Journal of Multidisciplinary Engineering Science and Technology (JMEST)
ISSN: 2458-9403
Vol. 13 Issue 4, April - 2026

Assessing Service Quality and System Reliability in Retail Micropayment Adoption: A Schema-Based Longitudinal Study

Chwen-Yea Lin
Dept. of Accounting and Information Management
Dayeh University
Changhua County, Taiwan
amberlin@mail.dyu.edu.tw

Chien-Chung Tu
Dept. of Marketing and Logistics Management
Vanung University
Taoyuan City, Taiwan
jacktu@mail.vnu.edu.tw

***Abstract*— The rapid diffusion of electronic payment technologies has accelerated the adoption of stored-value micropayment systems in retail environments. However, few studies have addressed the long-term consistency of adoption-related perceptions from a quality and reliability perspective. This study investigates how prior experience shapes the evaluation of service quality and system reliability through a schema-based longitudinal comparison.**

Based on three waves of in-depth interviews conducted over a ten-week observation period, the findings indicate that although both groups recognized the functional quality (convenience) of micropayment usage, inexperienced users initially perceived lower operational reliability and demonstrated higher sensitivity to system-related risks. With repeated usage exposure, the reliability beliefs and quality perceptions of both groups converged, suggesting that system dependability is established through a cognitive schema evolution process. Most quality adjustments and reliability stabilizations occurred within the first five weeks. This research provides insights into the process quality of technology adoption and the reliability-building mechanisms necessary for long-term user retention in the retail payment industry.

Keywords—Schema evolution; Service Quality; Payment behavior; Longitudinal study; Micropayment Adoption; System Reliability; Operational Risk

I. INTRODUCTION

The rapid diffusion of electronic payment technologies has transformed everyday consumption practices by reducing reliance on physical cash and simplifying transaction processes. The expansion of digital technologies has reshaped communication environments and routine consumption behavior across societies, accelerating the adoption of alternative payment instruments in retail contexts **[1]**. Among these innovations, micropayment cash loading cards provide a convenient alternative to traditional payment methods by eliminating the need to carry coins, handle small change, or complete signature-based transactions. In Taiwan, i-cash card, introduced by 7-ELEVEN, represents an important example of a stored-value payment instrument designed specifically to facilitate frequent low-value purchases in convenience retail environments. Given that daily small-amount consumption accounts for approximately 3.4 trillion in transaction volume, the cumulative economic significance of micropayment behavior is substantial.

Compared with credit cards, which typically require signatures and involve transaction fees that may reduce their suitability for small purchases in convenience store settings, low-cost IC-based stored-value cards provide a potentially more efficient and secure payment alternative for both consumers and retailers. Prior studies have similarly identified convenience, time independence, and reduced reliance on physical cash as key advantages of electronic micropayment systems, particularly in small-value transaction environments [2]. As such, understanding the factors that influence users' continued adoption of micropayment cash loading cards is essential for evaluating their long-term viability as a retail payment solution.

Prior research on technology adoption has emphasized that users' acceptance of emerging information technologies is largely shaped by perceived usefulness, perceived ease of use, and compatibility with existing consumption practices, as highlighted in the Technology Acceptance Model [3] and innovation diffusion research [4]. These perspectives further suggest that adoption decisions are influenced not only by users' initial evaluations of technological functionality but also by experiential learning processes that develop through repeated interaction with new technologies over time, through which usage experience gradually shapes post-adoption cognition and behavioral habits [4], [5], [6]. From this viewpoint, the adoption of micropayment cash loading cards can be understood as a dynamic cognitive process in which users continuously evaluate the functional value and applicability of the payment system within their everyday purchasing environments through accumulated usage experience and ongoing cognitive adjustment over time [7]. Moreover, differences between experienced and inexperienced users may reflect variations in consumer expertise that

shape how individuals interpret and evaluate new technologies during adoption processes [8].

Despite the increasing practical importance of stored-value micropayment cards, prior research has paid relatively limited attention to the mechanisms underlying their continued usage behavior. Existing studies on electronic and mobile payment adoption have primarily focused on general adoption determinants such as perceived usefulness, compatibility, and security concerns, while deeper understanding of how adoption-related perceptions evolve through repeated usage experience remains limited [2]. In particular, little is known about how prior user experience shapes adoption dynamics over time. Addressing this gap, the present study investigates the factors influencing continued use intentions toward micropayment IC cards by comparing users with and without previous i-cash experience.

