tourism and hospitality

Article

Rethinking Smart Technology Adoption in Foodservice Microbusinesses Through Specialist-Driven Action Research

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Abstract

This study examines smart technology adoption in foodservice microbusinesses by moving beyond intention-based explanations to examine how adoption and post-adoption unfold in practice. Hospitality technology research has largely emphasised attitudes and behavioural intentions, offering limited insight into how technologies become embedded in everyday operations, particularly in resource-constrained microbusiness contexts. Focusing on foodservice microbusinesses in Malaysia, this study goes beyond pre-adoption intention and examines the nuances of actual technology implementation, guided by adaptive training as the central adoption-enabling mechanism. Using an action research approach, this study implemented a one-month adaptive training intervention that enabled operators to engage in hands-on, experiential learning within their own business environments. The findings uniquely indicate that technology adoption is shaped by capability asymmetry, with differences in technological literacy, prior experience, and resources producing varied adoption pathways. These differences were addressed through adaptive training that aligned the pace and intensity of learning with operators' capabilities. This study also identifies specialist mediation as a key mechanism supporting adoption, as guidance from a knowledgeable intermediary reduced complexity, facilitated learning, and enabled the transfer of trust. The findings suggest that smart technology adoption in microbusiness settings is not only a matter of intention but also a situated learning process shaped by unequal capabilities, adaptive training, and specialist-guided trust formation.

Keywords: foodservice microbusinesses; smart technology adoption; action research; case study; specialist-driven adaptive training

Academic Editor: Lewis Ting On Cheung

Received: 13 April 2026
Revised: 14 May 2026
Accepted: 20 May 2026
Published: 22 May 2026

1. Introduction

The integration of smart technologies within Malaysia's foodservice industry accelerated during the COVID-19 pandemic as e-commerce platforms for delivery services and digital payment systems became essential for operational continuity (Daniels, 2024; Jahari et al., 2022). For foodservice microbusinesses, adopting smart technologies is critical because it (1) strengthens customer relationships through digital engagement platforms (Shahriar et al., 2019); (2) improves operational efficiency by streamlining managerial functions (Jumawid et al., 2025); and (3) optimizes workflow processes through interconnected digital applications (Abd Aziz et al., 2024). For microbusinesses, these capabilities shape not only competitiveness but also the practical capacity to sustain everyday operations in changing market conditions.

Despite these benefits, existing research on technology adoption in microbusinesses has limitations. Most studies have relied on quantitative approaches and focused primarily on the pre-adoption stage, offering limited insight into how operators adopt and apply technologies in practice (Apfel & Herbes, 2021; Mosweu et al., 2016; Nguyen & Borusiak, 2021). If operators decide to adopt technologies, they need to experience them first-hand to assess their suitability, usefulness, and feasibility. Therefore, pre-adoption studies alone are limited in their ability to explain how adoption is enacted, adapted, and sustained in everyday business settings.

Often led by individual entrepreneurs operating across diverse contexts, microbusinesses arguably require tailored solutions and adaptive strategies to successfully adopt new technologies (Pipitwanichakarn & Wongtada, 2021). Challenges such as limited financial and human resources, insufficient expertise, and the absence of ongoing training hinder effective adoption and application (Hwang & Lockwood, 2006; Latip et al., 2026; Pranata et al., 2022; Trupp et al., 2025). In response, the present study adopts a specialist-driven adaptive training intervention within an action research framework. The one-month program enables foodservice microbusiness operators to engage with smart technologies in their own business settings, allowing the study to examine adoption as a situated, practice-based process. The study therefore shifts attention from pre-adoption intention to the practical processes through which smart technologies are learned, applied, and sustained in resource-constrained microbusiness settings. Methodologically, it demonstrates how adaptive training can serve as a mechanism for instituting rigorous empirical investigation and producing practical (and transformative) change. The findings contribute to the literature on technology adoption by providing a nuanced understanding of adoption dynamics in resource-constrained, contextually diverse microbusinesses, while offering practical guidance on how targeted, adaptive interventions can facilitate sustained technology integration.

Building on this rationale, the study seeks to examine how smart technologies are adopted and applied in foodservice microbusinesses and how a specialist-driven adaptive training intervention can facilitate this process. Accordingly, the study addresses the following research questions (RQs): (1) How do foodservice microbusiness operators engage with and adopt smart technologies in practice? (2) How can a specialist-driven adaptive training intervention, delivered through action research, support operators in effectively adopting and applying smart technologies? (3) What insights can be drawn from the experiential and reflective processes during adaptive training to inform theory and practice in technology adoption for microbusinesses? Overall, this paper argues that smart technology adoption in microbusinesses is not only a matter of intention but also a situated learning process shaped by uneven capabilities and specialist-guided support. In this study, the term smart technology is used broadly to refer to digitally enabled tools and platforms such as smart point-of-sale (POS) systems, business websites, social media, and online delivery platforms that support automation, connectivity, and data-driven decision-making in microbusiness contexts. By embedding operators in a participatory, iterative, specialist-driven adaptive training process, the study addresses RQ2 and RQ3, thereby extending technology adoption literature beyond pre-adoption intention while demonstrating the adaptive role of training as the central adoption-enabling mechanism.

https://doi.org/10.3390/tourhosp7060146

2. Literature Review

2.1. Technology Adoption Research and Its Limits in Microbusiness Settings

Technology adoption literature offers limited insight into operators' experiences, perceptions, and decision-making processes when presented with opportunities to adopt new technologies (Andrews & Johnson, 2016; Apfel & Herbes, 2021). In developing economies such as Malaysia, understanding how operators make adoption decisions and translate them into actual use is particularly important. Current research often focuses on readiness and intention (Apfel & Herbes, 2021; Nguyen & Borusiak, 2021), leaving post-adoption practices largely underexplored. This gap limits the development of robust theories of technology adoption and reduces the practical guidance available to microbusiness operators. It also constrains understanding of how adoption unfolds in everyday business settings, where use, adaptation, and continued engagement are shaped by context.

Since the mid-twentieth century, numerous theoretical models have been developed to explain technology acceptance and adoption (Chen et al., 2020). Among the most widely applied are the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1975), Technology Acceptance Model (TAM) (Davis et al., 1989), Theory of Planned Behaviour (TPB) (Ajzen, 1985), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), UTAUT2 (Venkatesh et al., 2012), and the Diffusion of Innovations (DOI) (Rogers, 1962) theory. Despite growth in research on digitalisation, these models have primarily focused on the pre-adoption stage, and their application to actual technology adoption remains limited (Anton et al., 2023; Gokalp et al., 2017; Sony & Naik, 2019).

Although these models differ in constructs and emphasis, they share a common limitation in this context: they explain readiness and intention more effectively than the situated processes through which technologies are learned, enacted, and sustained in practice. Moreover, they largely overlook the role of training and specialist support, which are arguably critical for translating intention into successful adoption and sustained application. Matthews (2007) emphasised that training is crucial for overcoming low confidence in technology adoption among micro, small and medium enterprises (MSMEs), while Raymond et al. (2005) demonstrated its positive impact on attitudes and usage behaviour. Unlike many constructs that are used to explain adoption intention, training and specialist support appear especially relevant to actual adoption and post-adoption application, and also shape early understanding and confidence at the pre-adoption stage.

Foodservice microbusinesses face additional challenges compared with larger organisations. They often rely on short-term planning, informal, dynamic strategies, and decision-making processes, while exhibiting limited technological literacy, skills, and resources (Dibrell et al., 2008; Thong et al., 1996; Trupp et al., 2025). These organisational and individual constraints make smart technology adoption substantially more difficult (Ghobakhloo et al., 2012). During the COVID-19 pandemic, many operators attempted to adopt online delivery and other digital solutions without formal expertise, acting as generalists in areas that required specialist knowledge (Ghobakhloo et al., 2012). Although external expertise is a key determinant of technology implementation success (Thong, 2001), hiring specialists is often financially unviable for microbusiness operators (Caldeira & Ward, 2003; Sarosa & Zowghi, 2003). Comparisons with larger small and medium enterprises (SMEs) also indicate that a lack of in-house expertise in technology adoption can negatively affect technology adoption processes (Chau, 1995; Cragg & Zinatelli, 1995; Fink, 1998). Despite its importance, the role of specialists in technology adoption has been largely overlooked, highlighting a critical gap in both theory and practice. This gap is especially important in microbusiness settings, where constrained resources make external guidance difficult to access, even when it is most needed.

