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Research Paper

Technology Adoption Intention Among Tinapa Producers in Rosario, Cavite, Philippines: A Correlational and Narrative Analysis

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Abstract

Rosario, Cavite, Philippines, well-known for its tinapa production, exemplifies the importance of the artisanal food production sector, where the traditional practice of tinapa making is deeply embedded in the local economy and culture. This sector often relies on manual processes that could benefit from technological innovation to enhance efficiency and product quality. Recognizing this potential, this study investigates the factors influencing technology adoption intention among tinapa producers in Rosario, Cavite, Philippines, employing a descriptive-correlational and narrative research design. Quantitative data were collected from 40 tinapa producers using survey questionnaires, while qualitative insights were gathered through semi-structured interviews. The results indicate that the respondents have a neutral intention toward technology adoption. Correlation analysis reveals that technology adoption intention is significantly and positively related to perceived benefits, technological know-how, and available resources. In contrast, perceived risk did not significantly related to adoption intention. The narrative analysis highlights that producers' inclination towards technology adoption is constrained by strong adherence to traditional practices, limited technological awareness, and resource scarcity, despite recognizing potential modernization advantages. The study concludes that effective technology adoption strategies must integrate financial support, infrastructure development, and tailored education to address the unique challenges and cultural context of tinapa producers.

Keywords: *available resources; perceived benefit; perceived risks; technology adoption; technological knowledge*

INTRODUCTION

The Philippine artisanal food production sector, a valuable yet often underfunded cornerstone of the national economy and cultural heritage, is characterized by small-scale operations, time-honored techniques, and the creation of regionally distinct products such as tinapa, bagoong, kesong puti, and tsokolate de tablea. Rosario, Cavite, recognized as the "tinapa Capital of the Philippines," exemplifies the significance of this sector. Here, the local economy and cultural identity are deeply intertwined with the traditional practice of tinapa production. This industry, sustained by numerous family-run smokehouses, provides a vital source of income for many households and offers seasonal employment, particularly for women involved in processing and packaging. Traditional food production methods, such as open-fire smoking for tinapa, often involve significant manual labor and limited access to modern equipment. This reliance on conventional practices can lead to inconsistencies in product quality and potential food safety concerns, underscoring the crucial role of technology in driving innovation within these traditional food sectors.

Technology adoption is a key driver for enhancing production efficiency and product quality across diverse agricultural industries, and technological innovation is now a fundamental engine of economic growth and industrial advancement globally (Rusmayadi et al., 2024). In traditional sectors, such as food processing, the adoption of technology is influenced by various factors, including market needs, resource constraints, regulatory requirements, and cultural norms (Priyadarshini et al., 2019). Tinapa, a traditional Filipino product made by smoking or curing fish,

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holds a significant position within the fishing sector, particularly in regions with abundant fish resources. The city of Balanga in Bataan, for example, is also renowned for its tinapa production, where small-scale producers form the core of the local economy. These producers often encounter challenges, including limited production efficiency, restricted product shelf life, and difficulties in adhering to government regulations. Addressing these issues through the integration of technology can lead to product optimization and improved profitability (De Leon, 2021). Research has indicated that the adoption of modern agricultural technologies, as demonstrated in Philippine rice farming, yields positive impacts on both productivity and profitability (Mariano et al., 2012). Similarly, the implementation of integrated rice-fish farming systems in Bangladesh has significantly enhanced farm income and overall welfare (Islam et al., 2015). Factors such as ease of use, compatibility with existing traditional processes, and the economic viability of adopting new technologies significantly influence the willingness to embrace innovation within aquaculture. These considerations are likely equally relevant for tinapa producers in Rosario, Cavite (Kumar et al., 2018). Furthermore, external factors, including market prices and environmental conditions, can pose barriers to the widespread adoption of technology, as observed in rural aquaculture communities in the Philippines (Baticados, 2015). Technology plays a vital role in production by mitigating biological constraints, increasing yields, reducing labor requirements, and promoting environmental sustainability, as evidenced by advancements in areas such as selective breeding, mechanization, and enhanced information systems (Sassenrath et al., 2008).