Because adoption-related cognition is shaped through continuous interaction between prior knowledge structures and emerging usage experience, schema theory provides an appropriate analytical framework for examining how users revise their interpretations of unfamiliar payment technologies during the adoption process. Schema structures are not static but evolve through iterative comparison between prior expectations and accumulated experience, enabling individuals to adjust their interpretations of new consumption environments over time [4], [9], [10], [11]. From this perspective, differences between users with and without prior i-cash experience may reflect variations in experience-based schema structures that influence how micropayment technologies are perceived and evaluated during different stages of adoption.

To capture changes in adoption-related perceptions over time, this study adopts a longitudinal design based on three interview waves conducted over a ten-week observation period. Longitudinal observation enables identification of schema comparison and adjustment processes as users repeatedly interact with micropayment technologies and gradually refine their interpretations through accumulated usage experience. By examining behavioral differences between experienced and inexperienced users across multiple observation points, the study provides insight into the temporal development of micropayment card adoption behavior. Through this schema-based longitudinal comparison, the research contributes to technology adoption literature by demonstrating how experience-based cognitive interpretations converge and stabilize during repeated usage exposure and offers practical implications for retailers seeking to promote stored-value card adoption in convenience store settings.

II. Research Method

Schema theory, originally introduced by Bartlett, provides an important cognitive framework for understanding how individuals organize prior knowledge and interpret new information. In psychology and cognitive science, schema refers to a mental structure through which individuals organize current information and construct a framework for future understanding based on accumulated experience. Through this mechanism, individuals integrate new perceptions into existing cognitive structures and respond effectively to their environment.

Schema has been widely regarded as an effective analytical tool for understanding human cognitive processing. By relying on schema, individuals are able to rapidly categorize and interpret new information in ways that are meaningful within their existing knowledge structures [12], [9]. Because schema is grounded in past experience, it provides an explanation for how generic knowledge is represented and stored in long-term memory as a form of mental representation that guides perception and behavioral interpretation.

Prior research has suggested that relevant knowledge structures should be activated before individual process new information. When newly encountered information is consistent with an individual's existing schema, it is more likely to be remembered and incorporated into cognitive perception. In contrast, when new information is inconsistent with existing schema structures, individuals may ignore it or quickly forget it. From this perspective, schema plays a critical role in shaping how individuals interpret unfamiliar technologies and evaluate their applicability in everyday consumption contexts.

Importantly, schema structures are not static but evolve through iterative comparison between prior expectations and newly accumulated experience over time. During this process, individuals continuously evaluate incoming information against existing cognitive frameworks, and schema revision occurs when repeated experiences reinforce alternative interpretations or reduce uncertainty associated with new situations. Such schema comparison processes have been identified as a central mechanism through which individuals gradually adjust their interpretations of changing environments and behavioral contexts [4], [9], [10], [11].

Based on this theoretical perspective, schema theory provides an appropriate analytical foundation for examining how prior experience influences individuals' interpretation and continued use of micropayment cash loading cards. Specifically, differences between users with and without prior i-cash experience may reflect variations in experience-based schema structures that influence how micropayment technologies are perceived and evaluated.

To capture how these experience-based schemas influence adoption-related perceptions over time, this study adopts a longitudinal interview-based research design consisting of three interview waves conducted over a ten-week observation period. Longitudinal observation enables the identification of schema comparison and adjustment processes as users repeatedly interact with micropayment technologies and gradually refine their interpretations through accumulated usage experience. By comparing participants with and without prior micropayment card

experience across multiple observation points, the study is able to examine how schema-consistent and schema-inconsistent interpretations evolve during the adoption process. This schema-based longitudinal comparison provides a methodological basis for understanding how prior experience shapes cognitive responses to micropayment technology and supports the investigation of continued usage behavior in emerging retail payment systems.

III. Data Collection Procedure

This study employed in-depth interviews as the primary data collection method, as such interviews are widely recognized as an effective qualitative approach for capturing participants' perceptions, attitudes, and experiential interpretations of emerging technologies [13], [14]. The use of repeated in-depth interviews enabled the study to obtain rich contextual information regarding participants' cognitive responses to micropayment card usage over time.

Participants were recruited and categorized into two groups based on their prior experience with i-cash card. Group 1 consisted of four participants with prior i-cash usage experience, while Group 2 included four participants without previous experience using the card. All participants were between 22 and 26 years of age and had at least a college-level educational background. This experience-based grouping strategy enabled the study to compare differences in adoption-related perceptions between experienced and inexperienced users across multiple observation points.