2.2. Training, Specialist Support, and Action Research as a Response to Post-Adoption Gaps

Addressing these limitations requires theoretical and methodological rethinking. Adoption frameworks need to incorporate the interplay between experiential learning, context-specific adaptation, and ongoing practitioner engagement. Participatory and iterative approaches can provide rich insights into the actual adoption process while simultaneously supporting practical improvements. Action research arguably offers a suitable mechanism for achieving this. By emphasising collaboration between researchers and practitioners, action research enables continuous evaluation, reflection, and improvement of practices, producing both knowledge and tangible outcomes (Baum et al., 2006).

The present study positions specialist-driven adaptive training within an action-research framework as both a methodological approach and a practical mechanism for examining post-adoption processes in foodservice microbusinesses. Unlike prior conceptions of training (Matthews, 2007; Raymond et al., 2005), this study conceptualises adaptive training as part of the adoption process itself, allowing closer examination of how guidance, learning, and application interact in practice. To examine these underexplored post-adoption processes empirically, the study adopts an action research approach centred on specialist-driven adaptive training. This enables guided experiential learning for operators while allowing the researchers to observe, reflect on, and evaluate adoption as it unfolds in practice. These gaps suggest that technology adoption in microbusiness settings must be understood not only as a matter of intention but as a context-dependent learning process shaped by uneven capabilities and access to guidance.

3. Materials and Methods

3.1. Research Design and Methodological Rationale

This study adopts a qualitative, theory-building research design to examine smart technology adoption as a processual and post-adoption phenomenon in foodservice microbusinesses. To capture adoption as it unfolds in practice, a specialist-driven action research approach is employed, enabling close engagement with operators as they experimented with different smart technologies (see Table 1). In this study, the term 'specialist' is used as the primary descriptor for the role performed by the researcher. This role encompasses functions commonly described as 'trainer', 'facilitator', and 'change agent', which are used interchangeably to reflect different aspects of the same specialist-led intervention.

Table 1. Implemented smart technologies.

Smart Technology	Description
Smart POS System	Loyverse POS (UK) mobile application—version 2.69.1: A free-to-use POS software application downloadable via the Google Play Store or Apple App Store, providing all functions, including sales tracking, e-shop, receipt management, employee management and inventory management. The software also generates daily, weekly, monthly, and annual reports, downloadable as Excel documents.
Business Domain and Website	GoDaddy (version 9.5.2): An affordable domain provider offering easy website development services, among many others. A domain can be purchased for an annual fee as low as RM 70.00 (USD16.63), including a website and website editing tool.
Social Media Pages	Instagram (version 430.0.0.53.80)/Facebook (version 561.0.0.42.67)/TikTok (version 45.2.3): Renowned social media platforms for marketing products free of charge, along with photo and video editing tools and statistics.
Online Delivery	Grab food (version 5.410.0)/Shopee food (version 3.74.34)/Foodpanda (version 26.20.0): Popular third-party food delivery platforms providing delivery, marketing, and online store-related services in exchange for a percentage of product sales.

Source: authors.

https://doi.org/10.3390/tourhosp7060146

Action research represents a synthesis of theory and practice, occurring through iterative cycles of problem diagnosis, action intervention, and reflective learning within a mutually agreed ethical framework, and involving close collaboration between researchers and practitioners (Avison et al., 1999). Unlike traditional research approaches that position the researcher as an external observer, action research emphasizes collaborative learning and insider engagement to understand and improve practice (McNiff & Whitehead, 2009; McNiff, 2016).

While action research can be situated within interpretivist, positivist, or pragmatist/critical paradigms (Grundy, 1988; McCutcheon & Jurg, 1990; McKernan, 1991), this study adopts a mutual-collaborative interpretivist stance aligned with its aim of co-developing and implementing a training program with foodservice microbusiness operators to facilitate the practical adoption of smart technologies. Beyond problem-solving, action research seeks to examine the underlying reasons for actions and systematically evaluate whether the associated values and outcomes are realised, thereby linking knowledge generation with praxis and practical improvement (Baum et al., 2006; Derrida, 1997). To strengthen the empirical evidence generated during the action research process, phenomenological methods, including serial interviews and journaling, were incorporated to monitor and document experiences and progress throughout the intervention.

The study, therefore, integrates action research with phenomenological support methods (Turner & Mulholland, 2017), including adaptive training, serial interviews, and reflective journaling, to examine adoption as a situated and evolving process. Figure 1 below shows the integration of adaptive training into the action research cycle and the process of reaching operators' final decision to adopt or reject the application of technology in their businesses.

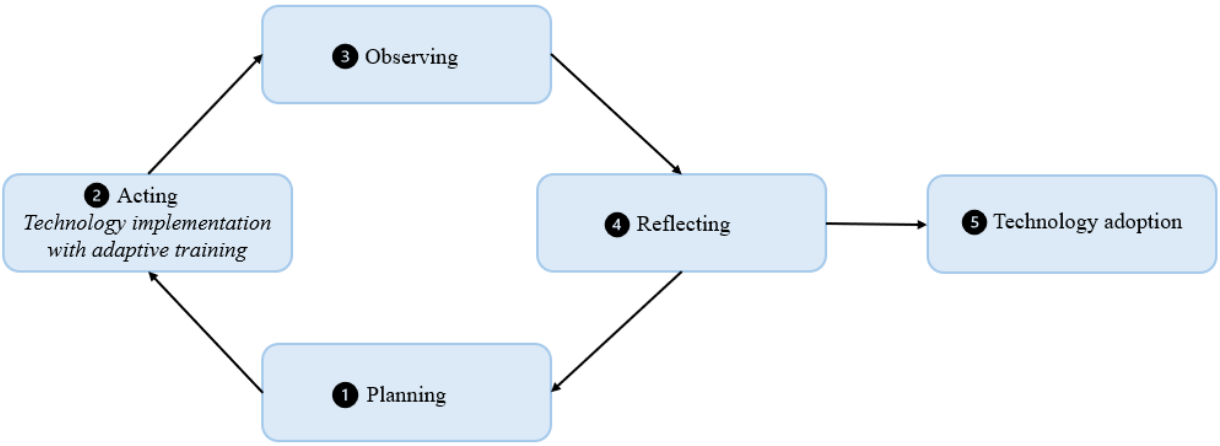

Figure 1. Action research cycle (source: adopted from Lewin (1946) and extended by authors to reflect the incorporation of adaptive training).

3.2. Data Collection: Participants, Sampling, and Data Sources

To qualify as research participants, operators needed to fulfil the following criteria: (1) owning and operating a foodservice microbusiness; (2) having no more than five employees; (3) having no more than one outlet; (4) having no smart technologies applied in the business at the time of this research; (5) willing to engage in a longitudinal intervention-based study over an extended period; and (6) consenting to repeated observations and reflective participation throughout the adoption process. Such respondents are inherently rare, particularly among microbusiness operators, where time constraints, operational pressures, and limited research engagement commonly reduce participation willingness. Consequently, the cases were selected purposively as information-rich cases rather than as statistically representative samples (Sawitri & Suswati, 2019).

The data analysed and discussed in this chapter were drawn from a range of key sources (Figure 2). Serial interviews provided important insights into the evolution of participants' acceptance and use of smart technology in their businesses across the different stages of adoption. Meanwhile, both a participant and a researcher journal were used to record detailed accounts of casual discussions, challenges, limitations, and operators' daily progress. Lastly, information generated through the smart systems, such as frequency of use, uptake of features, and the practical effectiveness of the applied technologies in improving participants' business operations, was used to assess the overall outcome of the specialist-driven adaptive training program. These sources were triangulated across the stages of adoption to strengthen the trustworthiness and overall quality of the data through transparency and rigor.