Most studies on technology acceptance have focused on office environments, general consumers, or large industries. Applying these models to a specific and traditional sector, such as tinapa production, offers important insights and helps test whether existing theories remain valid in new contexts. This research investigates whether the core concepts of the Technology Acceptance Model (TAM), including perceived usefulness and perceived ease of use, as represented by perceived benefits and technological knowledge, apply to micro-entrepreneurs operating in a culturally rooted, informal industry. Meanwhile, applying the Theory of Planned Behaviour (TPB) offers a more comprehensive understanding of technology adoption in this context. TPB considers both the producers' attitudes toward adoption, shaped by their views on benefits and risks, and their perceived control over adoption, influenced by their technological knowledge and available resources. This approach helps explain not just what motivates tinapa producers to adopt technology, but also what enables or limits their ability to do so, offering a deeper understanding of technology adoption in traditional industry settings. Despite potential obstacles to technology adoption, the successful integration of new technologies holds the promise of substantial improvements in production efficiency, product quality, and overall market competitiveness for traditional food producers, such as those in Rosario, Cavite. Hence, understanding the behavioural intention to adopt technology among these tinapa producers is crucial for formulating effective strategies aimed at optimising products and promoting sustainable growth within this significant sector of the local economy.

Research Objectives

The researchers generally aimed to analyze and explore the factors influencing the behavioral intention to adopt the technology of tinapa producers in Rosario, Cavite, Philippines. Specifically, this aimed to:

1. Determine the demographic profile of the respondents.
2. Determine the tinapa producers' perceptions of the benefits and risks of technology adoption.
3. Determine the tinapa producers' existing technological knowledge and available resources for technology adoption.

4. Determine the intention of tinapa producers to adopt new technology.
5. Determine the significant relationships between perceived benefits, perceived risk, technological know-how, available resources, and the intention to adopt technology among tinapa producers.
6. Explore the factors influencing the behavioral intention to adopt the technology of tinapa producers through a narrative approach.

LITERATURE REVIEW

Technology Adoption

Technology adoption plays a pivotal role in enhancing productivity and fostering economic growth in the Philippines (Rosales et al., 2020), a process intricately shaped by cognitive, emotional, and contextual factors (Moreno et al., 2024). The agricultural sector offers compelling evidence of this impact. For instance, the integration of modern rice technologies, such as certified seeds, has demonstrably elevated both productivity levels and the income of farming households. Research by Villano et al. (2015) highlights that these technological advancements enhance technical efficiency and overall performance in rice farming, thereby addressing the increasing demand for food. The transformative power of technology was further highlighted during the COVID-19 pandemic, where Micro, Small, and Medium Enterprises (MSMEs) across the Philippines were compelled to embrace digital platforms as a survival strategy. Mia et al. (2024) found that MSMEs that successfully navigated challenges such as limited infrastructure and digital skills deficiencies exhibited significant resilience, positioning them for potential growth in the post-pandemic economic landscape. These instances suggest potential parallels for small-scale food producers, such as those involved in tinapa (smoked fish) production, who could similarly benefit from strategic technological shifts.

Despite the evident advancements and potential benefits, the widespread adoption of technology in the Philippines remains hindered by significant barriers. These include high implementation costs, inadequate infrastructure, and resistance to change, particularly among small enterprises (Bugayong et al., 2022). For the food production industry, including tinapa producers, overcoming these obstacles is crucial to optimising production processes and enhancing overall competitiveness. Cui and Wang (2023) observed that younger farmers in China demonstrate a higher propensity to adopt digital technologies, likely due to their greater familiarity with digital tools. Similarly, Dhraief et al. (2019) highlighted the crucial role of education in technology adoption among farmers in Tunisia, noting that more educated individuals tend to show a greater inclination to invest in new technologies. In Nigeria's maize farming sector, Haruna et al. (2023) identified inadequate market information, limited financial resources, and a lack of technical knowledge as key impediments to the adoption of technology. The study also highlighted the significant role of institutional support mechanisms, such as government extension services, in mitigating these barriers by providing training and financial assistance. These international experiences highlight the importance of targeted interventions and supportive ecosystems in facilitating broader and more effective technology adoption across various sectors in the Philippines.

The Relationship Between Perceived Benefit and Intention to Adopt

In developing countries, people and businesses are more likely to adopt new technologies when they see clear benefits. Research indicates that training programs in Nigeria's food processing industry enhance both skills and positive attitudes towards technology, resulting in increased adoption (Adeyonu et al., 2020). This is also true for small and medium-sized businesses (SMEs).