To examine changes in cognition related to micropayment card adoption, data were collected through a three-wave interview design. The first round of interviews (T0) was conducted prior to the usage period in order to capture participants' baseline cognitive perceptions of i-cash card before the experimental observation phase. Following the initial interview, participants were asked to use the i-cash card during their routine purchasing activities over a ten-week period.

Subsequent follow-up interviews were conducted at the fifth week (T1) and the tenth week (T2) of the observation period. This longitudinal interview structure enabled the study to track how participants' knowledge, behavioral experiences, value perceptions, and affective responses toward micropayment card usage evolved over time. The ten-week observation window was designed to allow sufficient exposure to routine usage situations while reducing the possibility that participants' responses would be influenced by recall of earlier interview content [15].

Across the three interview waves, the interview protocol addressed several thematic dimensions, including participants' demographic background, knowledge development related to i-cash card, transaction experiences in convenience store settings, perceived problems and value evaluations associated with card usage, and perceived lifestyle impacts resulting from adoption. These repeated thematic observations enabled the study to capture temporal changes in adoption-related cognition during the usage process.

Interview transcripts were analyzed using an open-coding procedure to identify schema-related keywords, followed by axial coding to group conceptually related categories and interpret emerging cognitive patterns more systematically. Through this coding process, the study examined how participants constructed and adjusted their schema structures during the adoption process. Consistent with this analytical approach, the study adopts a narrative research perspective that emphasizes the interpretation of human experience and behavioral change (through participants' evolving usage stories [16]. This analytical strategy supports the investigation of longitudinal changes in cognition associated with micropayment card adoption..

IV. Data Analysis

To examine how adoption-related cognitive structures evolved over time, schema configurations were constructed separately for both participant groups at three observation stages (T0, T1, and T2) based on keywords extracted from the interview transcripts. Comparing schema structures across these three time points enabled identification of both shared and group-specific cognitive interpretations associated with micropayment card usage as participants accumulated usage experience during the observation period. In particular, the baseline schema configuration at T0 provided a reference point for understanding subsequent cognitive adjustments observed at T1 and the relative stabilization of schema structures at T2. The following sections present the schema configurations identified at each observation stage, beginning with the baseline comparison at time point T0.

A. Schema Configuration at Time Point T0

To examine differences in adoption-related cognitive structures between experienced and inexperienced users, schema configurations for both participant groups were constructed based on keywords extracted from the first-wave interview transcripts (T0). In this study, the term schema at time point n refers to the set of cognitive representations identified from participants' interview responses at a specific observation stage of the adoption process. These schema structures were derived through coding procedures that organized recurring perceptions into thematic cognitive categories representing participants' interpretations of micropayment card usage.

Figure 1 presents the schema configuration obtained from the first interview conducted prior to the usage observation period (T0). In the figure, the two ovals represent schema structures associated with Group 1 (participants with prior i-cash experience) and Group 2 (participants without prior experience), respectively. The intersecting area between the two ovals indicates shared schema elements across both groups, while the non-overlapping areas represent group-specific cognitive interpretations.

At the baseline observation stage (T0), both groups shared a common perception that i-cash card provides convenience in everyday transactions by reducing the need to carry coins and simplifying payment procedures. This shared perception reflects a generally positive evaluation of card usage functionality across participants regardless of prior experience.

However, important differences emerged in the non-overlapping schema areas between the two groups. Participants without prior i-cash experience (Group 2) expressed a greater number of concerns related to potential risks associated with card usage, including the possibility of losing the card, demagnetization, and forgetting to carry the card when needed. In addition, these participants reported lower interest in promotional products associated with i-cash system and demonstrated weaker location-independent purchasing flexibility. Their purchasing behavior also reflected lower levels of brand loyalty and a stronger tendency to avoid unnecessary spending.

In contrast, participants with prior i-cash experience (Group 1) expressed more positive perceptions related to the symbolic and experiential value of the card. For example, i-cash card was described as reflecting fashion trends, brand image, and collectible value. Although some concerns related to usage inconvenience and card loss were also identified, these participants demonstrated stronger affective attachment to promotional activities and higher levels of usage-related loyalty.

Taken together, the schema comparison at T0 indicates that experienced users exhibited more positive and diversified cognitive representations of i-cash usage, whereas inexperienced users showed comparatively stronger concern-related interpretations. The relatively limited overlap between the two schema structures suggests that prior usage experience plays an important role in shaping baseline adoption-related cognition before the observation period. This baseline schema configuration provides an analytical reference point for examining how experience-based cognitive interpretations evolve across subsequent observation stages (T1 and T2) during the longitudinal adoption process.