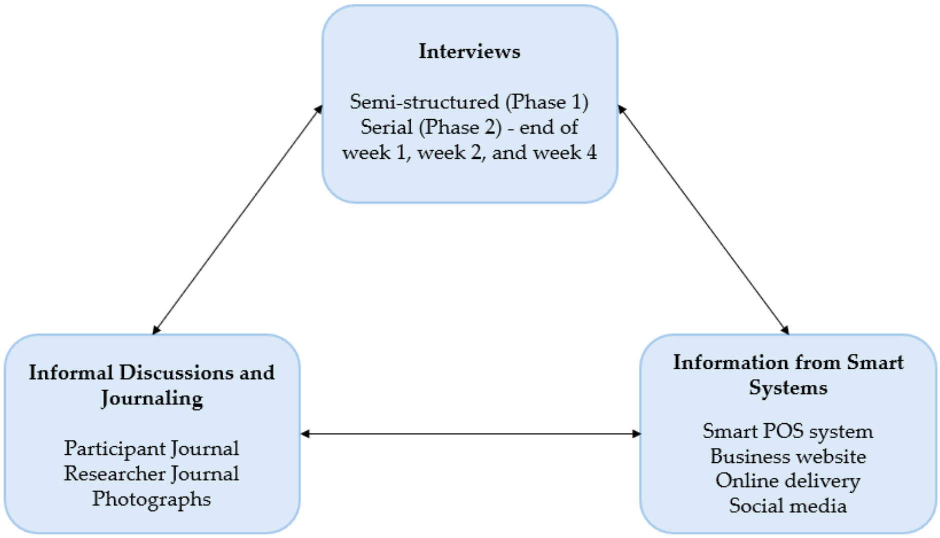

Figure 2. Data triangulation process (source: authors).

As the application of action research to study technology adoption in the foodservice sector is relatively new, a standard sample size for conducting action research in this context does not yet exist. While four operators were initially included, two were unable to complete the full training program. One participant withdrew due to personal reasons, while another completed only part of the training due to an unforeseen staffing shortage. Although the analysis presented in this study focuses on the two participants who completed the full program, these instances of non-completion highlight practical constraints commonly faced by microbusiness operators, particularly time and resource limitations. The data from the two non-completing participants were reviewed at a descriptive level. Although not subjected to a full thematic analysis, their partial participation offered contrastive insights into barriers to engagement, particularly those related to personal constraints and staffing limitations, thereby complementing the findings from the completed cases. As such, they provide additional contextual insight into potential barriers to sustained engagement with training interventions. At the same time, the reduced number of complete cases may introduce a degree of attrition bias, and the findings should therefore be interpreted with appropriate caution. This further reinforces the importance of flexible and adaptive training approaches that can accommodate such constraints, underscoring the complex nature of sustaining foodservice microbusinesses in developing economies.

While the analysis focuses on two completed cases, this is consistent with the objectives of action research, which prioritizes depth of engagement and the process of understanding over statistical generalization. The purpose of this study is not to generalize findings across populations, but to develop analytically grounded insights into how smart technology adoption unfolds in practice. The two cases provided sufficiently rich, longitudinal data through repeated interactions, observations, and training sessions, enabling the identification of underlying mechanisms such as capability asymmetry, adaptive learning, and specialist mediation. As such, the findings should be understood as analytical generalizations that offer transferable insights into similar microbusiness contexts, rather than as statistically representative outcomes. Moreover, the contrasting profiles of the two participants enhanced the study's ability to bring out variations in capability and learning processes, further supporting the identification of these mechanisms. Therefore, the decision to proceed with two participants was informed by the study's process tracing, the extent of participant engagement, the resource demands of the intervention, the uniqueness of participants, and the intensity of the adaptive training, which amounted to over 200 h of participant engagement over a two-month period (see Section 3.6).

Although the study is based on a small number of completed cases, the extended duration and intensity of engagement provided a high level of analytical depth. The action research design enabled close, longitudinal observations of participants' learning processes, decision-making, and interactions with smart technologies as they unfolded in real time. This sustained engagement allowed for repeated cycles of observation, intervention, and reflection, generating rich, processual data that would be difficult to capture through short-term or cross-sectional approaches. As a result, this study was able to identify and refine underlying mechanisms such as capability asymmetry, adaptive learning, specialist mediation, and trust transfer, through detailed examinations of how adoption was enacted in practice. In this manner, depth of engagement compensates for the limited number of cases by supporting theory building through mechanism-based insight rather than empirical breadth. Accordingly, the findings are best understood as analytically generalizable, offering transferable insights into similar microbusiness contexts. This level of temporal and contextual depth is consistent with action research traditions, where understanding mechanisms, practices, and behavioral change processes is prioritized over population-level generalization.

Lastly, to protect the identity of respondents and adhere to standard research practices concerning data confidentiality, pseudonyms are assigned to both research participants discussed herein. Accordingly, the participants involved in this adaptive training are Ajith (case study 1) and Malik (case study 2).

3.3. Participant Profiles and Selection of Smart Technologies

Ajith is a 37-year-old operator who runs a foodservice microbusiness specialising in Indian cuisine. His business has been in operation for over six years. He currently employs two individuals, and his business generates a monthly income of approximately Ringgit Malaysia (RM) 6000 (USD1425). Nevertheless, Ajith has not applied any smart technologies to his business at the time of this study, citing limited technological literacy, insufficient skills and experience, and a lack of support from government institutions and smart technology service providers in the form of training and digital infrastructure. Meanwhile, Malik is a 28-year-old operator who runs a foodservice microbusiness specialising in Western cuisine. He has been operating his business on his own for the past five years, generating an average monthly income of around RM4000 (USD950). Unlike Ajith, Malik previously attempted to adopt such smart technologies as a smart POS system and a business website. However, he discontinued using the technologies due to limited know-how, difficulties in accessibility, and a lack of support from smart technology service providers. Thus, both Ajith and Malik proved to be suitable participants, and upon preliminary discussions, expressed their interest and willingness to participate in the training program and to adopt and apply smart technologies in their businesses.

https://doi.org/10.3390/tourhosp7060146

Prior to developing the specialist-driven adaptive training program, it was necessary to identify the relevant smart technologies suitable for application in foodservice microbusinesses. As a result, the smart technologies implemented during the adaptive training were determined through on-site observations of participants' businesses and preliminary discussions with participants. As participants are new to smart technology application in their businesses, it was important to ensure that the smart technologies being introduced were: (1) simple and easy to follow; (2) capable of providing both short- and long-term improvements to their businesses; (3) capable of simplifying and streamlining complex process such as order management; and (4) capable of enabling participants to access and leverage the online marketplace. Moreover, participants' technological literacy, skills, experiences, and their business resource capacities, such as capital, staff, and technological infrastructure, were also considered in determining the most suitable smart technologies for implementation (see Table 1).

The selection of the above smart technologies was intentional and aligned with the entry-level capabilities of foodservice microbusiness operators. Given that participants had limited prior exposure to smart technologies, the intervention focused on foundational tools such as smart POS systems, business websites, social media, and online delivery platforms, which represent accessible entry points into technology adoption. More advanced technologies related to sustainability, such as food waste monitoring systems or resource efficiency tools, were not included, as they typically require a higher level of technological literacy, financial investment, and operational readiness. As such, introducing these technologies at an early stage may have increased complexity and reduced the feasibility of adoption. This decision reflects a staged approach to smart technology adoption, where foundational capabilities are developed first before progressing to more advanced or sustainability-oriented innovations. Accordingly, the findings of this study are most applicable to early-stage adoption contexts, while also providing a basis for future research to examine how such capabilities may enable the subsequent adoption of more advanced technologies in foodservice microbusinesses.

