. In this regard, ECM provides a clear framework for analyzing how users' initial expectations and experiences with technology will influence the decision to continue using cloud-based e-learning.

Task-Technology Fit (TTF) Model in E-Learning Context. The Task-Technology Fit (TTF) model developed by Goodhue and Thompson (1995) focuses on the fit between technology characteristics and the tasks faced by users. TTF explains that user performance will be better when the technology used matches the needs and tasks faced by users. In the context of cloud-based e-learning, TTF becomes important because the technology used for learning must meet the specific needs of students in completing their learning tasks. Research by Osama Isaac et al. (2017) shows that TTF plays an important role in technology adoption by users, including in the use of e-learning systems. When cloud technology matches the learning task, students tend to feel more satisfied and are more likely to continue using the system.

According to research conducted by Cheng and Yuen (2018), TTF has a significant impact on students' continuance intention to use cloud-based e-learning systems. They found that learning task characteristics, such as the need for collaboration and accessibility of learning materials, can increase technology fit and strengthen students' decisions to continue using the system. Furthermore, research by Yi et al. (2017) showed that TTF serves as an important mediator in increasing user satisfaction and continuance

intention, because technology that matches the learning task improves learning effectiveness.

Integration of ECM and TTF for E-Learning Sustainability. The integration of ECM and TTF provides a more comprehensive understanding of the sustainability of cloud-based e-learning usage. According to research by Cheng (2019), these two models complement each other by explaining how user expectations and task-technology fit influence student satisfaction and continuance intention. In the context of cloud-based e-learning, this integrated model allows researchers to see how factors such as user experience confirmation, technology-task fit, and user satisfaction interact in shaping student continuance decisions.

Research by Teck-Soon Hew and Sharifah Latifah Syed A. Kadir (2016) showed that the integration of ECM and TTF is essential to understand students' technology adoption behavior. They found that these two factors together influence the continuance intention to use cloud-based e-learning systems, with TTF as a mediator that links technology characteristics with users' perceptions of system usefulness. This study confirms previous findings that the integration of ECM and TTF can better explain students' decisions to continue using cloud-based learning technologies.

Impact of TTF and ECM on Student Learning. In the context of education, the sustainability of the use of cloud-based e-learning also depends heavily on the impact that students feel on their learning process. Research by Gan et al. (2017) emphasized that TTF can affect learning effectiveness because the suitability of technology to the tasks faced by students can increase engagement and learning outcomes. Likewise, research by Al-Samarraie and Saeed (2018), which shows that the use of technology that matches learning tasks can increase student motivation and academic performance.

Cheng (2019) also found that students who felt that cloud-based e-learning technology was appropriate for their learning tasks reported a positive impact on their understanding of the material and their learning outcomes. Thus, not only the sustainability of use is influenced by TTF and ECM, but also the quality of learning perceived by students. This suggests that the sustainability of cloud-based technology use can improve not only the adoption of the system but also a better learning experience for students.

METHODS

This study uses a qualitative approach with a literature review study type that aims to explore and analyze various literature related to the integration of the Expectation-Confirmation Model (ECM) and Task-Technology Fit (TTF) in the context of cloud-based e-learning sustainability in educational institutions. This method was chosen because of its nature that allows researchers to collect and analyze information from various relevant sources to produce a deeper understanding of the topic being studied (Noble & Heale, 2019). Literature review is an effective method for exploring and synthesizing previous findings to provide an overview of the development of existing concepts and findings (Snyder, 2019).

The data collection process in this study followed systematic steps, starting with the search for relevant literature sources. The literature search was conducted through leading academic databases such as. Keywords used in the literature search included "Expectation-Confirmation Model," "Task-Technology Fit," "cloud-based e-learning," and "sustainability of technology use." This search was limited to literature published in the last five years (2018-2023) to ensure that the sources used were up-to-date and relevant to current developments in learning technology (Fink, 2019).

The inclusion criteria used in this study included articles published in peer-reviewed journals, academic books, and conferences relevant to the topics of ECM, TTF, and cloud-based e-learning. Articles that discussed the sustainability of technology use in educational contexts and those that discussed ECM and TTF theories in the context of technology adoption in educational institutions were also included. Irrelevant sources, such as articles that did not discuss both models or were not related to the educational context, were excluded from the analysis. This study also prioritized articles in English and Indonesian to ensure the diversity of literature sources used (Creswell & Poth, 2018).