Studies have found that perceived advantages, such as lower costs, increased sales, and improved operations, strongly predict whether SMEs will adopt new technologies. For example, Malaysian SMEs adopted cloud computing because they anticipated it would help them grow and remain competitive (Alshamaila et al., 2013). Similarly, manufacturers have adopted Industry 4.0 technologies to enhance quality control and improve supply chain visibility (Müller et al., 2018). Farmers also adopt technology based on perceived benefits. They are more likely to use tools like precision agriculture or mobile advice if they believe it will improve their crops and reduce risks. A study in Kenya found that farmers who perceived mobile advice as applicable were more likely to utilise it (Aker, 2011). However, if farmers do not see benefits, often due to a lack of trust or the use of unsuitable technology, they are unlikely to adopt it (Aubert et al., 2020).

The Relationship Between Perceived Risks and Intention to Adopt

Perceived risk consistently impedes technology adoption, as evidenced in mobile payment contexts, where performance and financial risks negatively impact adoption intentions (Manrai & Gupta, 2022). This phenomenon is further complicated by individual traits, such as openness and agreeableness, influencing risk perception (Changchit et al., 2024). While perceived usefulness and ease of use can enhance adoption, suggesting a risk-benefit evaluation (Patil et al., 2017), perceived risk can also indirectly reduce adoption by diminishing perceived usefulness, ultimately demonstrating a direct negative correlation with adoption intentions (Suryawan & Santikasari, 2024). Consequently, the adoption of new technologies by tinapa producers may be hindered by perceived risks related to reliability, financial implications, and product impact, underscoring the importance of addressing these concerns to facilitate technology uptake in this sector.

The Relationship Between Available Resources and Intention to Adopt

Organizational readiness, particularly in terms of resource availability, is a key factor in technology adoption (Tornatzky & Fleischer,1990; Oyetade et al., 2024). In food production, businesses with sufficient funding, skilled labor, and infrastructure find it easier to adopt new technologies. They see innovations as achievable and can overcome obstacles. A lack of funds is a significant barrier to technology adoption in the food sector, particularly for small businesses in developing countries. They often cannot afford advanced technologies, which reduces their willingness to adopt them (Daxini et al., 2018). However, access to credit or subsidies increases adoption intentions (Feder et al., 1985). For instance, Nigerian farmers who received microloans were more likely to utilise mobile farming tools (Aker, 2011). Reliable infrastructure, like internet access, is also crucial. In rural Philippines, poor internet access hindered fisherfolk from using mobile apps for market pricing, despite recognising the benefits (Philippine Statistics Authority, 2022). This indicates that even if people want to adopt technology, a lack of resources can hinder their efforts. Essentially, resources enable food sector stakeholders to overcome practical and financial barriers, allowing them to turn their intentions into actual technology adoption.

The Relationship Between Technological Knowledge and The Intention to Adopt

Davis (1989) stated that people are more likely to adopt technology if they find it easy to use and helpful. Notably, possessing technical knowledge alters how people perceive these things. People with technical skills find technology easier to use and more valuable because they know how to use it effectively (Venkatesh et al., 2003). This relationship is particularly evident in agricultural and small business contexts. Farmers and SMEs demonstrate a higher likelihood of adopting new technologies when they perceive clear benefits in terms of improved productivity and efficiency (Zhang et al., 2024). This perception of benefit is deeply rooted in their technological knowledge. For instance, Kenyan farmers who understood how to interpret and apply data from mobile-based

advisory services showed stronger adoption intentions (Aker, 2011). This understanding reduces uncertainty and enables them to see the practical advantages of the technology.

Furthermore, positive attitudes towards technology, influenced by experience and environmental factors, play a significant role in adoption intentions (Suvittawat, 2024). Learning about technology makes people more positive towards it by helping them understand its capabilities. For instance, farmers trained to use soil sensors were much more likely to use them (Pierpaoli et al., 2013). This increase in adoption can be attributed to the fact that knowledge reduced uncertainty about the operational benefits, making the technology appear more accessible and valuable.

