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Retail technology adaptation in traditional retailers: A technology-to-performance chain perspective

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ABSTRACT

Traditional retailers must immediately embrace and adapt technology to survive in the competitive retail industry as retail technology rapidly changes consumers' buying habits and expectations. This study may be the first to apply the Technology-to-Performance Chain (TPC) to traditional retailers' technological adaptation in an emerging market. A developing country's traditional retailers were studied qualitatively. Most of traditional retail's ongoing technologies are the result of adaptation by combining existing technologies to local conditions or technology adoption improvements. Technology adaptation includes using PoS system software with a printer and barcode scanner to substitute modern retail cash registers, a combination of mobile apps and PoS system software to mimic mPoS, and adapted EDC for digital product transactions. This technology adaptation is meant to manage business processes and manage the business growth of traditional retail that has limited resources and unique additional services. Therefore, available technology should be adapted to ensure low complexity, compatibility, and reliance on technologies that are familiar to people in developing countries. Furthermore, the task-technology fit (TTF) component requires the support of traditional retailers' awareness, effective partnerships with technology providers, and perceived technical competence to increase the utilization of adapted technology and achieve the expected performance which includes inventory data clarity, increased retail revenue, and time savings.

1. Introduction

Successful technology adoption by retailers in the developed nations encourages the limited introduction of interactive tools in traditional retailers, such as inventory management or accounting software, mobile applications, handheld devices (billing POS) (Aithal et al., 2022), e-commerce (Yaseen et al., 2017), and mobile payment (Seethamraju and Diatha, 2018). These can improve the appearance of traditional retail, influencing consumer shopping behavior (Pantano and Di Pietro, 2012). Previous studies have highlighted the use of technology in traditional retailers as a potential strategy for establishing a sustainable competitive edge, particularly in the context of new channel challenges (Neumeier et al., 2020). However, the lack of cash for investment, inability to find specific technology that meets their needs, and lack of human resources with knowledge or skills to operate complex technology are the most common hindrances among traditional retailers to

adopting retail technology (Seethamraju and Diatha, 2018).

Technology adoption in developing nations requires effective adaptation to the local context of traditional retailers to survive sustainably in retail competitiveness. Technology adaptation is necessary because oftentimes, the concept and assumption of technology adopted in developed nations cannot always be implemented in developing economies (White and Absher, 2007). Different characteristics between large and traditional retailers are the reason why the research results on large retailers cannot be generalized to traditional retailers (Thong, 2001). Adapting to local conditions encourages retail technology transfer, unlike adopting for global benefits. Many organizational benefits of retail technology adoption will stem from adaptations (Alter, 2014). However, no research has examined technology adaptation, in either large or traditional retailers in developing nations. Therefore, further research on technology adaptation in traditional retailers is required to reduce costs and leverage the maximum prospective of the implemented

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technology (Drave et al., 2020).

Technology-to-Performance Chain (TPC) is a combination of Task-Technology Fit (TTF) and technology utilization that affects overall organizational performance. TTF has been employed as an evaluation parameter by technology users on the degree of fit between the function or features of the technology and their task requirement as a surrogate measure for the successful adoption of the technology (Goodhue and Thompson, 1995). The TTF model's validity has been demonstrated repeatedly in the context of multimedia-based information systems for shop floor workers (Tjahjono, 2009), the adoption of e-commerce (Liu and Goodhue, 2012), the adoption of mobile banking (Oliveira et al., 2014; Zhou et al., 2010), contactless delivery services during the Covid-19 pandemic (Zhao and Bacao, 2020), and more recently for technology adoption in shopping activities under social distancing (Wang et al., 2021). However, TTF and utilization in the TPC model have yet to be employed in traditional retailers' technology adoption, moreover the potential adaptation during the process. Therefore, the employment of TPC proposed by Goodhue and Thompson (Goodhue and Thompson, 1995) opens up significant opportunities for mapping the capability and resources required to succeed in adapting technology among traditional retailers in developing nations.

Empirical studies on technological adaptation among traditional retailers in developing countries are rare despite their importance for their sustainable survival. Therefore, our objective is to fill this gap by conducting an empirical study on traditional retailers' technology adaptation. As a case study, we are conducting surveys, interviews, and observing traditional retailers from big city in Indonesia.

Our central research question in this paper is double-pronged: "How was the process of technology adaptation in traditional retailers in a developing country, and what capabilities and resources do traditional retailers in a developing country require to successfully adapt technology using the TPC approach?" Addressing these questions is fundamentally important for both theory and practice development in three ways. First, this study proposes a framework to better understand the capabilities and resources traditional retailers need to successfully adapt the technology. Second, this study informs the adaptation path or evolution of the adopted retail technology by traditional retailers. Third, this study provides insights for traditional retailers, technology providers, and the government to develop adapted retail technology for traditional retailers and formulate appropriate strategies to support the adaptation. For that reason, we propose a framework that conceptualizes suitable technology adaptation for task requirements and traditional retailers' capabilities through the TPC approach to ensure the success of technology adaptation among traditional retailers.

The remainder of this paper comprises five sections. The next section discusses a review of relevant research that serves as a basis for this study. Section 3 describes the research methodology and explains the research design and data collection. Section 4 presents the findings and analysis of our semi-structured interviews. Finally, the conclusion is summarized together with research limitations and future directions in Section 5.

2. Theoretical background

This section is divided into three sections. The first section defines and explores the scope of traditional retail, the second section examines the adaptation of technology in developing nations, and the third section discusses the technology-to-performance (TPC) model as a theoretical framework that served as the foundation for this study.

2.1. Traditional retailing

Traditional retail in developed countries refers to the traditional way of doing business and marketing within the retail sector. For example, traditional retail in the USA uses traditional marketing channels such as sponsoring, print advertising, events, and TV commercials (Dholakia

et al., 2005; Rangaswamy and Van Bruggen, 2005). To put it simply, it implies traditional brick-and-mortar or traditional business with physical stores (Drave et al., 2020; Johansson and Kask, 2017). This kind of traditional retailer can be in the form of a retail chain firm managed in a modern and structured way, as seen in New Zealand (Petrova and Wang, 2013). On the other hand, in developing countries, retail that is organized in a modern and structured manner, featuring self-service systems and fixed prices non-negotiable, is categorized as modern retail.

The concept of traditional retailers in developing nations is more complicated when it concerns business location, sales area, proprietorship, technology use, and personalized services. In terms of location, traditional retailers are small retailers located in the neighborhoods of big cities, which are then referred to as nano stores (Boulaksil et al., 2019). In terms of sales area, Seminari et al (Seminari et al., 2017). refer to Indonesian traditional retailers such as small stores, like a kiosk, operating as a small business with a sales area of less than 100 meter square, while Goswami and Mishra (Goswami and Mishra, 2009) refer to "kirana", an Indian traditional retailer with a sales area less than 500 square feet. In terms of proprietorship, technology use, and personal involvement, the term traditional retailers refers to single stores with sole-proprietorships or family-owned businesses (Praharsi et al., 2014), which have low demand for high technology (Kim and Yoon, 2022) and allow for personal and continuous closeness with customers in day-to-day retail operation (D'Andrea et al., 2006). Traditional retailers generally engage in direct customer service and offer customary traditional retail services, such as flexible pricing, and availability of informal credit and debt to well-known customers (Boulaksil et al., 2019). The above explanation leads to the definition of traditional retail for the purposes of this study as retail in the form of stores or kiosks that are individually or family-owned and have traditional management but are still able to offer personalized services to customers. Traditional management includes simple inventory and sales documentation, cash-based and face-to-face (non-self-service), and traditional marketing channels such as print advertising. Furthermore, personal services include negotiable prices, and providing informal credit and debt to well-known customers.