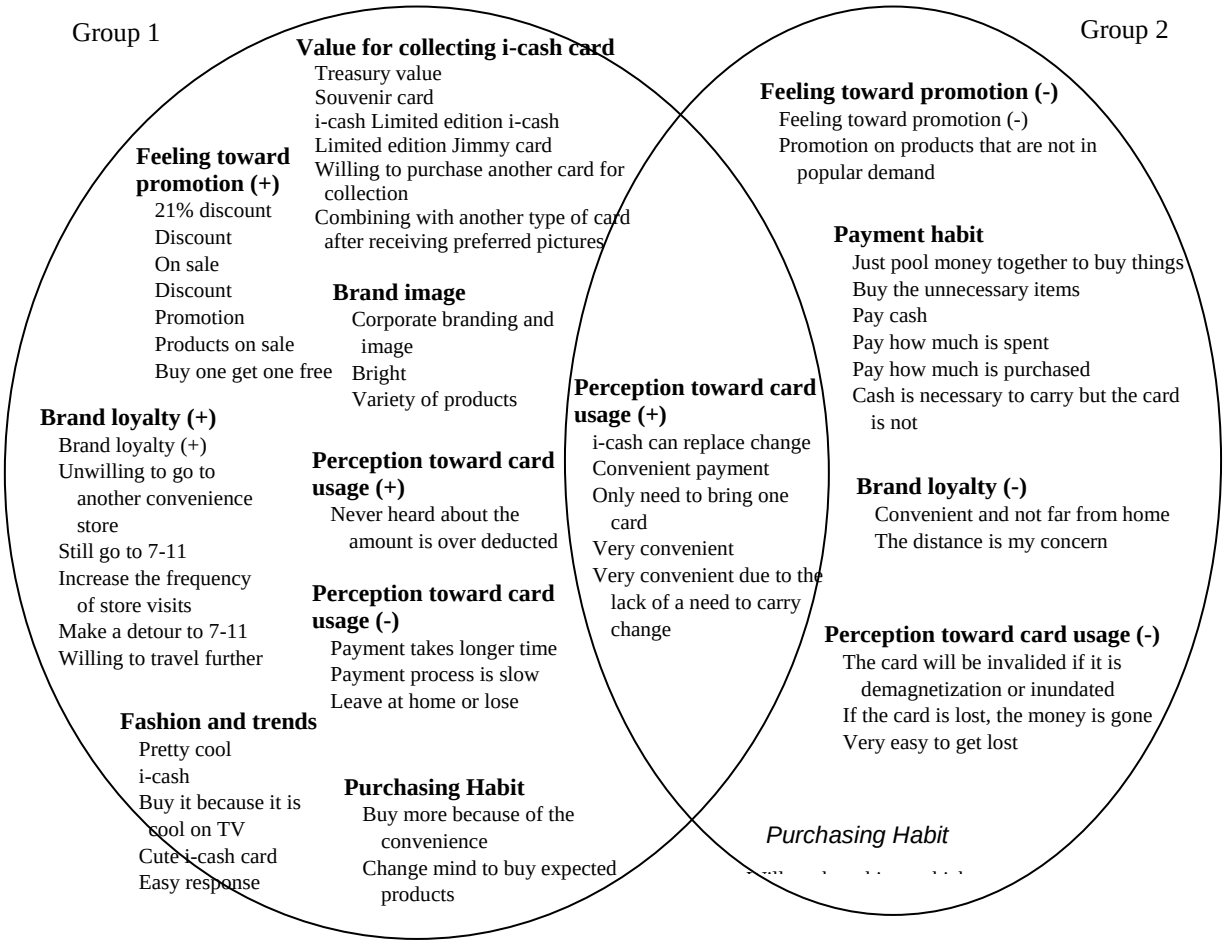

Fig. 1. *Schema of those two groups at the time point T0*

B. Schema Configuration at Time Point T1

To examine how adoption-related cognitive structures evolved after initial exposure to i-cash usage, schema configurations at the second observation stage (T1) were constructed based on interview data collected after five weeks of usage experience. Compared with the baseline schema structures identified at T0, the schema configurations at T1 revealed a noticeable expansion in the shared

cognitive elements between experienced and inexperienced users, as reflected by the increased intersection between the two groups in Figure 2. This change suggests that continued usage contributed to a gradual convergence of adoption-related perceptions across participants.

Participants with prior i-cash experience (Group 1) continued to maintain positive schema elements associated with promotional activities, fashion and trend value, and favorable affective responses toward card usage. These schema elements indicate that experienced users preserved their positive symbolic and experiential interpretations of i-cash during the early stage of the observation period.