3.4. Developing the Specialist-Driven Adaptive Training Program

This research looks beyond using adaptive training solely as a training intervention and instead uses it as a research mechanism through which smart technology adoption processes, such as experimentation, confidence development, adaptation, and routinization, can be observed and theorised. Whereas prior adaptive training research has largely been confined to controlled metacognitive or computer-based settings, the present study applies it in real-world foodservice operations through specialist-driven action research, thereby enabling observation of adoption processes in situ. The adaptive training involved working collaboratively with participants to introduce, train, and guide them in applying smart technologies in their businesses. This included observing and discussing participants' experiences and interactions with the application of various smart technologies in their foodservice businesses over a one-month implementation period. Prior to implementation, two months were set aside to test and learn the selected smart technologies, assess their suitability, and determine appropriate training intensities and durations in relation to participants' varying technological literacy, skills, experience, and resource capacities. This learning period helped the researcher develop into a specialist in applying each of the proposed smart technologies (Table 1). Therefore, to conduct the adaptive training program implemented in this study, an individual with sufficient practical proficiency in the relevant smart technologies, combined with the ability to guide users through hands-on application and problem-solving in real business contexts, is sufficient to be considered a specialist. At a minimum, this includes familiarity with the core functions, setup, and limitations of the technologies, as well as the capacity to adapt instructions to users' varying capabilities; as such, the role can be performed by trained government officers, consultants, non-government organization (NGO) practitioners, or technology providers with appropriate technical and facilitation skills. Moreover, the researcher's two-month self-training in preparation for the adaptive training culminated in the creation of a four-week specialist-driven adaptive training program (Table 2) and a smart technology adoption and application guidebook, which served as a supporting tool providing structure to the training program.

Table 2. Weekly structure of the specialist-driven adaptive training program.

Week	Training Plan
Week 1	Introduction and training on the use of the smart POS system Creation of business domain and website Smart Business Guidebook, Chapter 0: Creating an Online Identity Smart Business Guidebook, Chapter 1: Business Management End of week discussions (serial interviews—round 1)
Week 2	Creation of social media pages Registering e-stores on third-party delivery platforms Smart Business Guidebook, Chapter 3: Product Extension Smart Business Guidebook, Chapter 4: Inventory Management Smart Business Guidebook, Chapter 7: Online Marketing End of week discussions (serial interviews—round 2)
Week 3	Smart Business Guidebook, Chapter 2: Daily Smart Technology Adoption Smart Business Guidebook, Chapter 5: Safe & Healthy Food Production Smart Business Guidebook, Chapter 6: Supplier Selection Observation and documentation
Week 4	Smart Business Guidebook, Chapter 8: Staff Recruitment and Management Smart Business Guidebook, Chapter 9: External Support Observation and documentation Final discussions/Closing interviews (serial interviews—round 3)

Source: authors.

During adaptive training, the researcher's role temporarily shifted to that of a facilitator and trainer, and then back to an observer and researcher towards the end of the training program. The application of smart technology in operators' businesses required changes to their business operations, with new technologies implemented across areas such as order management, sales tracking, marketing, and order distribution (Cawsey et al., 2012). As a result, the concept of a 'change agent' was utilised to underpin the researcher's role as a facilitator of smart technology adoption. Within this participatory setting, the researcher acted primarily as a specialist facilitator, providing practical guidance while enabling participants to build their own capacity to adopt and apply smart technologies. This emphasis on 'enabling' rather than 'doing' reflects the role of facilitation in action-oriented research settings (Grealish et al., 2015; Harvey et al., 2002). While the researcher took on the roles of trainer and observer during the adaptive training, this could introduce bias, which was mitigated by practising reflexivity throughout data collection and analysis. In this study, reflexivity involved monitoring the researcher's involvement, particularly during adaptive training, and critically reflecting on actions, interactions, and potential biases throughout data collection, analysis, and interpretation (O'Leary, 2004).

Therefore, journaling was utilised to practice reflexivity throughout data collection and analysis. Two separate journals, a participant journal and a researcher journal, were used. The 'Participant Journal' recorded observations of participant interactions with smart technologies, adoption challenges, and how those challenges were managed. It also documented participants' interactions with the researcher, their attitudes, emotions, and profiles, as well as the success or failure of smart technology implementation and its contributing factors. The 'Researcher Journal' documented the researcher's personal thoughts, feelings, involvement, and approaches to training and guiding participants in smart technology use, along with any biases, doubts, challenges, and successes throughout the adaptive training. Updated daily entries note the researcher's reflections at the end of each day's interactions with participants, both on-site and online, and are marked with dates and times for tracking and reference. Thus, the researcher's journal helped monitor personal feelings and thoughts that emerged from time to time, thereby preventing emotional attachment to participants and minimising biases in training, observations, and interpretations of the empirical data.

3.5. Structure of the Specialist-Driven Adaptive Training Program

Ahead of the adaptive training period, participants were briefed on their roles and responsibilities and asked to restate their desire to participate or withdraw from the study, as each participant was required to commit to a one-month period of adaptive training. It must be noted that the specialist-driven adaptive training program is designed to be conducted on-site (i.e., at the participant's business) and during daily operation hours.

Week one of the training program begins with an introduction to the smart POS system. Over the first two days, a specialist supports participants in installing the relevant mobile applications and completing the necessary registration processes. Time is also allocated for participants to familiarise themselves with the system during off-peak business hours. From the third day onward, the POS software is formally integrated into each participant's business operations, with the specialist/researcher providing on-the-job training and guidance amid ongoing daily operations. Towards the end of the week, the specialist/researcher guides participants in purchasing their own business domain and setting up their business websites, with website design progressing into week two. Concurrently, two chapters of the smart business guidebook (Table 2) that align with the week's activities are reviewed and discussed. Week one concludes with an individual interview with each participant, aimed at exploring their experiences, challenges, key learnings, and suggestions for improvement. In addition to these structured interviews, informal daily discussions are documented in a research journal to track progress and inform real-time adjustments to the training's intensity and structure. This initial stage was designed to align training intensity with each participant's capabilities and resource constraints.

Week two builds upon the foundational work of the previous week by continuing the website design process, establishing social media pages, and registering participants' e-stores on third-party delivery platforms. Throughout the week, the specialist provides ongoing training and guidance to help participants navigate and manage these online platforms, while also monitoring their continued use of the smart systems introduced in week one. Three further guidebook chapters corresponding to the scheduled tasks are also discussed (Table 2). Week two also includes the official launch of participants' business websites and the creation of their Google Business Profiles, which are interlinked with their social media accounts and delivery-platform e-stores. Week two concludes with a second round of interviews with each participant.

In week three, the specialist/researcher's direct involvement with participants gradually decreased. Participants begin to engage with smart technologies independently, without intervention unless necessary. From this point onward, the specialist/researcher shifts from a training role to that of an observer. The focus of week three is on monitoring and documenting participants' interactions with the smart technologies to support reflective learning (Avison et al., 1999). Three additional chapters of the smart business guidebook are discussed during the week, focusing on the broader applications of smart technologies within foodservice businesses (Table 2). Compared with earlier weeks, more time is dedicated to observing participants' online interactions with the smart systems, while on-site support is deliberately minimised (Table 3). These online observations include documenting participants' activities across platforms such as the smart POS system, third-party delivery services, and social media accounts, with the aim of capturing data for subsequent analysis and reflection. This staged reduction in support with technology application from the specialist/researcher was intended to observe the transition from guided adoption to more independent use.

Table 3. Training implementation.

	Onsite Training and Monitoring				
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Duration**
Ajith	8 h × 5 days	8 h × 5 days	5 h × 3 days	3 h × 3 days	104 h
Malik	6 h × 5 days	6 h × 5 days	4 h × 3 days	3 h × 3 days	81 h
	Observing Participants' Online Interactions with Smart Technologies				
	Week 1	**Week 2**	**Week 3**	**Week 4**	**Duration**
Ajith	-	-	4 h × 2 days	2 h × 2 days	12 h
Malik	-	-	4 h × 2 days	2 h × 2 days	12 h
Total participant and researcher involvement duration					209 h

Source: authors.