Traditional retailers' lower- and middle-income customers (Suyono et al., 2016) with substantial purchasing power as a group justify the survival and growth of traditional retailers (D'Andrea et al., 2006). Local customers visit them to have social interaction, discover the latest news of the neighborhood, and have self-expression (Boulaksil et al., 2019). Therefore, traditional retailers meet the expectations and socio-cultural demands that modern retailers do not (Lenartowicz and Balasubramanian, 2009). This helps traditional retailers remain developing countries' primary shopping option.

2.2. Technological adaptation as an open innovation opportunity in developing countries

Retail in developed countries had adequate capacity to adopt technology. Therefore, technology adoption has dominated retail technology studies, while adaptation has received little attention. The different characteristics between large and traditional retailers, in both developed and developing countries, make research findings regarding technology adoption in large retailers cannot be generalized to traditional retailers (Thong, 2001). The concepts and assumptions that apply to retailers in developed nations will not always be suitable for the condition and situation of developing nations' retailers (White and Absher, 2007). For that reason, adopting developed countries' technology towards retailers in developing countries should always be adjusted to fit the local condition, because the benefits of technology adoption on an organizational scale originate from adaptation (Alter, 2014). Drave et al (Drave et al., 2020). believe that traditional retailers can reduce the overall cost and maximize the potential benefits from technology adaptation.

According to Cooper & Zmud (Cooper and Zmud, 1990), adaptation is understood as a part of information technology (IT) adoption which

includes applying IT and revising organizational procedures. Jeyaraj and Shaberwal (Jeyaraj and Sabherwal, 2008) argue that adjustments to technological innovation to overcome its perceived limitations are closely linked to the concept of technological adaptation. Some researchers (Hristov and Reynolds, 2015) argue that innovation is more strongly associated with continued transformation and adaptation to changing consumer preferences and market demands. Moreover, the study by Buchan (Buchan, 2014) emphasizes the encouragement to shift the focus of the research from technology adoption to adaptation by revealing the excellence of adaptation as a system-oriented process, considering the complex environment, and admitting the various contextual factors (positive and negative) which can influence individual, organization or institution, and technology use. However, the context in which all this research is discussed is still largely limited to non-retail large firms. The discussion on adaptation in the retail industry is still limited to retail format transfer from developed countries to developing countries. There are two transfer formats, they are as-is transfers and adaptation options. As-is transfer is encouraged by the motivation to gain leverage advantages from global operations, while adaptation is encouraged by the need to adapt to local conditions (Goldman, 2001).

Technological adaptation in developing countries is primarily addressed in the context of business process adaptation (Stohr and Zhao, 1997) and production technology in manufacturing companies (Nikas and Poullymenakou, 2008; Lahiri et al., 2018; Singh et al., 2021). Drave et al (Drave et al., 2020). attempted to study the adaptation of technology in e-tailers to meet modern retail business operations in India, however, the focus of the discussion is not on physical retail such as traditional retail. Therefore, this opens up a chance to research technology adaptation, particularly to help traditional retailers survive the ever complex and complicated competition of the retail industry. Furthermore, technological adaptation could encourage opportunities for open innovation, which is characterized as the implementation of external ideas and technologies into an organization to expand markets and accelerate internal innovation (Chesbrough, 2023).

2.3. Technology-to-performance Chain Model for technology adoption

The Technology-to-Performance Chain (TPC) model has been widely used in various fields to better understand the parameters of technology adoption. Previous studies in large non-retail businesses, such as Nyathi & Kekwaletswe (Nyathi and Kekwaletswe, 2023), used the TPC model to build a model for improving employee performance through the adoption of electronic human resource management (e-HRM), which has the potential to enhance overall organizational performance. Furthermore, Rodriguez and Trainor (Rodriguez and Trainor, 2016) developed a conceptual model of the drivers and outcomes of mobile customer relationship management (mCRM) adoption on the TPC and the Technology Acceptance Model (TAM). Singh (Singh et al., 2023) used a more complicated model combination of TPC, Task-Technology Fit (TTF), and TAM to identify the factors that can impact the institutionalization of product lifecycle management (PLM) in manufacturing companies so that its advantages can be perceived by consumers. The TPC model has also been used in the education sector to evaluate instructor performance in institutions due to digital transformation during the COVID-19 pandemic (Tripathi and Urkude, 2022) and to investigate the effect of smartphone use by college students on their perceived academic performance (Han and Yi, 2019; Yi et al., 2016). Previous TPC research in testing the fit has focused mostly on task and technology characteristics, with only a minor involvement of organizational characteristics. We believe that organizational characteristics such as prior experience with adapted technology should be considered when assessing the task-to-technology fit. Therefore, our proposed model includes organizational characteristics of traditional retail in developing countries.

The TPC model integrates the TTF model with technology utilization, focusing on overall organizational performance based on utilization and

task fit (Singh et al., 2021). This model addresses the inadequacies of the TTF model, which does not give performance improvements only based on fit without utilizing the adopted technological system. Because the utilization of technology is reliant on attitudes and behaviors theories, behavioral models are frequently used to describe them. For example, the TPC model was generated by the integration of the Unified Theory of Use and Acceptance of Technology (UTAUT) and Expectancy Confirmation Model (ECM) with TTF to identify the factors affecting customers' continued intention to use food delivery apps (FDAs) during the COVID-19 pandemic period in China (Zhao and Bacao, 2020). The combination of TTF and UTAUT is also used by Oliveira et al (Oliveira et al., 2014). alongside the Initial Trust Model (ITM) theory to identify the factors affecting the adoption of mobile Banking (mBanking) in Portugal. Moreover, Lin et al (Lin et al., 2019). combined UTAUT and TTF with the information system success model (D&M ISS) to identify factors influencing Korean and Chinese customers' mobile payment (m-payment) usage intention.

All of these studies provided insights into measuring the success of retail technology adoption, but none have explored the success of technology adaptation, especially in traditional retail in developing countries. The TPC model should be able to be used to measure the success of technology adaptation with the same basic concept, measure the compatibility between task requirements and adapted technology function, and observe the effect on technology users' performance. The TPC model by Goodhue and Thompson (Goodhue and Thompson, 1995) emphasizes that technology must be utilized first and must be a good fit with the tasks it supports to improve users' performance. TTF can be improved by improving the technological function (Technology Characteristics – TEC) to fulfill the tasks (Task Characteristics – TAC) taken on by individual or organization technology users (Organizational Characteristics – OC) more efficiently. The tasks can be redesigning and reengineering to better utilize technology features ((Sean) Jaspersen et al., 2005). The whole TPC process illustrates the adaptation made between task needs and technology features to be able to satisfy users' expectations which eventually improve technology user performance.

3. Research method

3.1. Research design

Research questions and the scope of the study were used to construct the initial framework utilizing Goodhue and Thompson's TPC model (Goodhue and Thompson, 1995) to qualitatively assess technological adaptation in traditional retailers in developing nations. The initial framework was used to analyze, evaluate, and extract appropriate data that can highlight interrelated constructs. This initial framework, as depicted in Figure 1, featured TTF as influenced by TEC, TAC, and OC, thereby influencing technology utilization, including technology adoption and adaptation. TAC is constructed from benefits from retail technology adoption (labeled C in Figure 1), and TEC is constructed from the potential future retail technology (labeled D). Moreover, respondent background (labeled A), and current state of retail technology adoption/adaptation (labeled B) are considered to construct OC, while drivers and barriers adopting new technology (labeled E) are considered to construct precursor to utilization. The interview guideline questions in Appendix A match these labels (A to E).

Qualitative research was performed on traditional retailers in Indonesia, a developing country that heavily depends on traditional retailers (Nurhayati-Wolff, 2022) to address the research questions. The unit of analysis is traditional retailers with varying business scales and digitization experience. Traditional retailers in this research mainly acquire their products from official and unofficial distributors, but they occasionally buy from modern retailers offering discounted prices and traditional retailers offering wholesale service (wholesale stall). Figure 2 shows this supply chain.