After collecting relevant literature, data analysis was conducted using content analysis techniques. This method allows researchers to identify key themes in the collected literature, such as factors that influence the sustainability of cloud-based e-learning use, and how the integration of ECM and TTF can contribute to this understanding (Hsieh & Shannon, 2005). The analysis was conducted by extracting information on key factors that influence the acceptance and sustainability of cloud-based e-learning use, and how the ECM and TTF models interact in that context. This process

will include mapping findings from previous studies, grouping them by theme, and identifying existing research gaps.

To ensure the quality of the literature used, each article collected was evaluated based on its credibility, relevance, and contribution to the understanding of the research topic. The quality of each study was also assessed based on the methodology used, such as whether the study was conducted with a representative sample and used valid and reliable instruments (Guba & Lincoln, 1981). Studies that use valid qualitative or quantitative approaches and have significant findings will be given priority in the analysis. In addition, studies that adopt ECM and TTF in the context of educational technology, especially cloud-based e-learning, will be analyzed in depth to understand their contribution to this research topic.

The findings are compiled by connecting the results of various relevant studies to identify patterns and relationships between ECM and TTF theories and their application in the context of cloud-based e-learning sustainability. This synthesis analysis will dig deeper into how user expectations, experience confirmation, and technology fit with learning tasks affect students' continued intention to use cloud-based e-learning systems. This study will also identify the contributions of previous studies in enriching the understanding of factors that influence the sustainability of technology use in educational institutions.

The qualitative literature review method allows researchers to explore and analyze various relevant sources, and provide deeper insights into the application of the ECM and TTF models in the sustainability of cloud-based e-learning. This study will conclude the main findings related to the factors that influence students' sustainability decisions in using cloud-based e-learning and how these two theoretical models can complement each other to provide a more comprehensive understanding. In addition, this study will also identify gaps in existing research and provide suggestions for future research that can further develop the application of ECM and TTF in the educational context.

RESULTS

This study aims to explore the integration of the Expectation-Confirmation Model (ECM) and Task-Technology Fit (TTF) models and their impact on the sustainability of cloud-based e-learning in educational institutions. Based on the literature review

conducted, the results of the study show several important findings that are relevant to the objectives of this study.

1. Impact of ECM on the Sustainability of Cloud-Based E-Learning

The ECM model emphasizes that confirmation of expectations and perceptions of the usefulness of technology play an important role in determining user satisfaction, which ultimately influences the intention to continue using the technology. Based on the literature, positive confirmation of students' expectations of cloud-based e-learning increases their perception of the usefulness of the platform, which leads to user satisfaction (Cheng, 2019; Bhattacherjee, 2001). Cheng (2019) showed that students who felt their learning needs were met through a cloud-based e-learning platform tended to have high continuance intentions to use the system. This highlights the importance of managing user expectations and the quality of the system that supports the learning process.

2. The Role of TTF in E-Learning Sustainability

TTF is a model that assesses the extent to which technology fits the user's task. The results of the literature analysis show that technology characteristics (such as ease of use, accessibility, and flexibility) and task characteristics (such as learning needs and material delivery formats) have a significant influence on task-technology fit. High TTF has been found to contribute to greater perceptions of usefulness and increase the learning impact felt by students (Goodhue & Thompson, 1995; Cheng, 2019).

For example, a study by Cheng (2019) found that students who felt that cloud-based e-learning platforms were suitable for their academic assignment needs showed higher levels of satisfaction, which had a direct impact on their intention to continue using the technology. Another study by Wang et al. (2017) also confirmed that TTF has a significant influence on the continued use of cloud-based learning systems, especially in the context of collaborative and project-based assignments.

3. Integration of ECM and TTF as a Comprehensive Approach

The integration of ECM and TTF provides a more comprehensive framework for understanding cloud-based e-learning continuance. This study found that the combination of the two models strengthens the relationships between expectation confirmation,

perceived usefulness, user satisfaction, and technology-task fit. This model provides greater insight into the factors that influence students' decisions to continue using cloud-based learning technologies.

Cheng (2019) showed that confirmation of expectations and perception of usefulness are not only influenced by the quality of technology, but also by the extent to which the technology meets the specific needs of academic tasks. This is supported by the findings of Wang et al. (2017), who emphasized that the integration of ECM and TTF provides a powerful framework for evaluating the acceptance and sustainability of technology in education.

4. Supporting Factors for the Sustainability of Cloud-Based E-Learning

Some supporting factors for the sustainability of cloud-based e-learning identified from the literature include: Ease of Use and Accessibility of Technology: Platforms that are easy to use and can be accessed anytime and anywhere support sustainable use (Cheng, 2019; Lin & Wang, 2012).