More substantial schema changes were observed among participants without prior i-cash experience (Group 2). After five weeks of usage, several previously identified concern-related schema elements—such as the risk of card loss and demagnetization became less salient. Instead, participants increasingly emphasized functional advantages of card usage, including reduced need to carry change, greater convenience, and time-saving benefits during transactions. In addition, Group 2 participants began to interpret i-cash as a fashionable payment tool and demonstrated stronger interest in promotional activities associated with the card system. These changes also corresponded with increased loyalty toward the 7-ELEVEN retail environments.

Despite these positive shifts, some usage-related concerns remained among Group 2 participants, particularly regarding the limited scope of card acceptance and the need to rely on sales clerks to check card balances. These residual concerns indicate that although experiential exposure reduced uncertainty associated with card usage, some functional barriers to adoption persisted during the mid-stage observation period.

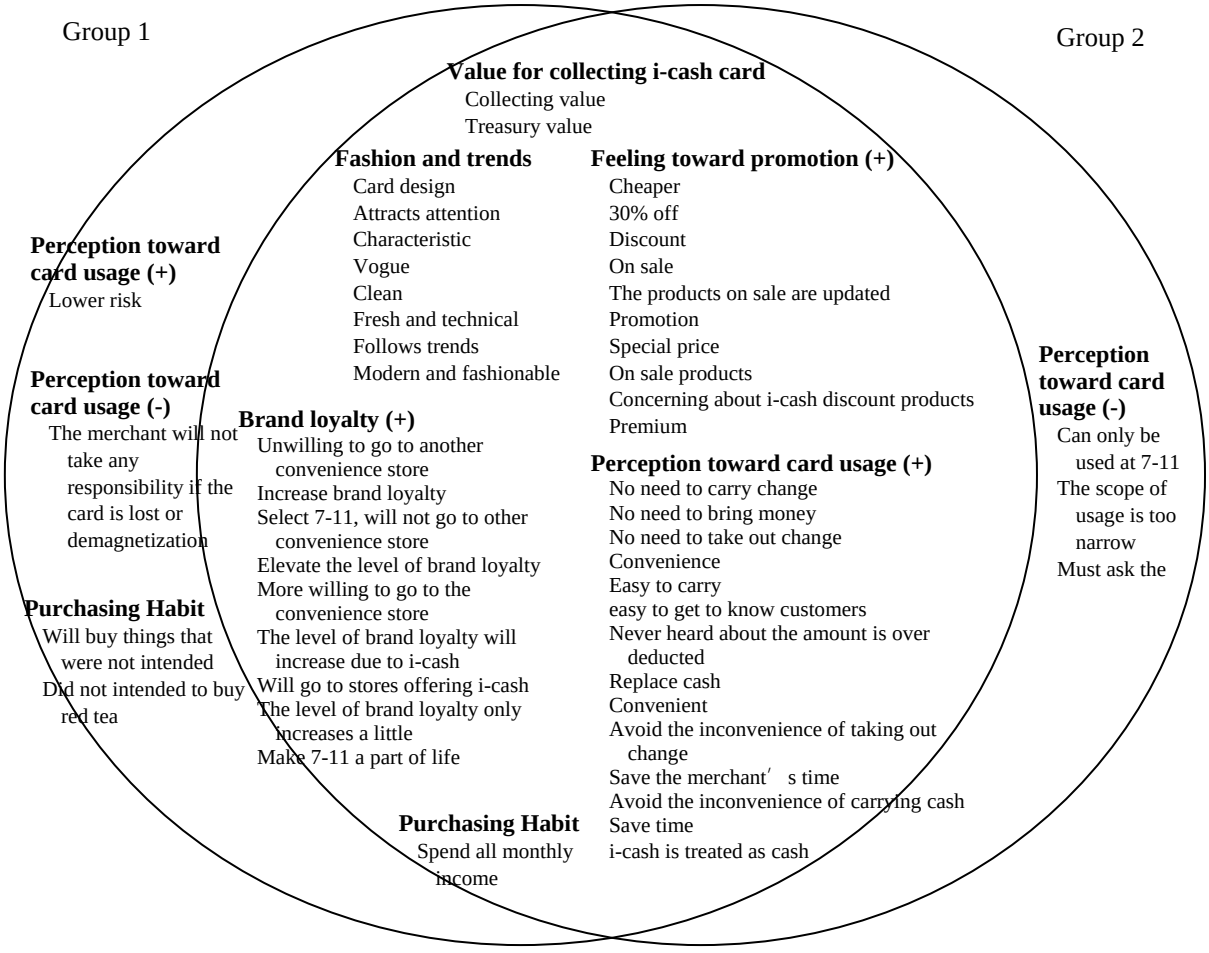

Fig. 2. *Schema of those two groups at the time point T1*

An additional phenomenon observed at T1 was a change in purchasing behavior among participants in Group 1. Following continued usage of i-cash card, some experienced users reported increased spending tendencies associated with the convenience of electronic micropayment transactions. This behavioral adjustment suggests that accumulated usage experience may influence not only cognitive interpretations of micropayment technology but also consumption patterns during the adoption process.