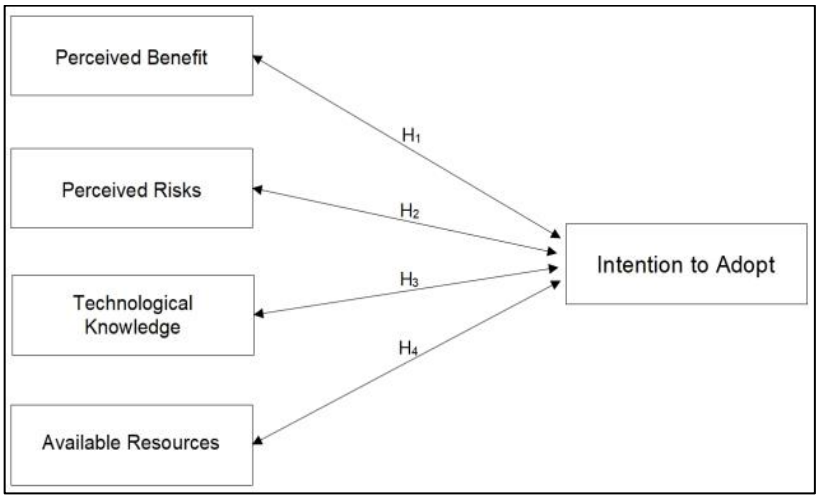

Figure 1. Conceptual framework

This conceptual framework posits that an individual's intention to adopt technology is influenced by perceived benefits, perceived risks, technological knowledge, and available resources, revealing notable parallels with established theories of adoption. Aligning with the Technology Acceptance Model (Davis, 1989), perceived benefit mirrors perceived usefulness, driving adoption intentions (H1). Similarly, technological knowledge is related to perceived ease of use, which reinforces an individual's confidence and fosters a stronger inclination to adopt technology (H3). Extending beyond TAM, the framework's inclusion of perceived risks (H2) acknowledges deterrents to adoption, aligning with findings that perceived security, privacy, or performance risks significantly impact technology acceptance (Featherman & Pavlou, 2003). From the perspective of the Theory of Planned Behavior (TPB) (Ajzen, 1991), both perceived benefits and perceived risks contribute to shaping the individual's attitude toward adoption. Crucially, technological knowledge and available resources (H4) align with the TPB's perceived behavioural control, reflecting an individual's assessment of their capacity to perform the adoption behaviour. Hence, the researchers crafted the following hypotheses:

H_1: There is a significant relationship between the perceived benefit and behavioral intention to adopt technology among tinapa producers.
H_2: There is a significant relationship between the perceived risks and behavioral intention to adopt technology among tinapa producers.
H_3: There is a significant relationship between technological knowledge and behavioral intention to adopt technology among tinapa producers.
H_4: There is a significant relationship between the available resources and behavioral intention to adopt technology among tinapa producers**.**

RESEARCH METHOD

Research Design

This study utilised a descriptive-correlational and narrative research design to explore and analyse variables related to the behavioural intention of tinapa producers in adopting technology. A descriptive-correlational approach was employed to describe the characteristics of tinapa producers systematically and to statistically examine the hypothesised relationships among key variables influencing their intention to adopt the technology. This quantitative method allowed for the identification of potential associations and the assessment of the strength and direction of these relationships. Moreover, the narrative component, through the collection of stories from tinapa producers, provided rich, qualitative insights into the contextual factors, personal motivations, and lived experiences shaping these intentions. This qualitative dimension provided a deeper understanding of the nuances and complexities underlying the statistical findings, capturing the human element that is often overlooked in purely quantitative studies. The integration of these quantitative and qualitative methodologies, a form of methodological triangulation, allowed for a more comprehensive and in-depth understanding of the lived experiences underpinning technology adoption within the specific context of tinapa production, thereby enhancing the validity and robustness of the findings.

Sampling Design

The tinapa producers were identified through a purposive sampling technique. Participants were chosen based on their significant experience in tinapa production. Scanning and screening methods were employed to ensure they met specific study criteria. All participants were from Rosario, Cavite, Philippines, an area known for its tinapa industry. This targeted approach aimed to gather contextually relevant and representative data. The study collected survey data from 40 tinapa producers, given that the entire population of tinapa producers in the locale is relatively small. A post hoc statistical power analysis was conducted using G Power, with the parametric counterpart of Spearman's Rank Correlation. An approximation of statistical power is presented in Figure 2. The result indicates that, given the observed effect size (correlation of 0.60), with a sample size of 40 and an alpha level of 0.05, there is approximately a 98.91% chance of correctly rejecting the null hypothesis if a correlation of 0.60 (or larger) truly exists in the population. Moreover, the present study is primarily exploratory in nature. Due to limited existing research on tinapa producers, the goal is to identify potential relationships and formulate hypotheses for future research with larger samples. Meanwhile, from the 40 tinapa producers, 15 participants were selected for in-depth interviews. This sample size is considered sufficient for qualitative research, as studies like Guest et al. (2006) indicate that saturation of common themes can often be achieved within the first 12 interviews.