Traditional retailers who are independent family-owned businesses

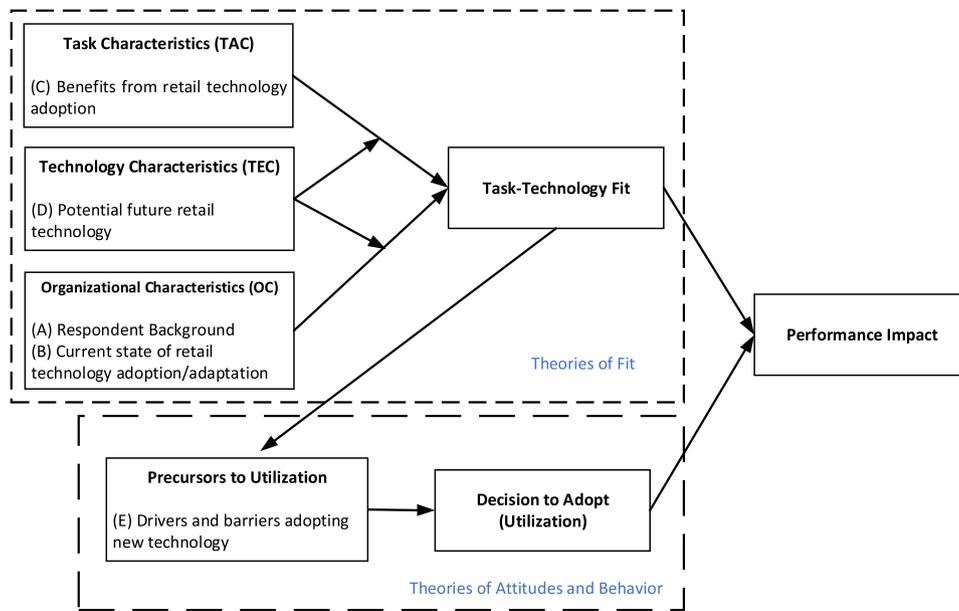


Fig. 1. The initial framework to guide the research.

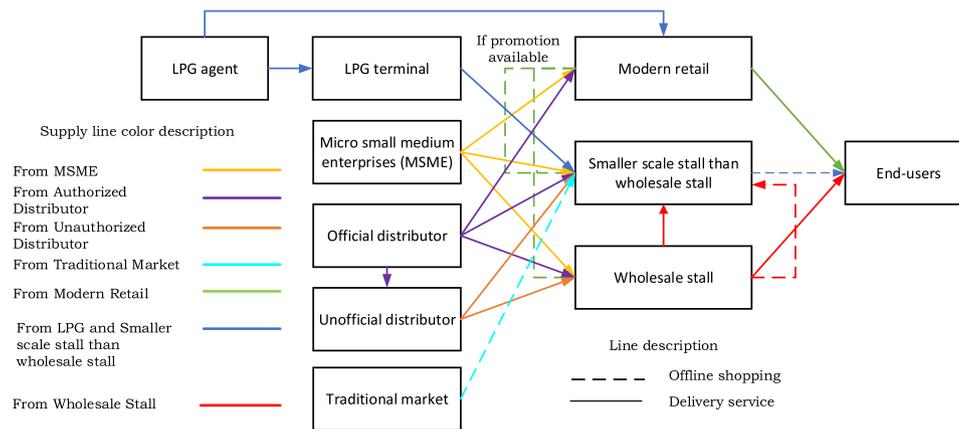


Fig. 2. Merchandise supply chain to traditional retail.

enable the owners to multitask. They are retail managers, cashiers, security officers, and general administration officers, and they even serve the customers without hiring anyone (optimizing the help from family members). Therefore, traditional retail owners represent the main subject of this study due to their extensive knowledge of traditional retail management.

Purposive sampling was deployed to sample traditional retailers in Samarinda, Indonesia, the provincial capital of East Kalimantan, which has been a smart city for three years (Widiastuti et al., 2020), as part of the smart city design for Indonesia’s new state capital. An interview protocol with leading questions allowed researchers to explore deeper during each semi-structured interview (see Appendix A).

3.2. Data Collection

Interviews with 36 traditional retailers were conducted in multiple rounds between March 2021 and November 2022 for this study. Pilot study improved the survey and question relevance. All visits occurred within store hours. Each interview lasted between 1.5 and 2 h during the hustle and bustle of traditional retailers serving customers. Traditional retailers are unlikely to schedule interviews because it will disrupt their work or rest time. Field notes were made throughout store visits and

observations. The interviews were conducted in the Indonesian language (Bahasa), audio recorded, transcribed, and then translated into English, with the respondents’ confidentiality guaranteed. Table 1 profiles respondents.

Table 1 Demographics of respondents and sample selection.

Dimension	Descriptive Statistics			
	M	SD	Min	Max
Continuous variable				
Number of employees	1.333	2.378	0	9
Traditional retailers’ personal experience in retailing (years)	9.250	7.019	0.17	27
Gross Revenue (millions of rupiah/month)	176.915	385.693	0.350	2000
Categorical variables	Frequency		%	
Level of education				
• Elementary school	3			8.3
• Junior high school	3			8.3
• Senior high school	27			7.5
• Bachelor’s degree	3			8.3
Management level				
• The owner (including a family member)	34			94.44
• Employee	2			5.56

3.3. Data Analysis

Data analysis began when the first round of interviews with 16 respondents was completed. We reviewed interview transcripts and existing literature after each interview to allow theory to emerge from the data. Open coding identified data categories until none remained as it was continuously collected, transcribed, and analyzed. The database coding procedure is iterative in nature to reveal new insights and enrich our explanation; therefore, different concepts identified during data collection were compared to other themes and concepts that emerged throughout the research. The initial list of codes was developed by using NVivo 12, a qualitative data analysis tool, and followed the coding procedure by Gioia et al (Gioia et al., 2012). and Saldana (Saldana et al., 2017). Coding data at the first level in the respondent’s language helps us understand the respondent’s reality to effectively account for their experiences (Gioia et al., 2012). To decode it further, it was essential to understand the respondents’ views on technology adaptation, i.e., what drives or inhibits them from using technology, what benefits they have received, and what kind of future technology they wish to adapt.

Our first level coding (axial codes) generated 25 codes, following Denzin’s coding steps (MacQueen et al., 1998). We then recoded the 25 axial codes into 12 s-order themes (selective codes) to better organize and understand the data (Gioia et al., 2012). We decided to conduct a second round of interviews with 10 new respondents after the initial coding process to reinforce and validate our preliminary findings. The second round of interviews yielded no new insights, indicating that data saturation had been reached and that no additional respondents were required (Denzin, 1988). We finally mapped these 10 selective codes into five themes for thematic analysis (Brooks et al., 2015), i.e., organizational characteristics (OC), task characteristics (TAC), technology characteristics (TEC), the precursor of utilization, and performance

Table 2
Code categories and the emerging themes.

Axial codes	Selective codes	Themes
<ul style="list-style-type: none"> Limited financial resources Limited infrastructure available Low-tech savvy users Bargainable prices Loan or credit options for known customers Individual connections and relationships built on trust Inventory and financial management Employee management Store promotion Faster services Adaptable to growing sales 	Limited Resources	Organizational Characteristics (OC)
<ul style="list-style-type: none"> Practical and easy to use Suitable with operational necessities Suitable with limited resources Established technology 	Specialty services	
<ul style="list-style-type: none"> Effective partnership with technology provider Government support Perceived technical competence Traditional retailers’ awareness Willingness to learn Clarity of inventory data Timesaving Enhance retail revenue 	Managing business process	Task Characteristics (TAC)
	Managing business growth	
	Low complexity	Technology Characteristics (TEC)
	Compatibility	
	Familiarity of technology	
	Facilitating condition	Precursor of utilization
	Internal users’ readiness	
	Expected consequences of utilization	Performance Impact

impact as shown in Table 2. There was complete agreement between the four authors for the second and third levels of coding. The validity of the coding theme analysis results is in compliance with the qualitative input validity criteria suggested by Whittemore et al (Whittemore et al., 2001). by gaining the approval of all respondents after two processes of asking for respondents’ responses. Furthermore, the reliability of the coding theme analysis results was achieved through intercoder reliability and agreement (Campbell et al., 2013; Krippendorff, 2022) in the form of agreement by all researchers on the results of coding theme analysis to reach 95.5% of the statements that can be coded.