Taken together, the schema comparison between T0 and T1 indicates that repeated exposure to i-cash usage contributed to a partial convergence of schema structures between experienced and inexperienced users. This mid-stage schema alignment provides important evidence that experiential interaction with

micropayment technology plays a critical role in reducing perceived risks and strengthening functional and symbolic interpretations during the early stages of adoption.

C. Schema Configuration at Time Point T2

The third round of interviews (T2) was conducted after ten weeks of continued i-cash usage in order to examine whether adoption-related schema structures continued to evolve following the mid-stage observation period. After the second interview wave (T1), all participants were asked to continue using the i-cash card in their routine purchasing activities so that longer-term changes in usage-related cognition could be observed. The schema configurations obtained from the third interview are presented in Figure 3.

Compared with the schema structures identified at T1, the schema configurations at T2 showed relatively limited additional changes across both participant groups. The reduced level of schema transformation suggests that participants' cognitive interpretations of i-cash usage had entered a relatively stable stage after approximately five weeks of continued exposure. In particular, the differences between experienced users (Group 1) and inexperienced users (Group 2) became minimal at this stage of the observation period, indicating a convergence of adoption-related perceptions across groups.

At T2, participants in both groups consistently described i-cash as a fashionable payment tool and expressed positive evaluations regarding its usage convenience. In addition, both groups demonstrated increased attention to promotional activities and reported a shift in payment habits from carrying change toward routine use of the i-cash card. These findings suggest that repeated usage experience contributed to the consolidation of positive functional and symbolic interpretations associated with micropayment card adoption.

An additional shared perception identified at T2 was that promotional campaigns associated with the 7-ELEVEN i-cash system were often perceived as focusing on products with relatively limited consumer demand. This observation indicates that although promotional activities attracted attention during the adoption process, their effectiveness may depend on the perceived relevance of the promoted items.