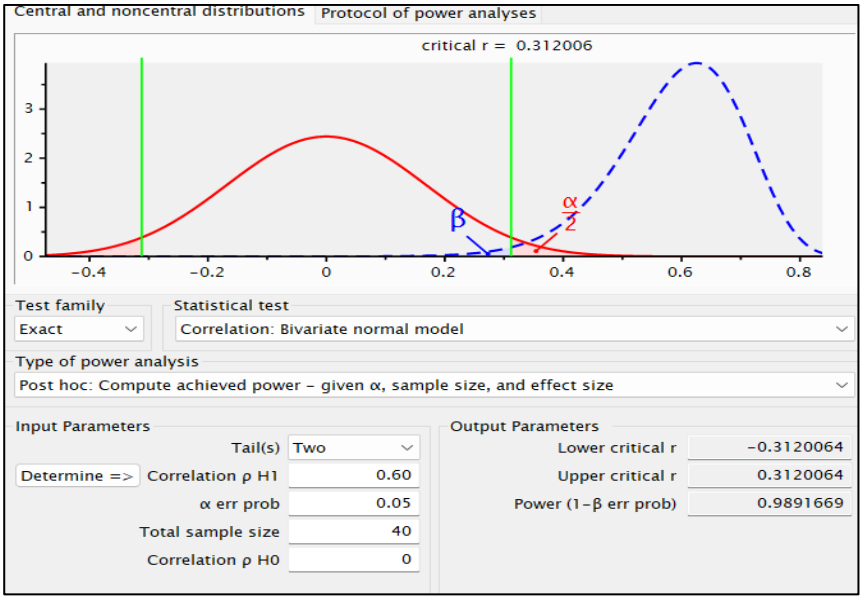

Figure 1. Post Hoc Calculation of Sample Size Using G Power

Research Instrument

Researcher-made survey questionnaires and semi-structured interview guides were utilized to collect the necessary information for this study. The first section of the questionnaire focused on profiling the participants. The second section employed a 7-point Likert scale, which ranges from 7 (Strongly Agree) to 1 (Strongly Disagree), to measure the degree level of each construct. Prior to data collection, this research instrument underwent content and semantic validation by a panel of four experts holding at least a master's degree in business and possessing experience in research. Furthermore, the reliability of the research instrument was assessed, and the calculated Cronbach's Alpha and McDonald's Omega coefficients are presented in Table 1. The interpretation of these reliability coefficients was based on established thresholds, where values of≥ .70 are considered acceptable, ≥ .80 are considered good, and ≥ .90 are considered excellent (Nunnally, 1978; McDonald, 1999). These thresholds provide a widely recognized framework for evaluating the internal consistency of measurement scales, with McDonald's Omega offering a more accurate estimate than Cronbach's Alpha, particularly when the assumption of tau-equivalence is not met (Hayes & Coutts, 2020; McDonald, 1999).

Table 1. Scale Reliability Statistics

Constructs	Number of items	Cronbach's α	McDonald's ω
Perceived Benefits	5	0.923	0.924
Perceived Risks	5	0.802	0.822
Technological knowledge	5	0.904	0.907
Resource availability	5	0.920	0.923
Intention to adopt	5	0.981	0.981

Data Analysis

The researchers tabulated, analysed, and summarised the completed surveys retrieved from the participants. Table 2 presents the normality test results, which, based on the Shapiro-Wilk test, indicate a failure to reject the assumption of non-normality. This finding signifies that the data

distribution significantly deviates from normality, thereby violating a key assumption required for parametric statistical tests to be valid. Consequently, the applicability of parametric tests, such as Pearson's r, to measure the relationships among the variables was deemed inappropriate. Instead, the Spearman rank correlation test, a non-parametric counterpart to Pearson's r, was employed. This non-parametric approach is suitable for analyzing relationships between variables when the data do not meet the assumptions of normality, as it relies on the ranks of the data rather than their raw values, thus providing a robust measure of association under these conditions.