4. Key Findings

This section presents the results of our data collection and coding analysis on factors influencing technology adaptation in traditional retail. This section is divided into six parts, i.e., the evolution of adopted retail technology in traditional retailers, the factors that drive technology adaptation from organizational characteristics, task characteristics, technological characteristics, precursor of utilization, and expected consequences of utilization.

4.1. Evolution of adopted technology in traditional retail

Based on the interview results, this section presents the respondents’ technological journey. Table 3 shows the past and current adopted retail technology including the technology adaptation by the sampled traditional retailers. Findings showed that the use of technology in traditional retail begins with the use of manual methods or traditional technologies such as calculators and handwritten bills for transaction purposes. Despite the adoption of more complex technologies, electronic calculators are still in use. All respondents also use mobile messaging apps as the main communication media for developing nations, along with calculators. Through mobile messaging apps, WhatsApp, traditional retailers place orders to distributors and sometimes receive orders from their regulars. Besides calculators and mobile messaging apps, most respondents used mobile apps provided by the official distributors to order their supply of goods (27.78%), Point of Sale (PoS) System (19,44%), a barcode scanner (5.56%), 5.56% of the respondents used Payment Point Online Banking (PPOB), and 2.78% used Electronic Data Capture (EDC).

It is interesting to note that most of the technologies still in use are those that have been adapted based on the capability of traditional retailers. Some respondents adapted the PoS System computer software combined with a printer and barcode scanner to function like modern retailers’ cash registers. Some respondents did not use a barcode scanner because they felt sufficient with PoS System computer software and printer.

Further adaptation on PoS System was done by Respondent 33 who managed to integrate PoS System with mobile apps to serve a function similar to mobile PoS (mPoS). Furthermore, the EDC machine, which is usually used to support debit or credit card payment, has been adapted by the Bank to accommodate digital product purchases with a wider scope of products than PPOB. This makes traditional retailers prefer EDC machines provided by banks to text messaging based PPOB. This kind of adaptation is an improvement from technology adoption. Both of these technological adaptations necessitate an internet connection, thus classifying them as Internet of Things (IoT) technologies, which are integral components of Industry 4.0.

Some respondents stopped using and even rejected the offer to use PoS System computer software and barcode scanner because they consider themselves incapable of operating it, but they still support its implementation when their children run the business in the future because they consider their children to be more tech-savvy. In addition to being unqualified to use technology based on the terms and conditions set by the technology providers, the majority of respondents rejected mobile apps (47.22%) because they had used the mobile apps

Table 3
Adopted retail technology by traditional retailers.

No	Retail Technology	Adoption		Adaptation		Had Used		Offered but rejected	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
1	Electronic calculator	36	100						
2	Mobile messaging apps	36	100						
3	POS System			7	19.44	1	2.78		
4	Barcode scanner	2	5.56			1	2.78		
5	EDC			1	2.78				
6	PPOB	2	5.56						
7	Mobile apps for ordering goods from official distributor	10	27.78			3	8.33	17	47.22
8	Mobile payment					1	2.78	2	5.56
9	mPOS			1	2.78				

from other technology providers and were satisfied with the existing technology. The fact that respondents were unable to use the technology yet willing to learn also influenced their decision. A different case happened to Respondent 1 who had been willing to adopt mobile payment, but they had to halt the use because none of their buyers were interested in using it.

Finding 1:

Most traditional retailers have supplemented the usage of simple technology with various technological adaptations so that they have functions comparable to modern retail technologies and are even slowly migrating to adapting mobile-based technologies and Internet of Things (IoT) technologies.

4.2. Organizational characteristics affecting traditional retail technology adaptation

Our findings indicate that limited resources and unique services provided by traditional retailers influence traditional retailers' technology requirements and adaptability. Traditional retail has financial, infrastructure, and low-tech savvy users' limitations. Financial limitation can be seen from the low level of capital and profit, which was around 2–3% for fast-moving goods, and 20–30% for slow-moving goods calculated from procurement cost. Financial constraints limit their facilities and infrastructure, as evidenced by their serving space, which also serves as a storage area, reducing capacity and product assortment. According to Respondent 6, inadequate facilities and infrastructure are reflected in limited devices and internet connections, making it difficult for respondents to use digital technology or Internet of Things (IoT) based technology. Interestingly, the limited funds for technology procurement and existing facilities and infrastructures have led to the adaptation of PoS System, mPoS, and EDC.

Traditional retailers also consider low technology competence possessed by technology users, while selecting and implementing technological adaptations. The respondents' main customers are daily wage workers and low socio-economic, low levels of education residents around the traditional retailers. The educational background of the owner and employees is relatively low, with the majority of the interviewed respondents (75%) having a senior high school degree and only

8% having a bachelor's degree. This affects the respondents' readiness and willingness to adopt technology, as seen in Figure 3. Bachelor's and senior high school graduates are more likely to adopt new technology. The internal users in traditional retailers are comfortable with cash transactions and un-willing to use digital technology due to their inadequate technological knowledge and skill. Therefore, most respondents rejected the offer to adopt technology such as PoS Systems and mobile applications, since they felt unable to understand a more advanced technology than a calculator.

The form and type of technical adaptation required is impacted by the traditional retail unique services that distinguishes it from modern retail, such as bargainable prices, wholesale price that is cheaper than retail price, and loan or credit options for known customers. These unique services occur because the majority of the respondents run their businesses and serve their buyers directly by actively recommending products and additional services or simply engaging and greeting close to every buyer. Personal interaction allows these unique services to be delivered fully on trust and increases store loyalty to improve the number of customers and sales.

Respondents keep track of the credits or loans in their notebooks, while some do not without a formal agreement with customers. Respondents also indicate customers who delay payments will likely not receive future credits or loans. Their present technology is incapable of facilitating these unique services; thus, technological adaptation is required for maintaining them.

Finding 2:

Limited resources and unique services to use technology are features of traditional retail organizations that encourage technological adaptation.

4.3. Task characteristics affecting traditional retail technology adaptation

Our findings identify that traditional retailers are required to adopt and adapt technologies that can manage business process dan growth. Respondents demand technology that allows them to handle inventory, finances, employee, stores promotion, and improve service speed. Uncertainty regarding store inventory and retail margins increases respondents' demand for inventory and financial management for

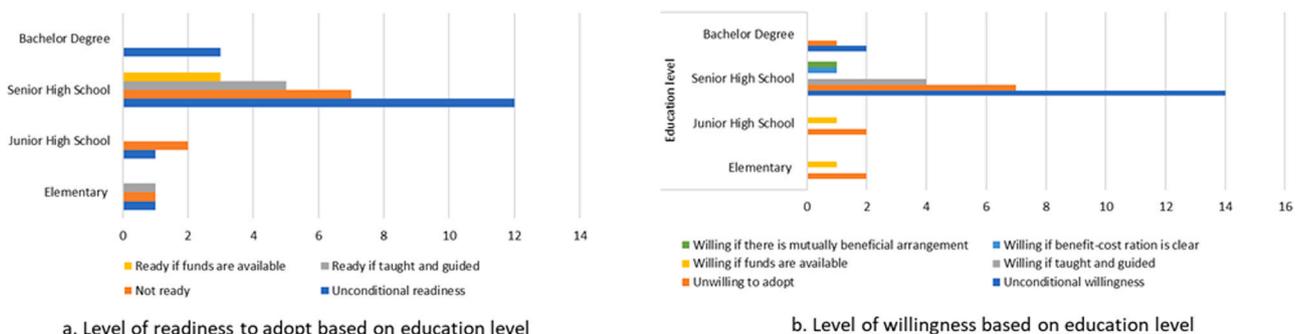


Fig. 3. The level of respondents' readiness and willingness to adopt technology is based on educational background.

recording and monitoring inventory while calculating store profit and loss. Respondent 30 and Respondent 34 have improved their inventory and financial management by adapting the PoS System in their stores. This proves that technology adaptation can measure traditional retailers' performance and assist owners make better business decisions.