During week four, participants' engagement with the smart systems and devices continues to be observed and documented, while the final two chapters of the smart business guidebook are reviewed and discussed (Table 2). In the final two days of the week, concluding interviews are conducted with each participant to gather insights on their overall experiences. On the last day, full user access to all relevant smart systems is formally transferred to the participants, ensuring the privacy of their business information and giving them the autonomy to either continue or discontinue the use of the smart technologies introduced during adaptive training. This marks the official conclusion of the specialist-led adaptive training program. The structure of the program provides a practical timeline for introducing and supporting new technologies while minimising interference with daily business operations. Program implementation should therefore assess participants' progress regularly and adjust the duration and intensity of training as and when required.

Accordingly, the training program must remain flexible, allowing specialists to adapt its activities based on the pace at which participants learn and become comfortable with each smart technology. For example, if a participant requires additional time to learn and effectively use the smart POS system, activities such as website development can be postponed to week two. Despite individual differences in technological literacy, skills, experience, and available resources, the specialist-driven adaptive training program developed and implemented in this study offers a practical, effective timeframe (one month) to enable operators to learn about, adopt, and apply a range of smart technologies. This is achieved by allocating sufficient time for learning, implementation, reflection, and relearning throughout the training period. Its effectiveness is discussed further in Section 4 through the cases of Ajith and Malik.

3.6. Implementing the Specialist-Driven Adaptive Training Program

A comprehensive breakdown of the participants' and researcher's co-involvement is detailed in Table 3. The training program was implemented for up to five days per week to allow the researcher sufficient time to compile and analyse the data gathered each week and thereby adapt the training program to match each participant's progress rate for the upcoming week.

During the first week, the researcher closely collaborated with the participants throughout their business operating hours, spending up to 40 h with Ajith (open eight hours/day) and up to 30 h with Malik (open six hours/day). This pattern continued into Week 2 as well. However, from Week 3 onwards, the researcher gradually reduced interactions with participants. During this week, the researcher spent up to 15 h with Ajith and up to 12 h with Malik on-site, guiding and observing them (reasons for spending more time on-site with Ajith than with Malik are discussed in the findings). Additionally, the researcher spent up to eight hours observing Ajith's and Malik's online interactions with the smart technologies by monitoring how they update their business websites, social media pages and e-stores on delivery platforms, as well as tracking their use of the smart POS system.

In week four, the researcher further minimised interactions with participants, spending up to nine hours with each participant onsite and an additional four hours observing their online activity. At this stage, the emphasis was on observing how participants engage with and adapt to the technologies more independently while continuing to document their progress. The data gathered from these various sources provide a detailed view of each participant's unique journey towards smart technology adoption through the specialist-driven adaptive training program. These findings are discussed in the following chapter through the case examples of Ajith and Malik.

3.7. Data Analysis

Data were analysed using a qualitative, iterative approach consistent with action research. Interview transcripts, field notes, and observational records were first organised and reviewed to ensure familiarity with the data. Initial coding was conducted inductively, where segments of data were assigned descriptive codes capturing participants' experiences of technology adoption, learning processes, and interactions with the specialist. Following this, codes were compared and grouped into broader categories through a process of constant comparison. These categories were then refined into higher-order themes that captured recurring patterns across the data. The analysis followed principles of thematic analysis (Eze et al., 2020), focusing on identifying patterns across cases while retaining sensitivity to individual differences. Key themes such as capability asymmetry, adaptive learning, specialist mediation, and trust transfer emerged through this process by linking participants' accounts of their technological skills, learning progression, and reliance on specialist guidance.

To enhance the robustness of the analysis, multiple data sources, including interviews, observations, and training interactions, were triangulated to validate emerging interpretations. In addition, the iterative nature of the action research allowed for ongoing reflection and refinement of themes throughout the study. Interpretations were continuously revisited against the data to ensure they accurately reflected participants' experiences and the observed adoption processes.

4. Findings and Discussion

The findings indicate that smart technology adoption in foodservice microbusinesses is facilitated through a process of contextualised capability building, enabled by specialist-driven adaptive training conducted within participants' own business environments. Rather than treating training as a discrete preparatory activity, the adaptive training approach embeds learning directly into daily operations, allowing participants to engage with smart technologies as part of their daily routine. The training design was adapted to each participant's technological literacy, prior experience, resource capacity (e.g., capital, staffing, and technological infrastructure), location, and operating hours.

This contextual alignment reduced disruption to everyday business activities and lowered the perceived effort associated with adoption. Participants were able to engage in hands-on learning without halting daily operations. Both Ajith and Malik demonstrated sustained increases in interest and motivation as the training progressed, suggesting that early experiential engagement played a critical role in supporting continued adoption. Importantly, the findings suggest that convenience and minimal operational disruption served not merely as practical benefits but also as adoption-enabling conditions that supported the development of confidence and trust. Through repeated, low-friction interactions with smart technologies, participants moved beyond mere adoption intention. This process strengthened their willingness to continue experimenting with and applying smart technologies within their businesses, thereby supporting the transition from initial engagement to sustained post-adoption use. The discussion that follows is organised around two interrelated mechanisms: 'capability asymmetry and adaptive learning', and 'specialist mediation and trust transfer'.

To complement the narrative findings, Table 4 provides a case-level summary of smart technology adoption outcomes for Ajith and Malik before and after the training. The table highlights changes in technology use, confidence, and continued application, supporting the patterns identified through interviews and observations. As shown, both participants progressed from limited or partial use to more consistent and integrated application of smart technologies, although the pace and pathways of adoption differed.

Table 4. Case-level comparison of smart technology adoption outcomes.

Dimension	Ajith (Before)	Ajith (After)	Malik (Before)	Malik (After)
Smart POS system	No prior use; limited understanding	Fully implemented; regular use in daily operations	Basic familiarity; partial use	Fully implemented; integrated into operations
Business website	None	Website created and maintained	None	Website created and actively used
Social media use	Limited or informal use	More structured and purposeful use	Moderate use	Enhanced and more strategic use
Online delivery platforms	Not registered	Registered and operational	Not registered	Registered and operational
Technological confidence	Low; expressed uncertainty	Increased confidence and independence	Moderate confidence	Higher confidence and efficiency
Frequency of use	Minimal or none	Regular use across a range of tools	Occasional use	Consistent and integrated use
Continued usage (Post-training)	Not applicable	Continued use observed	Not applicable	Continued use observed

Source: authors.

4.1. *Capability Asymmetry and Adaptive Learning*

Differences in participants' technological literacy, skills, experience and age shaped their engagement with the adoption of smart technologies. Although both operators participated in the same specialist-driven initiative, their individual capabilities influenced the pace at which they could learn and apply the new systems. Ajith had extremely limited knowledge of smart technology and no prior experience with the systems introduced during the adaptive training. As he explained, "online I have no idea, the online I don't know how lah." This limited technological literacy meant that Ajith required more time to understand the basic functions of the smart systems. As a result, his learning process progressed at a slower pace and required additional time for familiarisation and practice. In contrast, Malik demonstrated a stronger baseline capability in using digital tools. He was already comfortable with certain technologies, such as the smart POS system, noting that "the basic stuff is okay, like Excel, Word, using the POS system, I'm quite okay with it." This prior exposure enabled Malik to engage with the new technologies more quickly. Age may also have intersected with these differences, with Malik appearing more comfortable exploring new digital tools (e.g., business websites) than Ajith.

Beyond individual capabilities, participants' operational circumstances also influenced their engagement with the learning process. Ajith was able to dedicate longer periods of time to learning because he had two employees who managed business operations while he focused on developing his technological capabilities. This allowed him to participate in longer and more consistent learning sessions with fewer interruptions. In contrast, Malik operated his business without additional staff, which meant that customer interactions frequently interrupted his engagement with the learning process. These interruptions limited the amount of uninterrupted time he could devote to exploring and practising the new systems. Despite Malik's stronger initial technological capabilities, these operational constraints slowed the pace at which he could integrate the technologies into his daily business activities.