Table 2. Test of Normality of the Distribution of Data

Constructs	Shapiro-Wilk	
	W	p
Perceived Benefit	0.957	0.128
Perceived Risk	0.922	0.009
Technological knowledge	0.943	0.043
Resource availability	0.911	0.004
Intention to Adopt	0.891	0.001

For qualitative data analysis, the researchers employed the thematic analysis procedure introduced by Braun and Clarke (2006). To gain an in-depth understanding, the interview data analysis process began with multiple readings of the transcripts. Relevant words, phrases, and concepts associated with the research topics were then found and systematically coded. Following their initial classification into more general themes, these codes underwent an iterative review and improvement process to ensure that they accurately reflected the data and aligned with the study's goals. Additionally, to enhance the credibility of the emergent themes, member checking was performed. A select group of participants was provided with a concise summary of the identified themes, along with illustrative quotations that supported these themes. Their feedback was then integrated to ensure the themes accurately reflected their experiences and perspectives. Subsequently, relevant quotes from respondents were carefully chosen to provide empirical support for each theme.

Ethical Consideration

The researchers ensured that participants were fully informed that their participation was voluntary and not mandatory. They were explicitly informed that they were free to withdraw from the study at any time without incurring any negative consequences or harm. Prior to their involvement, the researchers obtained informed consent from each participant by having them sign a consent form, confirming their willingness to answer the survey questionnaires and participate in the interviews. Furthermore, the researchers guaranteed that all information gathered from the participants would be treated with the utmost confidentiality and securely maintained. This emphasis on voluntary participation, the right to withdraw, informed consent, and confidentiality underscores the researchers' commitment to ethical research practices, ensuring the well-being and privacy of all individuals involved in the study, as mandated by research ethics guidelines.

FINDINGS AND DISCUSSION

Descriptive Results

The demographic profile of the participants indicates a sample with a notable prevalence

of middle-aged to older individuals, as evidenced by 45.00% falling within the 45-54 age range and an additional 20.00% in the 55-64 age bracket. A clear gender imbalance is apparent, with females constituting a larger segment of the sample (60.00%) compared to males (40.00%). In terms of civil status, nearly half of the participants are married (47.50%), while over one-third are single (35.00%). The educational attainment of the participants is concentrated at the secondary and primary levels, with high school graduates representing 30.00% and elementary graduates comprising 25.00% of the sample. Economically, the participants are predominantly situated within the lower income strata, with a substantial 45.00% reporting a monthly income below ₱10,957 and a further 30.00% earning between ₱10,957 and ₱21,194.

Table 3. Demographics Characteristics

	Caetgory	**Frequency**	**Percentage**
Age	18 to 24 years old	1	2.50%
	25 to 34 years old	3	7.50%
	35 to 44 years old	6	15.00%
	45 to 54 years old	18	45.00%
	55 to 64 years old	8	20.00%
	65 years and above	4	10.00%
Sex	Male	16	40.00%
	Female	24	60.00%
Civil Status	Single	14	35.00%
	Married	19	47.50%
	Widowed	5	12.50%
	Legally separated	2	5.00%
Highest Education Attainment	Elementary Undergraduate	3	7.50%
	Elementary Graduate	10	25.00%
	Highschool Undergraduate	8	20.00%
	Highschool Graduate	12	30.00%
	College Undergraduate	1	2.50%
	College Graduate	6	15.00%
Monthly Income	Below ₱10,957	18	45.00%
	₱10,957 to ₱21,194	12	30.00%
	₱21,164 to ₱43,828	6	15.00%
	₱43,828 to ₱76,669	2	5.00%
	₱76,669 to ₱131,484	1	2.50%
	₱131,484 to ₱219,140	1	2.50%
Length of Doing Business	Less than 1 year	3	7.50%
	1 to 3 years	1	2.50%
	4 to 6 years	2	5.00%
	7 to 10 years	2	5.00%
	More than 10 years	32	80.00%