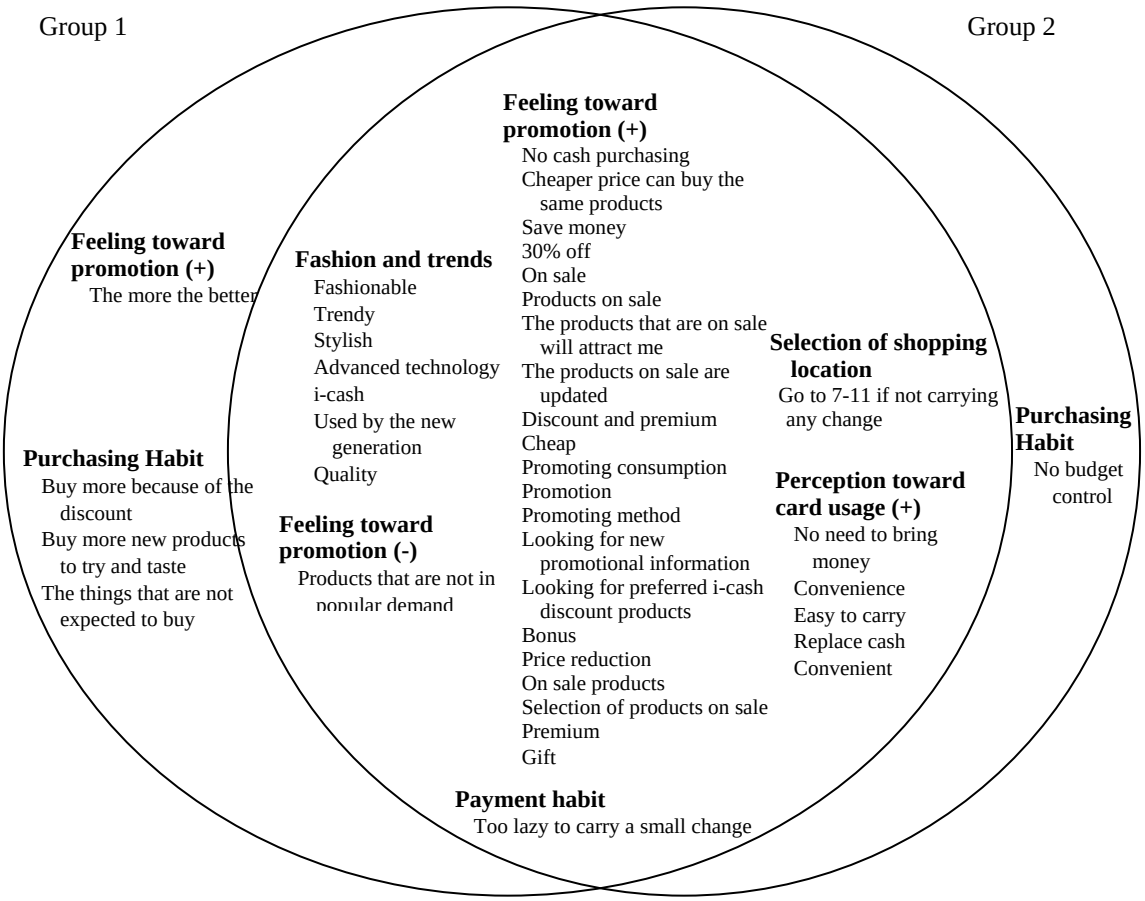

Fig. 3. *Schema of those two groups at the time point T2*

Differences between the two groups at T2 were primarily reflected in the intensity rather than the direction of adoption-related perceptions. Participants in Group 1 showed stronger engagement with promotional activities and reported actively seeking additional promotional opportunities associated with i-cash usage. Meanwhile, participants in Group 2 demonstrated a noticeable increase in purchasing

frequency following continued card usage, with some participants reporting reduced budget control during the observation period. These behavioral adjustments suggest that accumulated usage experience may influence not only cognitive evaluations of micropayment technology but also consumption patterns during the later stages of the adoption process.

Taken together, the schema comparison across T1 and T2 indicates that continued interaction with i-cash system contributed to the stabilization of adoption-related schema structures and reduced differences between experienced and inexperienced users. This late-stage schema convergence provides important evidence that repeated exposure to micropayment card usage supports the transition from initial evaluation to routine behavioral integration during the adoption process.

V. CONCLUSION AND DISCUSSISSON

This study examined how adoption-related schema structures associated with i-cash usage evolved over time by comparing participants with and without prior experience across three observation points (T0, T1, and T2) within a ten-week period. The longitudinal schema comparison provides important insight into how repeated usage exposure reshapes users' cognitive interpretations of micropayment card adoption.

At the baseline observation stage (T0), participants in both groups already shared a generally positive perception of i-cash in terms of functional usage convenience, including the reduced need to carry change and simplified payment procedures. This finding suggests that awareness of functional benefits associated with micropayment cards may exist even before direct usage experience. From a managerial perspective, this indicates that the perceived convenience of micropayment systems can be widely recognized without intensive marketing efforts.

Despite this shared functional evaluation, clear differences between experienced and inexperienced users were observed at the early stage of the adoption process. Participants with prior i-cash experience demonstrated more diversified and positive schema structures, including perceptions related to fashion trends, card collecting value, brand image, usage convenience, brand loyalty, and purchasing behavior. In contrast, participants without prior experience showed greater concern regarding usage-related risks, lower interest in promotional activities, and weaker loyalty toward the retail environment. These differences indicate that prior usage experience plays an important role in shaping early-stage adoption-related cognition.

Following five weeks of continued usage exposure, the schema structures of inexperienced users showed substantial convergence with those of experienced users. Participants without prior experience began to recognize the functional advantages of card usage, developed stronger interest in promotional activities, and demonstrated increased loyalty toward the 7-ELEVEN retail environments. This convergence suggests that repeated interaction with micropayment technology reduces perceived uncertainty and facilitates the transition from initial evaluation to experiential acceptance. In addition, increased willingness to make non-essential purchases following card usage indicates that micropayment adoption may influence consumption behavior by lowering transaction-related psychological barriers.

Although inexperienced users initially expressed concerns regarding issues such as card loss, demagnetization, and limited usage scope, these concerns became less salient after continued exposure to routine usage situations. However, the perceived limitation that i-cash card could only be used within the 7-ELEVEN retail system remained an important constraint affecting adoption intention. This finding suggests that expanding functional applicability and improving technical reliability may further strengthen users' willingness to adopt micropayment cards.