Together, these findings illustrate the presence of capability asymmetry among food-service microbusiness operators. Individual attributes, such as technological literacy, skills, prior experience, and age, interact with operational conditions, such as staffing capacity, to shape how operators learn and apply new technologies. As a result, the process of smart technology adoption does not occur uniformly across operators. Instead, it unfolds at different speeds and through different learning pathways depending on each operator's capabilities and resource conditions. In this study, capability asymmetry refers to these unequal starting conditions and learning capacities across operators.

In response to these differences, the study highlights the importance of adaptive training approaches when supporting foodservice microbusiness operators in adopting smart technologies. In this research, adaptive training refers to a flexible instructional approach in which the pace, intensity, and duration of learning are adjusted to align with each operator's capabilities, limitations, resource availability, and learning preferences. The concept of adaptive training has been previously explored in studies on metacognition, learning, and memory (Metcalfe & Kornell, 2003; Woźniak & Gorzelańczyk, 1994). More recently, Metzler-Baddeley and Baddeley (2009) applied adaptive training to computer-based learning systems. Although adaptive training remains less common in the scientific memory literature due to the methodological challenges of evaluating it under controlled conditions, these studies collectively highlight its potential as a valuable instructional strategy (Metzler-Baddeley & Baddeley, 2009).

The findings of this study further reinforce the relevance of adaptive training for smart technology adoption among microbusiness operators. Allowing participants to engage with new technologies at a pace aligned with their capabilities thus enabled them to gradually build confidence and familiarity with the systems. Both operators highlighted the importance of guided learning and practice in helping them overcome initial uncertainty when using the technologies:

> "The smart POS system and website are very nice, very easy. So, after you taught how to use them, I feel much better. I learned from you and I practiced. If you did not provide the proper training, I could not learn." (Ajith)

> "Without training, it is difficult to learn this. Once you get the hang of it (smart POS system, business website) and with people training me, then it will be okay along the way." (Malik)

Furthermore, the adaptive training approach enabled adjustments to the pace and intensity of instruction according to each participant's capabilities. This flexibility helped

https://doi.org/10.3390/tourhosp7060146

prevent participants from feeling overwhelmed or anxious when interacting with unfamiliar technologies. For operators with limited technological literacy, gradual exposure and guided practice made the learning process more manageable. At the same time, the findings revealed that operators with stronger baseline capabilities progressed more quickly while still receiving targeted guidance when needed.

Another important feature of the adaptive training approach was that learning took place within the participants' own business environments. This reduced the additional effort required from participants and made it easier for them to engage with the learning process while continuing to manage their businesses. In this way, adaptive training not only supported skill development but also accommodated the operational realities faced by foodservice microbusiness operators. Through this process, both participants gradually developed greater technological literacy and confidence in using the newly introduced systems. As Ajith explained:

> "I got lot of experience lah, in these 4 week(s), connecting the POS system and we create(d) the website. So now for (the) first time I am using all that, so that all I learned lah."

Similarly, Malik emphasized the importance of guidance when learning unfamiliar technologies:

> "I cannot because this website and everything is new to me. I never use this before so if you don't give me the guidance then I cannot do it by myself."

The above reflections highlight how capability gaps can limit operators' ability to explore and adopt new technologies independently. However, when learning support is aligned with operators' capabilities and learning pace, these gaps can gradually be reduced. By the end of the adaptive training process, both participants also demonstrated a stronger awareness of their own learning needs when adopting new technologies. In particular, they recognised the importance of seeking guidance from individuals with relevant expertise. As Malik noted, successful learning required "the guidance from someone that knows the system and has been using it." This suggests that the effectiveness of adaptive learning depends not only on flexibility in instructional design but also on access to knowledgeable specialists who provide relevant guidance throughout the adoption process.

These findings highlight that adaptive training for smart technology adoption involves a collaborative process between operators, specialists, and the learning approach itself. Specialists play an important role in recognising operators' capability limitations, adjusting the learning process accordingly, and providing consistent guidance throughout the different stages of technology adoption, including pre-adoption familiarisation, initial application, and continued use. Such support helps operators gradually build the confidence and skills required to integrate smart technologies into their daily business operations. These findings suggest that adaptive training is most effective when it is responsive not only to task complexity but also to unequal operator capabilities and operational constraints.

Importantly, these findings also offer insights that extend beyond existing theories of technology adoption, suggesting that the availability of learning support can influence operators' willingness to engage with new technologies. Knowing that guidance would be available appeared to reduce participants' uncertainty and anxiety about adopting unfamiliar systems. This observation is consistent with the findings of Matthews (2007), who also identified training as an important mechanism for overcoming low confidence in technology adoption.

These findings highlight the value of adaptive training as a supportive approach to facilitating the adoption of smart technology among foodservice microbusiness operators. Similar to outcomes in controlled settings (Metcalfe & Kornell, 2003; Metzler-Baddeley &

Baddeley, 2009; Woźniak & Gorzelańczyk, 1994), the present adaptive training approach enabled capability building. Nonetheless, this study demonstrates its effectiveness when embedded in specialist-driven action research within microbusiness operations, thereby extending TAM, UTAUT, and DOI models (see Section 5.1).

4.2. Specialist Mediation and Trust Transfer in Smart Technology Adoption

As discussed in Section 4.1, foodservice microbusiness operators display varying levels of technological literacy, skills, experience, and resource capacity, resulting in different learning pathways during smart technology adoption. These capability differences highlight the need for adaptive training approaches that can accommodate individual operator characteristics. However, the findings also reveal that adaptive training alone is insufficient without the involvement of knowledgeable intermediaries who can guide operators through the adoption process. In this context, the specialist plays an important role in mediating between operators and unfamiliar technologies while also facilitating the development of trust in the adoption process. The following sections examine the role of specialist mediation and the subsequent transfer of trust from the specialist to the technologies being adopted. Here, specialist mediation refers to the process through which a knowledgeable intermediary translates unfamiliar technologies into workable practices for operators while adapting guidance to their capabilities and needs.

4.2.1. Specialist Mediation

During the pandemic, many microbusiness operators adopted smart technologies such as online delivery systems, and in doing so were required to function as de facto technology specialists despite often lacking the necessary expertise, knowledge, and skills (Ghobakhloo et al., 2012). In many cases, operators attempted to adopt these technologies independently without seeking guidance from specialists, which reduced the likelihood of successful implementation. Prior research has identified external expertise as an important determinant of successful technology adoption (Thong, 2001). However, engaging professional specialists is often difficult for microbusiness operators due to financial constraints (Caldeira & Ward, 2003; Sarosa & Zowghi, 2003).

In the present study, the specialist role was performed by the researcher during the adaptive training program. The researcher's guidance and training played a significant role in enabling participants to adopt, apply, and continue using smart technologies in their businesses. As both Ajith and Malik had limited technological literacy, skills, experience, and training in smart technology, the presence of a knowledgeable specialist proved relevant to facilitating the adoption process. As Ajith explained:

> "I cannot adopt this on my own. It can only be done after you explain everything. It is very helpful. So far, your training makes it easy for me. You are like the lecturer, and I am the student."

Effective specialist mediation requires facilitators to possess a strong understanding of the technologies being introduced. In this study, the researcher spent two months prior to the action research learning, testing and developing familiarity with the smart technologies to be implemented.

The specialist also played an important role in adapting the learning process to suit each operator's individual capabilities and resource conditions. As discussed in Section 4.1, operators demonstrated different levels of technological literacy, skills, and experience. For example, Ajith faced greater difficulty adapting to the smart POS system and required additional guidance and time to develop familiarity with the technology. Malik, by contrast, adapted more quickly due to stronger baseline technological skills. Consequently, the specialist had to adjust the pace, level of detail, and instructional approach accordingly.

https://doi.org/10.3390/tourhosp7060146

With Ajith, the training process required greater patience, encouragement, and detailed guidance, whereas with Malik, the specialist adopted a faster, more exploratory approach.

By mediating between operators and the technologies being introduced, the specialist helped translate complex technological concepts into practical applications within the operators' business environments. This mediation reduced the cognitive burden associated with learning unfamiliar technologies and allowed operators to gradually develop the technological literacy and skills necessary for adoption. More specifically, mediation operated by reducing complexity, tailoring instruction, and linking technological functions to operators' everyday business practices.