Table 4 reveals a generally positive perception among tinapa producers regarding the benefits of technology adoption (Grand Mean = 4.47, Somewhat agree). The most strongly perceived advantage lies in the potential for reduced reliance on manual labor (Mean = 4.83, Somewhat agree), indicating a high value placed on technology for automating production processes. Participants also significantly acknowledge the potential of technology to improve

product shelf life (Mean = 4.72, Somewhat agree), suggesting an understanding of its role in preservation and market expansion. Considerably, a moderate agreement exists regarding technology's ability to increase production capacity (Mean = 4.47, Somewhat agree), highlighting an awareness of scalability. Conversely, the perceived impact of technology on directly improving the quality and efficiency of tinapa production (Mean = 4.28, Neither agree nor disagree) and the willingness to adopt technology for optimization (Mean = 4.05, Neither agree nor disagree) are more neutral. This suggests that while producers recognize certain advantages of technology, they exhibit less certainty about its direct influence on core production aspects and their readiness for implementation, potentially due to factors beyond the scope of these specific perceptions.

Table 4. Perceived Benefits of The Participants in Technology Adoption

Category	Mean	Description
I believe that adopting new technology will significantly improve the quality and efficiency of my tinapa production	4.28	Neither agree nor disagree
I am willing to adopt new technologies to optimize the production process of tinapa.	4.05	Neither agree nor disagree
Using technology will improve the shelf life of my tinapa products.	4.72	Somewhat agree
I believe that technology will allow me to increase production capacity.	4.47	Somewhat agree
Adopting new technology can help reduce dependency on manual labor.	4.83	Somewhat agree
Grand Mean	4.47	Somewhat agree

Table 5 generally provides a consistent "Somewhat agree" response (Grand Mean = 5.06) among tinapa producers, indicating a moderate level of perceived risk associated with technology adoption. Concerns are uniformly distributed across the identified risk categories, with mean scores ranging from 5.05 to 5.08. Specifically, participants express apprehension regarding potential financial losses linked to technology investment (Mean = 5.05) and the possibility of disruptions to current production processes and reduced efficiency (Mean = 5.05). They also voice concerns about the compatibility of new technologies with existing resources (Mean = 5.08) and uncertainty regarding the long-term reliability and performance of these technologies in tinapa production (Mean = 5.08). Notably, there is an overarching concern that the risks of technology adoption may outweigh the potential benefits (Mean = 5.05). In essence, the findings highlight a generally cautious stance towards technological integration, driven by concerns about financial stability, operational continuity, infrastructure compatibility, technology reliability, and the overall risk-benefit balance within the local tinapa production context.

Table 5. Perceived Risks of Participants in Technology Adoption

Category	Mean	Description
I am concerned that adopting new technology may lead to unexpected financial losses in my tinapa production business.	5.05	Somewhat agree
I believe that new technologies could disrupt my current production processes and reduce efficiency.	5.05	Somewhat agree
I worry that the technology might not be compatible with my existing resources and equipment.	5.08	Somewhat agree
I am uncertain about the long-term reliability and performance of the proposed technologies for tinapa production.	5.08	Somewhat agree
I feel that adopting new technology may expose my business to	5.05	Somewhat agree

Category	Mean	Description
risks that outweigh its potential benefits.		
Grand Mean	5.06	Somewhat agree

Table 6 reveals a generally neutral level of technological knowledge (Grand Mean = 3.96). This indicates that, on average, participants neither strongly agree nor disagree with statements concerning their technological understanding and awareness relevant to their production processes. Specifically, the findings reveal the lowest levels of agreement regarding their current knowledge of utilising new technologies and their awareness of available technological options for tinapa production (Mean = 3.70 for both). However, a slightly more positive sentiment is observed concerning their confidence in learning and applying new technological tools (Mean = 3.85) and a leaning towards agreement in their confidence to learn and adapt to new technologies for production improvement (Mean = 4.13). Notably, the strongest agreement lies in the recognition of technology's strategic importance for market competitiveness (Mean = 4.40). Generally, while producers acknowledge the value of technology for staying competitive and express some confidence in their learning abilities, they perceive their current technological knowledge and awareness as neutral, suggesting a potential gap that could be addressed through targeted training and information dissemination initiatives within the local tinapa production sector of Rosario, Cavite.