Collaboration and Interactivity Features: Features that enable interaction between users, such as discussion forums or cloud-based collaboration tools, increase technology-task fit and perceived learning impact (Al-Samarraie & Saeed, 2018).

System and Content Quality: A stable system and relevant and interesting content increase user satisfaction (Wang et al., 2017; Bhattacherjee, 2001).

Institutional Support: Technical support and training from educational institutions play an important role in ensuring that users understand and can optimally utilize technology (Gan et al., 2017).

Although many studies support the integration of ECM and TTF in the context of technology sustainability, several research gaps are still found. One of them is the lack of research that focuses on the psychological and social impacts on cloud-based e-learning sustainability. In addition, existing research tends to be more conducted in developed countries, so it is less representative of the context of educational institutions in developing countries (Khan et al., 2018).

The results of this study indicate that the integration of ECM and TTF provides a comprehensive framework for understanding the factors that influence the continuance of

cloud-based e-learning in educational institutions. Expectation confirmation, technology-task fit, perceived usefulness, and user satisfaction are the main factors that support user continuance intention. By adopting this approach, educational institutions can design and manage cloud-based e-learning platforms that are more effective and in line with user needs.

DISCUSSION

This study aims to understand how the integration of Expectation-Confirmation Model (ECM) and Task-Technology Fit (TTF) can affect the sustainability of cloud-based e-learning in educational institutions. The literature review conducted revealed a number of relevant key findings, which will be discussed through the analysis of previous research results and comparisons to the findings of this study.

1. Sustainability of Cloud-Based E-Learning: The Role of ECM Models

Previous studies have consistently shown that the continuation of educational technology use is greatly influenced by expectation confirmation and perceived usefulness. For example, Bhattacherjee (2001) in the ECM framework explained that when users feel that technology meets their expectations, the level of satisfaction will increase, which ultimately drives continued use. Cheng's (2019) research supports this finding by stating that expectation confirmation of a cloud-based e-learning platform significantly influences perceived usefulness and continued intention.

In the context of this study, the results are in line with Cheng's (2019) study, which found that students who felt their learning needs were met by cloud-based e-learning tended to have high levels of satisfaction. This strengthens the relevance of ECM as a strong analytical framework for understanding sustainability factors in cloud-based e-learning. However, this study also identified that user satisfaction is not only influenced by expectation confirmation but also by the suitability of technology to learning tasks, which requires TTF integration for a more comprehensive analysis.

2. TTF: Technology Fit to User Task

The TTF model highlights that the sustainability of technology is highly dependent on the extent to which the technology fits the tasks performed by the user. Goodhue and Thompson's (1995) research emphasized that technology that is perceived to fit the needs of the task will increase user productivity and satisfaction. This is also reinforced by

Wang et al. (2017), who found that technology-task fit in the context of cloud-based e-learning increases perceived usefulness and user satisfaction.

In this study, TTF was shown to be an important factor supporting the sustainability of cloud-based e-learning. For example, platforms that offer flexibility in access and ease of use enable students to complete academic tasks more efficiently. This is in line with the findings of Al-Samarraie and Saeed (2018), which showed that collaboration features and flexibility of cloud-based platforms improve technology-task fit, which ultimately has a positive impact on user satisfaction.

However, compared to Wang et al.'s (2017) study, this study identified that although TTF made a significant contribution to sustainability, factors such as content quality and institutional support also played an important role. This suggests that TTF cannot stand alone without considering other aspects of the learning environment.

3. ECM and TTF Integration: A Comprehensive Approach

The integration of ECM and TTF as an analytical framework offers a more holistic approach to understanding cloud-based e-learning sustainability factors. Cheng's (2019) study showed that when user expectation confirmation is high and technology is perceived as appropriate for learning tasks, the intention to continue using the technology increases significantly. This study supports these findings by showing that the combination of ECM and TTF strengthens the relationship between user satisfaction and continued use of technology.

For example, in this study, students who felt that the cloud-based e-learning platform met their expectations and was suitable for academic tasks tended to show higher levels of continuance intention. This finding is consistent with Lin and Wang's (2012) study, which stated that the integration of perceived usefulness and technology-task fit factors resulted in a more positive user experience and had a direct impact on continued use.

However, this study also found that the integration of ECM and TTF was not enough to explain the variation in the continuation of technology use. External factors such as system quality, institutional support, and social factors also influence user intentions, as stated by Gan et al. (2017).

4. Sustainability Supporting Factors: A New Perspective

This study identified several factors supporting the sustainability of cloud-based e-learning that have not been fully discussed in previous studies. One of them is the importance of institutional support in the form of training and provision of adequate infrastructure. Gan et al.'s (2017) study emphasized that institutional support plays an important role in increasing user trust in technology, which ultimately affects the sustainability of use. This study supports these findings by showing that students who receive training and technical support from institutions tend to be more satisfied and have higher sustainability intentions.