4.2.2. Trust Transfer

Beyond providing technical guidance, specialist mediation also played a crucial role in shaping participants' trust in the smart technologies being introduced. At the beginning of the adaptive training, both Ajith and Malik expressed scepticism about adopting new digital systems. However, their willingness to participate was influenced by the reassurance they received from the researcher's knowledge, skills, and experience with the technologies. Importantly, this trust was not based solely on technical expertise, but also on how the researcher was perceived by the participants. The researcher was not seen as a commercial actor seeking financial gain, but rather as someone engaged in a shared learning process with the operators. In this context, the specialist served as the initial point of trust for the operators. Because such technologies, introduced as smart POS systems, business websites, and online delivery platforms, were unfamiliar to the participants, they relied first on the specialist's credibility and guidance rather than on the technologies themselves. This perception helped shift the interaction away from a traditional client–consultant dynamic toward a more collaborative partnership. Over time, as participants gained experience using the technologies with the specialist's support, their trust in the specialist gradually extended to the technologies themselves. In this study, trust transfer refers to this movement from initial trust in the intermediary to growing trust in the technologies being learned and applied. In this context, trust transfer was supported not only by demonstrated competence but also by a sense of authentic participation, in which knowledge was co-created in an open, non-hierarchical manner.

By the conclusion of the adaptive training, both participants recognised the value of receiving guidance from individuals specialising in smart technology adoption. The specialist's involvement helped reduce their initial doubts and anxieties about adopting unfamiliar technologies and encouraged them to engage fully in the learning process. One key important mechanism of trust transfer concerns operators who initially place trust in a knowledgeable intermediary and subsequently extend that trust to the technology being introduced. This collaborative, non-commercial form of engagement reduced perceptions of risk, as participants could explore and adopt technologies without feeling obligated or influenced by external commercial interests. In doing so, the specialist reduces uncertainty and perceived risk associated with adopting unfamiliar technologies. The findings therefore reinforce the importance of external expertise in technology adoption contexts, consistent with prior research that identifies external expertise as a fundamental determinant of successful technology implementation (Thong, 2001). At the same time, the results extend this understanding by illustrating how specialists not only provide technical knowledge but also facilitate trust formation during the adoption process. The establishment of such authentic relationships with operators can be unique and beneficial in the world of business, intense competition and profit maximisation.

These findings suggest that trust in technology adoption may be shaped not only by perceptions of the technology itself, but also by the nature of the relationship between users and intermediaries. Importantly, the role of specialists has received limited attention in existing theories. These frameworks primarily focus on individual perceptions and behavioural intentions during the early stages of technology adoption and therefore do not explicitly account for the mediating role of specialists. The findings of this study suggest that specialist mediation can play a critical role in reducing technological fears and uncertainties while encouraging operators to engage with unfamiliar systems.

Overall, the results demonstrate that specialist-driven adaptive training can serve as a critical mechanism for enabling the adoption, application, and continued use of smart technologies among foodservice microbusiness operators. By mediating between operators and complex technologies while simultaneously facilitating trust formation, specialists help bridge capability gaps and support successful technology adoption. More broadly, this highlights the importance of relational dynamics such as partnership, mutual learning, and knowledge sharing in shaping technology adoption outcomes in microbusiness contexts. The sequence observed here can be summarised as unfamiliarity, specialist reassurance, guided use, positive experience, and growing confidence in the technology itself.

5. Conclusions

Microbusiness operators in Malaysia face challenges in adopting smart technologies due to differences in technological literacy, prior experience, age, and available resources (Del Pilar et al., 2020; Eze et al., 2021). The cases of Ajith and Malik illustrate how capability differences influence the pace and manner of adoption. The study shows that adaptive training approaches, tailored to individual operator capabilities, combined with specialist guidance, enable operators to adopt and continue using smart technologies effectively. Specialist involvement also serves as a key mechanism for building trust in the technology, reducing uncertainty, and supporting sustained adoption. Importantly, a distinction can be drawn between general specialist-driven trust and the form of researcher/specialist-driven trust observed in this study. Here, trust was not solely based on perceived expertise but was shaped by the researcher's non-commercial, collaborative role, in which trust developed through co-learning and shared problem-solving rather than through transactional client–consultant interactions.

Overall, the findings highlight that successful smart technology adoption in microbusinesses depends on both operator-centred training strategies and relational support mechanisms. By integrating action research with adaptive training, this study shows how experiential, on-the-job learning can help explain these mechanisms in practice and offers a useful basis for future research on smart technology adoption in microbusiness contexts. Ultimately, these findings extend existing adoption theories and suggest that greater emphasis be placed within adoption frameworks such as TAM, UTAUT, UTAUT2, and DOI on the roles of capability heterogeneity and specialist-driven trust in shaping both adoption intention and actual usage.

5.1. Theoretical Implications

The findings of this study offer several important theoretical implications for technology adoption research. First, they suggest the need to more explicitly account for capability asymmetry among users, particularly in microbusiness contexts. Existing models such as the TAM, UTAUT, UTAUT2, and DOI tend to treat users as relatively homogeneous in their ability to engage with new technologies. However, this study demonstrates that differences in technological literacy, prior experience, age, and resource availability can significantly shape adoption approaches. This implies that future theoretical models should incorporate user capability as a dynamic and differentiating factor in the adoption process. Second, the findings indicate that adaptive training should be considered as an integral component of technology adoption rather than a peripheral support mechanism. By showing how flexible, operator-centred learning approaches help bridge capability gaps, the study suggests that learning processes are not separate from adoption but are embedded within it. This implies a need to extend existing models to better capture how learning evolves alongside adoption, particularly in contexts where users lack prior technological experience and knowledge.

Third, the study highlights the importance of specialist-mediated trust transfer as a mechanism influencing adoption. Findings show that users may initially rely on trust in a knowledgeable intermediary, particularly one with no economic/financial interests/incentives, which then extends to the technology itself as familiarity increases. This has important implications for theory, as it suggests that trust formation in technology adoption is not solely based on perceptions of the technology, but can also be shaped by relational, social, equitable and authentic relations/interactions. Hence, future research should consider integrating intermediary roles and trust transfer processes into existing adoption frameworks. These implications point to the need for a more context-sensitive and relational understanding of technology adoption, in which capability differences, training processes, and intermediary influences are recognised as central to explaining adoption outcomes in microbusiness settings. Furthermore, the findings suggest that adoption in such settings is not only a matter of perceived usefulness or intention, but also a situated learning process shaped by unequal capabilities, guided support, and evolving trust.

Thus, while the findings are based on a small number of cases, they do not seek to replace established models such as the TAM, UTAUT, UTAUT2, and DOI. Instead, the study highlights how adaptive learning and specialist-mediated trust can complement these models by providing a process-oriented explanation of how adoption unfolds in practice, particularly in resource-constrained microbusiness contexts. In this way, the study extends existing frameworks by foregrounding relational and learning-based mechanisms that support the transition from adoption intention to sustained use (see Figure 3).

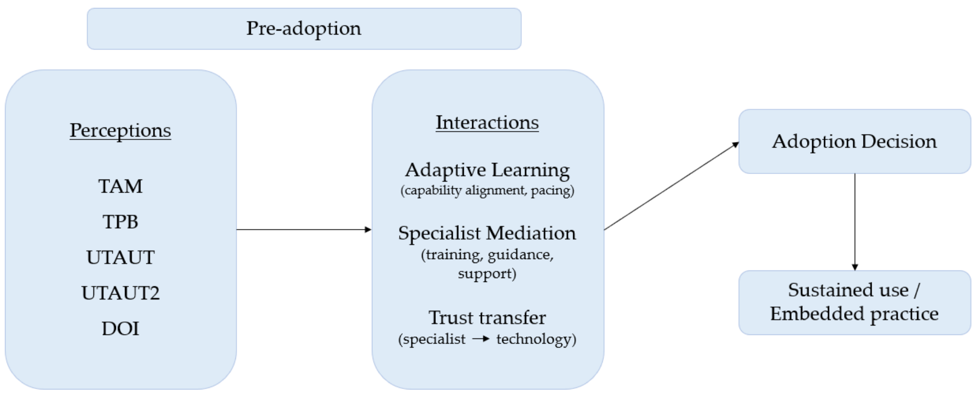

Figure 3. Extending technology adoption models through adaptive learning and specialist mediation (source: authors).