Employee management is another required feature as stated by Respondent 34, "...the demand is greater for employee affirmation over work discipline, employee management, and salary management". In addition, Respondent 30 emphasized the necessity for technology support in store promotion, "... We prefer promotional help to increase the number of customers. The most important aspect is how to market our products to our regulars.". Moreover, the adapted technology is expected to help in managing the required business process faster, as stated by Respondent 22: "The technology can make the purchasing process faster, more efficient, and also save time".

Respondents utilized the adapted POS System and barcode scanner due to operational requirements, particularly as business volume and scale increase to the point in which calculators are no longer able to facilitate large volumes of transactions. This includes bank-provided EDC adaptation. The adaptation is encouraged by the growing range of digital products offered to customers. This suggests that technology adaptation can be employed as an adjustment step towards the increase of sales or business scale.

Finding 3:

The technological capabilities to manage business processes and business growth is a required task in the process of adapting technology in traditional retail.

4.4. Technology characteristics affect traditional retail technology adaptation

Traditional retail's technological adaptation is motivated by the requirement for low-complexity technologies compatible with the capabilities and task requirements of technology users, as well as their familiarity with the technological platform. Several respondents' technology adaptations are proven to be more practical, easier to use, and compatible with their operational needs and limited resources, such as using the PoS System with printer and barcode scanner as a form to adapt the modern retailers' cash registers. This adaptation has helped some respondents track income, expenses, store inventory and speed up the transaction process. This also applies to the adaptation of mPoS in the form of combining PoS System and mobile application which can save time and increase the number of customers.

These two adaptations have cheaper procurement costs. The substitute technology is commonly used in developing countries, so the internal users in traditional retailers (owners and employees) may easily operating it. This fact is acknowledged by some respondents who prefer technology with procurement cost that does not exceed the number of goods purchased and that is compatible with the level of knowledge of internal users in traditional retailers, and also compatible with the owned technology facilities and infrastructures, as stated by Respondent 32: "I expect a user-friendly technology that will not cost me more than the expense I spend on goods".

Some respondents cited the unpopularity of the offered technology as cause for customers' disinterest in using it. The unpopularity of new technology makes most respondents think it would be too difficult to acquire and comprehend cutting-edge technologies like mobile applications and mobile payments, hence they were not interested in implementing them. This issue was amplified by the fact that respondents constantly engaged in serving buyers which makes them have limited time to learn new technology. This leads to respondents' unwillingness to adopt a more complex technology than the existing technologies since they do not want to be troubled with learning and understanding new technology. They consider using manual or traditional technology is still practical and profitable.

This proves that technology adaptation will be easier to accept if the

technology itself is widely known by the people of developing countries. Some respondents strengthen this by showing their willingness to adopt new technology if other stores are using it already, as stated by Respondent 17: "If everyone is using the technology, then we have to progress with time, we have to learn". Furthermore, our findings signify that adaptation happens by combining commonly known technologies to serve similar functions to the more expensive and sophisticated technologies needed by traditional retailers. For example, the adaptation of modern retailers' cash registers by combining PoS System software, a printer, and a barcode scanner that are commonly known by the people. This also applies to the adaptation of the EDC machine used in modern retail card transactions to perform a similar function to PPOB with a wider scope of digital products. Therefore, technology familiarity becomes one of the supporting factors that encourage traditional retailers to adapt to a particular technology.

Finding 4:

Technology adaptation is motivated by the need for technology that possesses low complexity, is compatible with needs, and is based on technology that is well-known to technology users in traditional retail.

4.5. Precursor of utilization affecting traditional retail technology adaptation

We identified non-TTF components that influence traditional retailers' intention to use technology. According to the TPC model of Goodhue and Thompson (Goodhue and Thompson, 1995), these elements are related to the behavior of technology users before utilization, and they include traditional retailers' awareness, perceived technical competency, effective partnership with technology providers, and government support.

The technology users' low level of education and technological knowledge affects respondents' readiness and willingness to use technological adaptations, as Figures 3 and 4 demonstrate. Technology acceptance depends on age and education. Respondents over the age of 50 tend to reject the idea, while the younger ones are more open to adopting new technology. Moreover, respondents with bachelor's degrees are more ready and willing to adopt new technology. This demonstrates their awareness of the importance of advanced technology, unlike younger and less educated respondents. The respondents' awareness will inspire a willingness to learn and understand newly adapted technology and may even encourage employees to become familiar with it, as demonstrated by Respondent 33, who trained her employees to facilitate mPoS adaptation by combining PoS Systems and mobile apps.

Technical competence from adapted technology can be depicted from prior technology adoption experience and the observable example and outcomes from technology implementation. This is why Respondent 30 requested a trial of the new technology before adopting it. A trial or implementation model can reduce the respondents' concerns about various risks, such as misusing the technology which can result in financial loss and personal data misuse, as stated by Respondent 30: "... I've been offered by a colleague to use a computer software, and I've seen the outcomes, so I want to use it as well. Whenever there is a new technology, we have to see the benefits and financial gain first. at least there should be a trial".

Respondents' technological adaptation was all provided by technology providers, so traditional retailers merely need to learn how to use them. Therefore, the respondents emphasized the importance of effective partnerships with technology providers to support the process of technology adaptation. The success of mobile applications adoption and adaptation process to become mPoS by Respondent 34 was due to the effective cooperation with the technology's official distributor. This cooperation is in the form of terms and conditions leniency during the adoption and adaptation process, and also the availability of assistance or mentoring and guidance in technology use. This cooperation is mutual because the distributor provides free technology and assistance

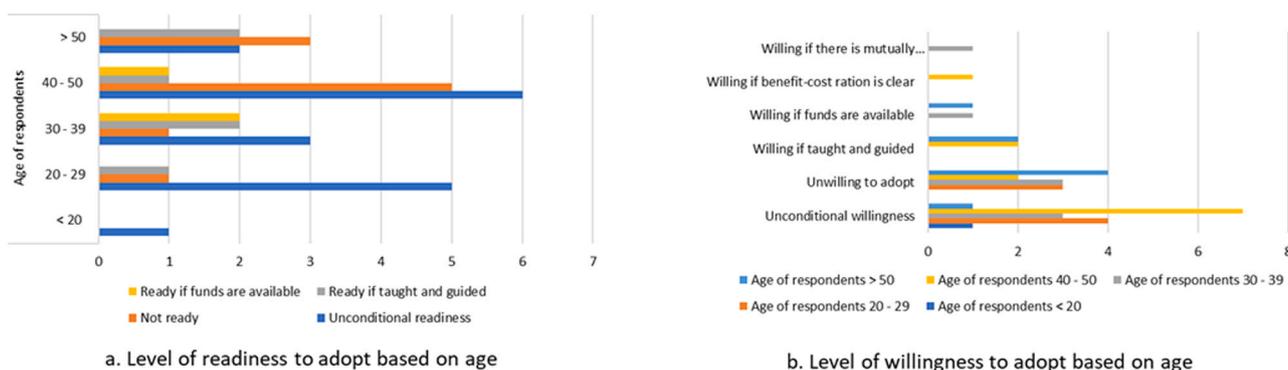


Fig. 4. The traditional retailers' level of readiness and willingness for technology adoption is based on age groups.

if the respondents keep purchasing goods from them. This is explained by Respondent 34 who has successfully adapted mPoS by combining PoS System with a mobile application provided by PT. H. M. Samporna as the official distributor of cigarette products. However, Respondent 28 experienced a failure in the technology adoption process involving the same provider due to complicated and burdensome terms and conditions.