Another important finding concerns the role of promotional strategies in influencing adoption-related perceptions. Promotional activities associated with the i-cash system were more effective among experienced users than among inexperienced users during the early stage of the observation period. This result indicates that promotional strategies may produce different effects depending on users' prior experience with micropayment systems and suggests that differentiated marketing approaches may be required for different user segments.

The longitudinal comparison across the three observation points further revealed that the majority of schema adjustments occurred within the first five weeks of usage exposure, whereas only limited additional changes were observed between the fifth and tenth weeks. This pattern suggests that users' adoption-related perceptions toward micropayment cards may become relatively stable after an initial experiential learning period. From a theoretical perspective, this finding highlights the importance of early-stage usage experience in shaping long-term adoption cognition.

Taken together, the results of this study demonstrate that schema-based longitudinal comparison provides a useful analytical framework for understanding how prior experience influences the evolution of micropayment adoption perceptions over time. By tracking schema structures across multiple observation stages, the study contributes to technology adoption research by showing how repeated usage exposure supports the convergence and stabilization of adoption-related cognition. From a managerial perspective, the findings suggest that retailers can promote micropayment card adoption by emphasizing usage convenience, strengthening symbolic and promotional value, and expanding the functional scope of payment applications. In addition, the observed increase in purchasing frequency associated with micropayment usage indicates that stored-value payment systems may influence consumer spending behavior by facilitating routine

transaction integration in everyday consumption contexts.

REFERENCES

[1] N. S. Tasbiha, “Qualitatively examining and analyzing social learning theory in an online arena with a focus on sexting,” European Journal of Humanities and Social Sciences, vol. 4, no. 1, pp. 9–14, 2024.

[2] N. Mallat, “Exploring consumer adoption of mobile payments–A qualitative study,” The Journal of Strategic Information Systems, vol. 16, no. 4, pp. 413–432, 2007.

[3] F. D. Davis, “Perceived usefulness, perceived ease of use, and user acceptance of information technology,” MIS Quarterly, vol. 13, no. 3, pp. 319–340, 1989.

[4] E. M. Rogers, Diffusion of Innovations, 4th ed. New York, NY: Free Press, 1995.

[5] A. M. Rezza, S. F. Widyana, A. D. Anggraeni, and A. Andriyanto, “Digital payment adoption: the antecedent of habit and behavioral intention,” JPPI (Jurnal Penelitian Pendidikan Indonesia), vol. 10, no. 4, 2024.

[6] Y. P. Yuan, G. W. H. Tan, and K. B. Ooi, “What shapes mobile fintech consumers' post-adoption experience? A multi-analytical PLS-ANN-fsQCA perspective,” Technological Forecasting and Social Change, vol. 217, Art. no. 124162, 2025.

[7] L. Serino, E. de Nuccio, E. Borin, and A. Papa, “FinTech adoption and continuance: unveiling the drivers of user engagement in Italy,” International Entrepreneurship and Management Journal, vol. 22, no. 1, p. 15, 2026.

[8] J. W. Alba and J. W. Hutchinson, “Dimensions of consumer expertise,” Journal of Consumer Research, vol. 13, no. 4, pp. 411–454, 1987.

[9] D. E. Rumelhart, “Schemata: The building blocks of cognition,” in Theoretical Issues in Reading Comprehension, R. J. Spiro et al., Eds. New York, NY: Routledge, 2017, pp. 33–58.

[10] F. C. Bartlett, Remembering: A Study in Experimental and Social Psychology. Cambridge, UK: Cambridge University Press, 1932.

[11] G. Labianca, B. Gray, and D. J. Brass, “A grounded model of organizational schema change during empowerment,” Organization Science, vol. 11, no. 2, pp. 235–257, 2000.

[12] R. C. Anderson, R. J. Spiro, and W. E. Montague, Eds., Schooling and the Acquisition of Knowledge. New York, NY: Routledge, 2017.

[13] C. Marshall and G. B. Rossman, Designing Qualitative Research, 2nd ed. Newbury Park, CA: Sage, 1995.

[14] J. Platt, “The history of the interview,” in Handbook of Interview Research: Context and Method, J. F. Gubrium and J. A. Holstein, Eds. London, UK: Sage, 2002, pp. 33–54.

[15] J. Balogun and G. Johnson, “Organizational restructuring and middle manager sensemaking,” Academy of Management Journal, vol. 47, no. 4, pp. 523–549, 2004.

[16] D. E. Polkinghorne, “Narrative configuration in qualitative analysis,” in Life History and Narrative, J. A. Hatch and R. Wisniewski, Eds. Washington, DC: Falmer Press, 1995, pp. 5–24.