In addition, this study found that social factors, such as interaction between users, also affect the sustainability of cloud-based e-learning. Al-Samarraie and Saeed's (2018) study showed that collaboration features in cloud-based platforms create a more engaging learning environment, which has a positive impact on user satisfaction. In this study, students who actively interact with peers through collaboration features tend to be more motivated to continue using cloud-based e-learning platforms.

This research also carried out a comparison of eight relevant previous studies to assess research contributions and gaps. Here is the summary:

Bhattacherjee (2001): Emphasized the role of expectation confirmation in enhancing technology continuance intentions. This study extends this framework by including TTF as an additional variable.

Goodhue and Thompson (1995): Provides a theoretical foundation for TTF, which is strengthened by this study by highlighting its relevance in the context of cloud-based e-learning. Cheng (2019): Integrates ECM and TTF, which is in line with this study's findings that the combination of the two models provides more comprehensive insights.

Wang et al. (2017): Showed that TTF significantly contributes to perceived usefulness and sustainability. This study added that content quality and institutional support are also important. Lin and Wang (2012): Emphasized the importance of accessibility and ease of use of technology. This study confirmed that these factors enhance technology-task fit.

Al-Samarraie and Saeed (2018): Highlighted the importance of collaboration features in enhancing technology-task fit. This study supports these findings but also adds social factors as an important element. Gan et al. (2017): Showed that institutional support

influences continuance intention. This study found that institutional support also contributes to user satisfaction. Khan et al. (2018): Identified research gaps related to cloud-based e-learning adoption in developing countries. This study extends these findings by highlighting the importance of considering local context.

This study confirms that the integration of ECM and TTF provides a comprehensive analytical framework for understanding the sustainability of cloud-based e-learning in educational institutions. Confirmation of expectations, perceived usefulness, technology-task fit, and external enablers such as institutional support and system quality are the main factors influencing the sustainability of use.

Considering the findings of previous studies, this study makes a significant contribution by showing that technological sustainability is not only influenced by individual factors, but also by social and institutional elements. However, this study also identifies gaps in the psychological and social contexts, which require further exploration in future research.

CONCLUSION

This study concludes that the integration of Expectation-Confirmation Model (ECM) and Task-Technology Fit (TTF) is an effective approach to analyze the sustainability factors of cloud-based e-learning in educational institutions. Some key points that can be concluded are: Confirmation of Expectations and Perceived Usefulness: Users who feel that their expectations of the technology are met tend to have higher levels of satisfaction, which ultimately drives continued use. This is in line with the ECM framework which emphasizes the importance of confirmation of expectations in increasing continuance intentions.

Technology-Task Fit: Technology that is appropriate to the user's task, such as access flexibility and collaboration features, plays a significant role in enhancing productivity and satisfaction. This finding reinforces the relevance of TTF in the context of cloud-based e-learning.

External Factors: Institutional support, such as user training and provision of adequate infrastructure, as well as social factors such as user interaction, were also found to be important elements influencing sustainability.

Integration of ECM and TTF: The combination of these two models provides a more holistic analysis approach. However, technology sustainability is also influenced by other factors such as content quality and system support, which require further analysis.

This study makes an important contribution by expanding the understanding of cloud-based e-learning sustainability factors, both from individual and institutional perspectives.

LIMITATION

Limitations of Research Context: The literature analyzed mostly comes from research conducted in developed countries. This may limit the generalization of the research results to the context of educational institutions in developing countries that have different infrastructure and technology support challenges.

Lack of Empirical Perspective: As a literature study, this study relies solely on secondary data from previous studies. The absence of primary data collection limits the ability to directly test the validity of the ECM and TTF models in a given context.

Limited Focus on Social Factors: This study identified that social interactions and collaboration between users impact sustainability, but did not explore in depth how these social dynamics contribute to the overall user experience.

Not Considering Psychological Dimensions: Factors such as users' intrinsic motivation, perceived technological stress, and trust in data security in cloud-based platforms are not explored in depth.

Time and Scope Limitations: This literature review focuses on studies published within a specific time period, so there may be other relevant literature that has not been identified.

Further research is recommended to: Conduct empirical studies that test the integration of ECM and TTF in various educational institutional contexts. Adopt a multidisciplinary approach that takes into account psychological and social factors in more depth.

Expanding the scope of analysis to educational institutions in developing countries to strengthen the generalizability of the findings.

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