In terms of government support, the findings of this study found that the respondents do not have high expectations of the government in the technology adoption process, as stated by Respondent 31: "I do not expect much when it comes to technology. I expect support for our business, for example in terms of price stability". This could happen because Indonesian traditional retailers prioritize economic stability over government support for technological adaptation. Therefore, government support does not influence technology adaptation.

Finding 5:

Perceived technical competence, traditional retailers' awareness, and effective partnerships with technology providers are three factors external to TTF that impact the decision to implement technology adaptation in traditional retail.

4.6. Expected consequences of utilization

Our findings indicate expected consequences of utilization as expected benefits when deciding to adopt or adapt certain technologies. Expected consequences of utilization also indicate the expected performance criteria set by traditional retailers as a measure of the success of retail technology adoption or adaptation (Isharyani et al., 2021). There are three benefits that the respondents expect when adapting technology into their stores: clarity of data inventory, enhancement of retail revenue, and timesaving.

Data inventory clarity is expected due to the traditional retailers' habit of not keeping track of the incoming and outgoing products or stock levels. This encourages the operational requirements of inventory dan financial management as discussed in Section 4.3. Data inventory clarity can be used by traditional retailers to order the supply of goods from distributors and calculate retail margins, as stated by Respondent 32: "...such as the incoming and outgoing goods, so we can have the record of income and expense of the store".

Some respondents also expect that technology adaptation will increase their stores' profit by attracting customers to purchase in their stores. Therefore, there is a need for technology that can help store promotion (Section 4.3) to increase the number of customers in traditional retailers, as stated by Respondent 10: "I prefer to choose the technology which brings profit to my store".

Timesaving is another benefit expected by the respondents from adapting technology to their stores. Given the volume of transactions in traditional retail, improving the speed of customer service is especially important. Adapting modern retailers' cash registers by combining the PoS System with printers and barcode scanners has been proved to

shorten the transaction processing time in the retailers' stores according to respondents who have used it (Respondents 36, 13, 26, 3, and 8). The adaptation of mPoS by combining the PoS System and mobile application makes Respondent 34 capable of ordering a supply of goods to the distributors and receiving customers' online orders, as well as offering a home delivery service.

Finding 6:

Traditional retailers expect that technology adaptation performance indicators will include improved inventory data clarity, increased retail revenue, and time savings.

5. Discussion

5.1. Traditional retail technology adaptation in developing countries

Findings showed that the use of technology in traditional retail begins with the use of manual methods or traditional technologies such as calculators and handwritten bills for transaction purposes. Despite the adoption of more complex technologies, electronic calculators are still in use. This is in accordance with Sopha et al (Sopha et al., 2022). findings which stated that most traditional retailers use simple technology such as electronic calculators, but Sopha et al (Sopha et al., 2022). still found around 34% of traditional retailers do not employ any technology in their business process.

Traditional retailers perceive digital technology, which is the most recent development in the 4.0 industrial revolution, as challenging to comprehend and implement for users within the industry, including retailers, employees, and buyers. The discontinuation and rejection of digital technology such as mobile apps and mobile payment which are capable of generating, storing, and process data (Ram et al., 2022) prove that digital technology adoption among traditional retailers is generally slow (Ramakrishnan, 2010) and quite difficult (Ram et al., 2022). The low levels at which more advanced technology is adopted shows that traditional retailers do not value technology as an enabler (Ramakrishnan, 2010) which can reduce customers' comfort and trust (Hardiani and Sisharini, 2017).

It is interesting to note that traditional retailers keep using adapted technology provided by technology providers, which suggests that they tend to embrace and implement it better. This is because these technologies have been developed according to the capabilities and requirements of technology users in traditional retail, thereby facilitating traditional retail business processes. This kind of adaptation is a form to adjust to the respondents' local condition which according to Goldman (Goldman, 2001) can maximize the benefits of a technology innovation and eventually improve the retailer's productivity (Lahiri et al., 2018) and strengthen the role of the physical store (Hagberg and Fuentes, 2018). On the other hand, retailers in developed countries possess adequate technological adoption capabilities and are not obligated to adapt. This insight can provide technology providers with the information necessary to adapt digital technologies in a manner that

facilitates and speeds their acceptance in traditional retail.

5.2. Development of performance chain framework for technology adaptation in traditional retail

Increasing competitiveness through technological change has emerged as a major policy concern for industrialized nations. East Asian countries, for example, have outstanding economic performance that is driven by technological adaptation, as evidenced by numerous case studies that investigate how firms, industries, markets (with their faults), and countries expand and compete (Nikas and Poulymenakou, 2008). However, neither developed nor developing countries have yet constructed a technology adaptation model capable of improving retail performance, particularly traditional retail, which is dominant in developing countries. Therefore, this study develops a technology adaptation model based on the fitness of OC with TAC and TEC, which is then completed with utilization precursors that motivate traditional retailers to adapt technology to achieve the objectives sought by traditional retailers.

The organization's unique additional traditional retail services (part of OC) define the tasks that require technological adaptation (TAC). Pricing is dynamic – they are always changing due to the availability of credit or debt services, variations in unit and wholesale pricing, and the prices that can be haggled. Traditional retailers are unable to obtain accurate information about their retail finances due to these factors as well as the absence of inventory and cash flow data collecting. This is consistent with Suyono et al (Suyono et al., 2016). and Maruyama and Trung (Maruyama and Trung, 2007) studies which mention inadequate bookkeeping and reporting as one of the weaknesses of traditional retailers. They typically do not manage their business to metrics like return on invested capital, sales per employee, or inventory turnover (D'Andrea et al., 2006). This necessitates the adaptation of technology responsibilities to manage business processes and business growth associated with this unique additional traditional retail service. All of these services must be maintained because they are the reason why traditional retailers survive and remain the most popular shopping option, despite charging higher prices than modern retailers (Boulaksil et al., 2019). Service bundling is one of the most effective strategies for successful technology adaptation by large e-commerce firms in developing countries (Reardon et al., 2021).

Limited resources in traditional retail (OC) require the adaptation of the latest technologies, including digital technologies, which are characterized by their simplicity, compatibility, affordability, and reliance on technology media that are widely used in developing countries (TEC). The integration of physical resources and appropriate technological adaptation enable synergy and flexibility to improve retail performance (Steinfeld et al., 2002). Inadequate resources and a lack of advanced infrastructure have been identified as risks in technology adaptation (Singh et al., 2021). In the context of technological innovation, environmental and resource issues are critical for creating innovation in micro, small and medium enterprises (MSMEs), such as traditional retailers, particularly in developing countries (Pozzo et al., 2023). Innovation can be viewed as a mediator between risk perception and entrepreneurial orientation on business success (Wijaya and Rahmayanti, 2023). Investment volume and resource availability have been widely discussed in relation to improving innovation performance (Yen et al., 2019).

The limited competence and experience of traditional retail technology users might hinder technology adaptation because it takes significant effort to educate them about the benefits of the technology (Prabhu et al., 2023). In line with Hilmer's (Hilmer, 2009) statement inadequate experience and technological capabilities of human resources are one of the barriers to technology adoption. The more educated retail customers and owners are aware of retail technology and can relatively quickly accept new technologies. In general, traditional retailers like to use technologies which require a minimum effort to use,

even better if it is in the form of automation technologies which can operate independently with only a few instructions (Wijaya and Rahmayanti, 2023). This will influence the decision to adapt technology among traditional retailers. Therefore, technological adaptation requires significant investment in trained employees (Nikas and Poulymenakou, 2008). Furthermore, Chen and Tan (Da Chen and Tan, 2004) provided support for this study's findings by highlighting the fact that while consumers have generally recognized the benefits of digital technologies, their ability to learn new technologies is hindered by things like a lack of familiarity with the technology's medium.