5.2. Methodological Implications

The present integration of specialist-driven adaptive training within action research, which has rarely been applied in technology adoption research, establishes a useful methodological template for studying post-adoption processes in microbusinesses. This directly addresses the limitations of pre-adoption designs noted in the literature review. The action research approach enabled both the researcher and participants to work collaboratively to apply smart technologies in their businesses and co-develop an effective, specialist-driven, adaptive training program. Furthermore, the adaptive training approach provided participants with the opportunity to experience smart technology adoption firsthand, and the researcher with the opportunity to closely observe, guide, and understand their ability to adopt and apply it. While action research is a common approach utilised in the fields of nursing and teaching (Grealish et al., 2015; Harvey et al., 2002; Holter & Schwartz-Barcott, 1993), this research establishes its applicability to the field of technology adoption in MSMEs, particularly to foodservice microbusinesses in developing economies such as Malaysia. Moreover, this research provides a detailed account of developing and implementing an effective adaptive training program through action research to facilitate the adoption of smart technology in foodservice microbusinesses.

While the use of action research is relatively new in technology adoption research (Sundarakani et al., 2021; Usoro, 2020), this study's adaptation of action research can be used to examine technology adoption among MSMEs in the food sector. Researchers can adopt the proposed adaptive training approach to engage more closely with participants and develop suitable approaches to drive change in participants' businesses, particularly through technology adoption. Furthermore, this study's adaptive training approach redefines the role of the researcher in technology adoption research. While the researcher need not be a technology adoption specialist, action research places them at the core of the investigative process, fostering a collaborative relationship with participants to explore, understand, address, and reflect on real-world challenges. The findings of this study highlight the importance of such collaboration, emphasising the value of research partnerships between scholars and technology adopters to gain a deeper, more accurate understanding of the complex factors influencing technology adoption. In doing so, this study highlights the methodological value of combining specialist-guided adaptive training with action research to examine technology adoption as an unfolding, practice-based process.

5.3. Practical Implications

The proposed specialist-driven adaptive training program offers a detailed, step-by-step guide to support operators in adopting and applying smart technologies in their businesses (see Sections 3.2 and 3.3). While the program is structured over a one-month period, it can be extended based on the needs of the operator or specialist, as well as the type and number of smart technologies being introduced. Central to the program is the involvement of a specialist, ideally from the public sector, based on public interests, who facilitates the training; however, the program is designed to be flexible and responsive to the operator's capabilities, the specialist's expertise, and the specific technologies in use. In practice, this may involve assigning trained digital advisors or training officers to work directly with operators through on-site visits and follow-up sessions. As such, the duration, intensity, and scope of the training can be adjusted as needed throughout its implementation. Although the program is intended to be specialist-driven, its structure may also provide operators with a useful framework for understanding the stages and requirements of technology adoption.

Both operators and specialists can apply the adaptive training program proposed in this study to enhance the effectiveness of smart technology adoption. Government agencies can use the program as a reference for developing targeted training initiatives to support technology adoption among both microbusinesses and small and medium enterprises (SMEs) across industries, particularly given the importance of external support and intervention for business resilience and adaptation (Gan et al., 2024). This can be operationalized by embedding the program within existing SME support schemes, such as subsidized training programs, digital adoption grants, or structured mentoring schemes that pair operators with trained specialists. Importantly, such engagement should be grounded in principles of knowledge democracy and egalitarian forms of trust, where learning is co-created through mutual exchange rather than delivered through hierarchical or transactional relationships.

Moreover, the program enables operators to assess their businesses, identify areas that could benefit from smart technologies, determine which technologies are most suitable, find ways to acquire them, and learn how to implement them effectively. Technology providers can also adopt this model by offering guided onboarding processes, hands-on demonstrations, and post-adoption support tailored to the capabilities of microbusiness operators, rather than relying solely on standardized or self-service approaches. Policymakers, support organisations such as SME Corp. Malaysia and SME Association of Malaysia, and the voluntary sector could also draw on this approach to support smart technology adoption in local foodservice microbusinesses. Their role can include developing specialist training capacity and improving the accessibility of support tools, for example, through localisation, translation, and online access to guidebooks and related resources.

5.4. Limitations and Avenues for Future Research

Firstly, the foodservice microbusinesses participating in this study were from technologically developed cities such as Kuala Lumpur and Subang Jaya in the Klang Valley of Malaysia. Hence, additional challenges and limitations may arise when applying similar approaches in more rural areas of the country and in other developing economies with limited access to technological infrastructure. This is an avenue for future research.

Another potential limitation of this study lies in the researcher’s dual role as both trainer and observer, which may have shaped participants’ responses and engagement during the study; however, reflexive journaling was consistently used to critically reflect on and mitigate potential bias. At the same time, this dual role enabled deeper, real-time insights into participants’ learning processes and technology adoption behaviors within their natural business contexts.

Furthermore, given the small and context-specific sample of this study, the findings may not be directly transferable to much broader business contexts (i.e., small and medium businesses), particularly those operating under different institutional, cultural, or resource conditions. Instead, the study offers analytically generalizable insights into key mechanisms, enabling readers and practitioners to make informed judgements about their applicability to comparable microbusiness contexts.

Additionally, the adaptive training approach, in and of itself, is individual and resource-intensive, requiring a high degree of time and physical investment from both the researcher and the participants (Mackenzie et al., 2012). Thus, the number of participants in this study was limited to two operators due to time and resource constraints, as well as the need to conduct the specialist-driven adaptive training program for a minimum of one month with each participant. Hence, future studies that aim to replicate this study’s adaptive training approach can use a larger sample size and conduct similar experiments over longer periods, especially to gain further insights and gather more data to evaluate the effectiveness of adaptive training and the role of specialists in facilitating smart technology adoption within foodservice microbusinesses.

Moreover, future studies can adapt the specialist-driven adaptive training program to study and/or facilitate technology adoption in different contexts. For instance, the training program can be used to study and/or facilitate the incorporation of AI adoption in larger businesses (i.e., SMEs) or other forms of technology adoption in sectors such as bakeries, agriculture, and textiles. In addition, future studies can also expand on the influence of specialists on technology adoption and develop guidelines for who qualifies as a specialist, how such assessments might be conducted, and what qualifications and skills qualify an individual to be a specialist to further enhance the effectiveness of the training.

Lastly, this research did not involve external stakeholders such as government agencies, policymakers, and service providers. Hence, future research can investigate smart technology adoption in the context of microbusinesses from the perspective of the aforementioned external stakeholders. This will provide greater insight into how such external stakeholders view microbusinesses, especially those belonging to the foodservice sector, and help raise awareness and develop more effective strategies to facilitate smart technology adoption in foodservice microbusinesses.

Author Contributions: Conceptualisation, T.S.A.; methodology, T.S.A.; writing and original draft preparation, T.S.A.; writing—reviewing, and editing, K.L.C., A.T. and M.L.S.; supervision, K.L.C., A.T. and M.L.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Sunway University PhD Studentship Scheme.

Institutional Review Board Statement: This research was approved by the Sunway University Research Ethics Committee (protocol code PGSUREC2022/038 and 6 September 2022).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors on request in efforts to uphold participant anonymity.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

DOI	Diffusion of innovation
MSME	Micro, small and medium enterprise
POS	Point-of-sale
RM	Ringgit Malaysia
RQ	Research question
SME	Small and medium enterprise
TAM	Technology acceptance model
TOE	Technology, organization, environment
TPB	Theory of planned behavior
TRA	Theory of reasoned action
USD	United States Dollar
UTAUT	Unified theory of acceptance and use of technology
UTAUT2	Unified theory of acceptance and use of technology version 2

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