Our findings suggest that existing digital technology needs to be adapted to fit the task characteristics demanded by traditional retailers. Technology adaptation must be focused on managing multiple business processes, including financial and inventory control, store promotion, and employee management. Traditional retail management is expected to better analyze cost, manage control, and determine the most profitable prices for their products or services as an outcome of this type of technological adaptation. This would enable them to maintain resilience (Imjai et al., 2023) and position themselves competitively in an era of open innovation and a high-competition market (Chenhall and Moers, 2015). Moreover, technological adaptation is required to speed up services and adapt to the expanding scale of traditional retail businesses. Our findings are in line with Aithal et al.'s (Aithal et al., 2022) study which found that Indian traditional retailers tend to use technology that is related to the internal operation of the store. Despite the reluctance of some retailers to use it, they started using it as it gave them the convenience of employing it. However, users' usage intention of technology adoption will be lower if the task needs more time and cost, or if the technology provides fewer functions (Tam and Oliveira, 2016). This can be seen in the large number of respondents who rejected the offer to use mobile applications because it is not directly related to their main task needs. Adaptation of adopted technologies to task characteristics will have positive impacts on users' willingness to use the technology, as seen in the number of mobile payment users in Korea and China (Lin et al., 2019).

Task technology fit is a predictor of performance, while user attitudes are a predictor of utilization (Goodhue and Thompson, 1995). User attitudes, along with social norms (Hartwick and Barki, 1994; Moore and Benbasat, 1991) and other situational factors, lead to intention to utilize systems and ultimately to increased utilization. The implication is that increased utilization will lead to a positive performance impact (Goodhue and Thompson, 1995). Utilization is not only a step after the implementation of any technology but also a process that defines the successful change through technology in an organization (Singh et al., 2021). Our findings indicate that perceived technical competence, traditional retailers' awareness, and effective partnerships with technology providers are behavioral factors that influence the utilization of adapted technology in traditional retail. The finding regarding traditional retailers' awareness is consistent with Singh et al.'s (Singh et al., 2021) findings that users' awareness is the key to effective technology adaptation.

There have been no studies on the other two precursors of utilization variables in the context of technological adaptation, but this is consistent with other studies on technology adoption in traditional retail. For example, Jordanian retailers lack of initiative to adopt e-commerce due to the lack of knowledge of the implementation model and result (Yaseen et al., 2017). This is different from the Indian traditional retailers who understand the benefits of digital payment for transaction security in a cash-based environment, which eventually encourages them to adopt the technology (Seethamraju and Diatha, 2018). Indeed, the biggest challenge in deciding whether to adapt a technology or not is providing a reasonable cost-benefit analysis for a wide range of technology so the technology users are familiar with potential risks (Pantano et al., 2018). External provider support is also essential for retail stores that lack the required technology competence to integrate new technology (DeLone, 1981). Training and program enlightenment should be

started from the basic level to effectively bridge any knowledge gap, so traditional retailers can align with the new technology (Ogbo et al., 2019). Distributors providing the technology are the ones receiving higher perceived benefits than the traditional retailers themselves. Technology adoption and adaptation can increase transaction efficiency and accuracy in traditional retailers' supply chains. Due to this fact, distributors have the interest and capacity to persuade traditional retailers to adopt and adapt retail technologies. This can be achieved through the investment of resources associated with learning how to use the technology and adapting it to local conditions (Lahiri et al., 2018). An effective partnership between retailers and their technology providers, who are also their suppliers, can encourage innovation (Albors-Garrigos, 2020) in the form of technological adaptation.

Our findings regarding government support differ from Ogbo et al.'s (Ogbo et al., 2019) study which highlighted the importance of government support in supporting technology adoption by providing basic and affordable internet service and formulating regulations. The findings of this study are also different from the findings of Seethamraju and Diatha's (Seethamraju and Diatha, 2018) study which highlighted the significance of the lack of trust in government regulation and bureaucracy that hinder the process of digital payment adoption among Indian traditional retailers. This could happen because Indonesian traditional retailers prioritize economic stability over technological support from the government. Therefore, government support for adaptable technology is not included in this study.

Adaptation between technology functionality and task requirements affects utilization and performance expectation (Goodhue and Thompson, 1995), whereas traditional retailers' performance expectations are expressed by the benefits they expect from technology adaptation. This then becomes a benchmark for the success of technology adaptation, as this benchmark has also been frequently employed as a measure of the success of retail technology adoption (Isharyani et al., 2021). The technologies given by large firms and banks to traditional retailers match the desired performance criteria, however, these technologies are regarded as challenging for traditional retail technology users to understand and utilize. Therefore, adaptation to these technologies is required so that their use can be optimum. Isharyani et al.'s (Isharyani et al., 2021) proposal can be used by software designers and developers to translate performance requirements for adapted technology into

design parameters of traditional retail systems that apply the feature of selected technology to entire retail operational activities, as well as to reduce the risks associated with implementing adapted technology.

The aforementioned factors are mapped according to the initial framework which uses the TTF paradigm and utilization to construct the framework for technology adaptation in traditional retailers as seen in Figure 5. This framework signifies the factors affecting utilization, that is the decision to adapt technology which leads to the achievement of the desired performance impact. Utilization is not only a step after the implementation of any innovation but also a process that defines the successful adaptation of the change through new technology in an organization (Singh et al., 2021). TTF determines the adaptation between technical ability and task requirements showing the extent to which the technical ability can support the task. Technology adaptation that is better towards technical features to match the task requirement will encourage technology utilization, but bad adaptation will decrease the utilization and performance of traditional retailers.

6. Conclusions, implications, and future research

Traditional retailers in developing nations have more complex characteristics than a merely traditional way of doing retail business and marketing as understood in developed countries. Traditional retailers in developing countries are identical to small family-owned retailers located in the neighborhoods of big cities in developing countries, which have low demand for high technology and allow for close and continuous personal involvement between retailers and customers in day-to-day operations. Traditional retailers can meet the socio-cultural expectations and needs that modern retailers are unable to meet, so traditional retailers remain the main shopping options for people in developing countries. To maintain the traditional retailer's position sustainably, the strategies for technology adaptation should be considered among the rapid advancement of technology and the change in customers' behavior due to technological advancement.

The implementation of technology in traditional retail began with the use of calculators and handwritten bills in the transaction process, followed by the use of mobile messaging apps to place an order for the supply of goods to the distributors. Along with the increase in volume and size of transactions, traditional retailers have started to adopt the

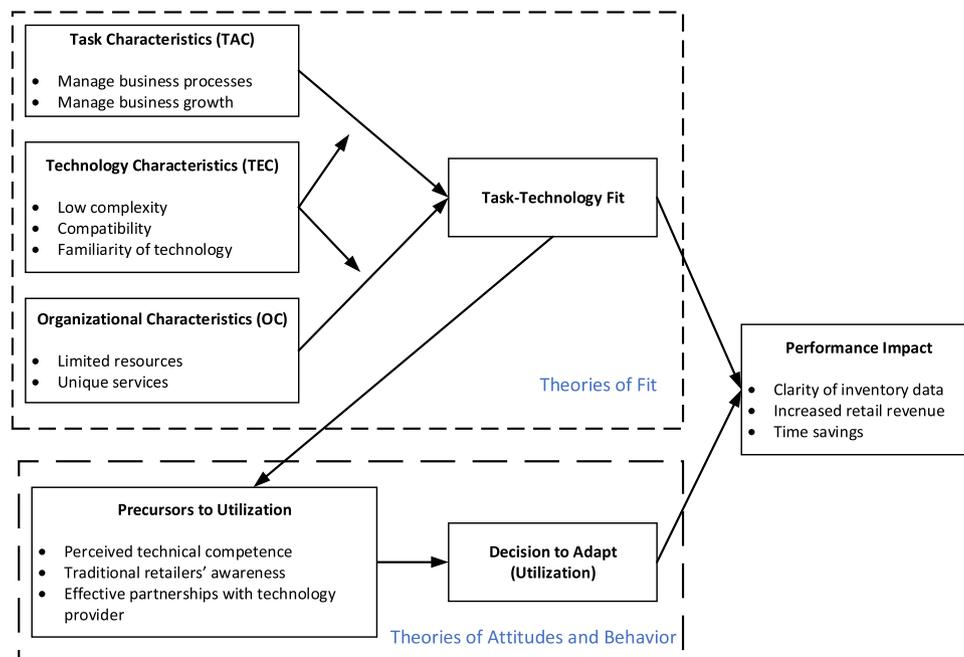


Fig. 5. Technology adaptation performance chain framework for traditional retail.

PoS System, barcode scanner, PPOB, EDC, and mobile-based technologies, such as mobile apps and mobile payment. The majority of the technologies that are still continuously in use are those adapted to meet the local condition of traditional retailers and also those that are the improved versions of the adopted technologies. Technology adaptation which has been used by traditional retailers includes the use of PoS System computer software combined with printer and barcode scanner to serve a similar function to large (modern) retailers' cash register, the integration of PoS System which has been adapted with the mobile application to mimic mPoS, and the adaptation of EDC machine to serve the wider scope of digital products transaction than those offered by PPOB.

The variety of technology adaptation that has been employed by traditional retailers illustrates the vast potential for technology adaptation as a sustainable survival strategy for traditional retailers. The TPC model is then used to identify the capabilities and resources required by traditional retailers to achieve success in technology adaptation process. The result of this study illustrates that the limited financial and human resources, facilities, and infrastructures, as well as the operational requirements of traditional retailers, become the reference to determine task requirements covering two aspects: managing business processes (inventory and financial management, employee management, store promotion, and faster services) and adapting to business growth. Traditional retailers' internal users' (owner and employees) readiness is the absolute factor in encouraging willingness and continuous intention to use technology even though they do not have adequate resources. Technology that can fulfill task requirements and the capabilities of traditional retailers should have low complexity, compatibility for meeting the demands and capabilities of technology users in traditional retail and use technologies that are familiar to the people of developing countries.

The aforementioned TTF components (organizational, task, and technology characteristics) will encourage traditional retailers' intention to utilize the technology that will determine the success of technology adaptation in traditional retail. Our findings identify the precursor of utilization consisting of perceived technical competence, traditional retailers' awareness, and effective partnership with technology providers. The mapping of the whole TTF components and the precursor of utilization which have been identified within this study is mapped into the framework illustrating the required capabilities and resources for the success of technology adaptation in traditional retail as measured by the expected consequences of utilization (clarity of inventory data, enhanced retail revenue, and time-saving ability).

6.1. Theoretical implication

Our study contributes to the body of research on technology adaptation in the retail sector and highlights the potential impact of technology adaptation on the business model of traditional retail. If traditional retailers fail to adapt to technological advancements, buyers may transfer their loyalty. This study may also be among the first to apply TPC to the unique context of technology adaptation in traditional retail in an emerging economy. It is expected that these findings will pave the way for further research in the field and contribute to the increased competitiveness and survival of the traditional retail sector.

6.2. Managerial implications

Our findings give insight into the required capabilities and resources required by traditional retailers to achieve success in technology adaptation in traditional retail. Generally, our study found that the majority of traditional retailers are willing to adopt new technology, and they need to adapt it to the existing technology to improve traditional retailers' performance which eventually also improves the quality of service for the customers. The findings of this study have practical implications for traditional retailers, to make them more open to

technology and capable of adapting the technology faster. Furthermore, government agencies need to improve the accessibility, reliability, and practicality of various retail technologies and improve public trust in laws and regulations. Retailers will have a greater opportunity to expand their operations if digital infrastructure is robust and supported by improved internet accessibility and government initiatives promoting digital innovations (Owoseni et al., 2022). For technology providers who are suppliers to traditional retailers and expect traditional retailers to become co-pivots in the supply chain, they must understand and utilize technology adaptation suitable to the task requirements, capabilities, and resources of traditional retail technology users. It is expected that the result of this study can be utilized by all relevant stakeholders to make traditional retailers more competitive and ready to face the future.

6.3. Limitations and directions for future research

The present study has limitations. First, further investigation is needed to determine the fittest alternative technology and the required adaptations for traditional retailers, particularly in developing economies. Second, quantitative research is required to test the generality of the findings. Third, because the present study is explorative, studies on behavioral factors such as Sopha (Sopha, 2013) are necessary. Hence, future research can be directed to address detailed investigations on the adaptations of retail technologies for traditional retailers, determinants of adoption/adaptation behavior, and expand the study across developing countries.

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Ethical statement

Hereby, I, Muriani Emelda Isharyani consciously assure that for the manuscript "Retail Technology Adoption in Traditional Retailers: Evolution, Decision-Making, Adaptation", the following is fulfilled:

1. This material is the author's original work, which has not been previously published elsewhere.
2. The paper is not currently being considered for publication elsewhere.
3. The paper reflects the authors' research and analysis truthfully and completely.
4. The paper properly credits the meaningful contributions of co-authors and co-researchers.
5. The results are appropriately placed in the context of prior and existing research.
6. All sources used are properly disclosed (correct citation). Copying of text must be indicated as such by using quotation marks and giving proper references.
7. The study involved humans as participants in the interviews (non-interventional study). No experiments or clinical trials were conducted.
8. This study and its instruments (including papers) have received the approval of Universitas Gadjah Mada Research Ethics Commission No. KE/UGM/017/EC/2022 on 19 May 2022.
9. All authors have been personally and actively involved in substantial work leading to the paper and will take public responsibility for its content. I agree with the above statements and declare that this submission follows the policies of Solid-State Ionics as outlined in the Guide for Authors and in the Ethical Statement.

CRedit authorship contribution statement

Conceptualization, B.M.S., M.A.W. and B.T.; methodology, M.E.I. and B.T.; software, M.E.I.; validation, B.M.S., M.A.W. and B.T.; formal analysis, B.M.S., M.A.W., and B.T.; investigation, M.E.I.; resources, M.E.I.; data curation, M.E.I.; writing—original draft preparation, M.E.I. B.M.S.; writing—review and editing, M.E.I., B.M.S., M.A.W., and B.T.; visualization, M.E.I.; supervision, B.M.S., M.A.W., and B.T.; project administration, M.E.I.; funding acquisition, M.E.I. All authors have read and agreed to the published version of the manuscript.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Muriyani Emelda Isharyani reports financial support was provided by Indonesia Endowment Fund for Education. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Semi-structured interview guideline

Introduction: description of the project by the researchers.

Research question:

- How was the process of technological adaptation in traditional retailing in a developing country?
- What capabilities and resources do traditional retailers in developing countries require to successfully adapt technology using the TPC approach?

A. Respondents background

1. Please begin by telling me about your level of education, your experience in retailing and how long has your store been running.
2. Would you mind telling me how much your store' estimated gross revenue is in a month?
3. How many people do you employ and what are their duties?
4. Who are your customers/target market? What services do you provide for buyers?

B. The current state of retail technology adoption/adaptation.

1. Could you please tell me about the process of technology adoption or adaptation in your store?
2. What challenges do you have when putting those technologies in your store? What have you done to overcome those challenges?
3. To what extent are your employees and buyers ready to use the new retail technologies? And how ready are you as a traditional retailer to employ new retail technologies?

C. Benefits from retail technology adoption.

1. What benefits have you felt from implementing retail technology in your store?
2. What kind of retail operation in your store requires the most technological assistance?
3. What benefits do you expect from implementing retail technology in your store? (benefit/cost ratio, time saved, the satisfaction of social needs, reducing lines, etc.)

D. Potential future retail technology.

1. What technology criteria are you considering implementing in your store?

2. What kind of retail technology do you desire and need but not yet available in your store?
3. How far can you adopt retail technology in your store? (Show examples of smart shelves, self-checkout machines, and JD.ID X Mart, etc.)

E. Drivers and barriers adopting new retail technology.

1. What makes you interested in implementing retail technology in your store? (Readiness to adopt, perceived performance impact, expected benefits, government support, etc.)
2. What are your reasons for accepting and declining an offer to employ new retail technology?
3. What are your main concerns about using new retail technologies in your store? (Costs, time consumption, complexity, security concern, business culture, and external factors)

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