Table 6. Technological Knowledge of The Participants in Technology Adoption

Category	Mean	Description
I have the necessary knowledge to use new technology in my tinapa production process	3.70	Neither agree nor disagree
I feel confident in learning and adapting to new technologies that could improve my tinapa production	4.13	Neither agree nor disagree
I am confident in my ability to learn and apply new technological tools for tinapa production	3.85	Neither agree nor disagree
I am aware of the different types of technology available for improving tinapa production	3.70	Neither agree nor disagree
I believe that keeping my production process up-to-date with technology will help me stay competitive in the tinapa market	4.40	Neither agree nor disagree
Grand Mean	3.96	Neither agree nor disagree

Table 7 indicates a generally neutral assessment (Grand Mean = 3.82) among tinapa producers regarding their available resources for technology adoption. A notable point is a relative disagreement concerning their financial resources for technology investment (Mean = 3.30, Somewhat disagree), suggesting a financial limitation for adopting new technologies. Similarly, their perception of having the necessary infrastructure and resources for successful implementation leans towards neutrality (Mean = 3.60), indicating potential infrastructural challenges. Conversely, the producers show a more positive inclination towards seeking external expertise or technical support (Mean = 4.15, Neither agree nor disagree), highlighting a willingness to utilize external knowledge. Their views on having sufficient human resources (Mean = 4.00) and the ability to secure funding or loans (Mean = 4.03) are also neutral. Overall, the data suggest that while a willingness to seek external support exists, the primary limitations to technology adoption among tinapa producers appear to be financial constraints and potential inadequacies in existing infrastructure.

Table 7. Available Resources of The Participants in Technology Adoption

Category	Mean	Description
I have the necessary infrastructure and resources to successfully implement new technology in my production process	3.60	Neither agree nor disagree
I have sufficient financial resources to invest in new technologies for optimizing my tinapa production process	3.30	Somewhat disagree
I am open to seeking external expertise or technical support to help implement new technologies in my production process	4.15	Neither agree nor disagree
I have enough human resources on hand to support technology adoption	4.00	Neither agree nor disagree
I believe that my business can secure funding or loans to adopt new technology for product optimization	4.03	Neither agree nor disagree
Grand Mean	3.82	Neither agree nor disagree

Table 8 reveals a generally neutral intention (Grand Mean = 3.98) among tinapa producers regarding the adoption of technology for their businesses. Across all measured aspects of adoption intention, the mean scores consistently fall within the "Neither agree nor disagree" range (3.88-4.08), indicating a lack of strong inclination toward embracing new technologies. Specifically, the producers express neutrality concerning the perceived importance of technology for future business success (Mean = 4.00), their interest in learning about beneficial technologies (Mean = 3.92), and their belief in technology's potential to improve profitability (Mean = 4.08). Similarly, their stated intention to adopt technology for product optimization in the near term (Mean = 4.00) and their willingness to explore technological options for production optimization (Mean = 3.88) are also neutral. The overall neutrality suggests an absence of strong motivating factors or the presence of inhibiting influences, such as the previously identified perceived risks and resource limitations, which may be hindering a definitive inclination towards technology adoption within the local tinapa production sector.

Table 8. Intention To Adopt The Technology of The Participants

Category	Mean	Description
I believe adopting technology is important for the future success of my tinapa business	4.00	Neither agree nor disagree
I am interested in learning about new technologies that could benefit my tinapa business	3.92	Neither agree nor disagree
I believe that adopting new technology will improve my business's profitability	4.08	Neither agree nor disagree
I intend to adopt technology to optimize my products in the near future	4.00	Neither agree nor disagree
I am willing to explore technological options for optimizing my production	3.88	Neither agree nor disagree
Grand Mean	3.98	Neither agree nor disagree

The correlational result in Table 9 reveals significant positive relationships between the intention to adopt technology among tinapa producers and perceived benefits ($\rho = 0.619$, $p < 0.001$), technological know-how ($\rho = 0.823$, $p < 0.001$), and available resources ($\rho = 0.798$, $p < 0.001$), supporting H1, H3, and H4 respectively. Notably, technological know-how exhibits the strongest correlation. This robust positive correlation strongly suggests that producers who feel more

competent and knowledgeable about technology are significantly more inclined to adopt it. This highlights the importance of digital literacy and technical skills in driving technological adoption within this sector. Interventions aimed at enhancing producers' understanding and skills related to new technologies are likely to be highly effective in fostering adoption. Closely following technological know-how is the availability of resources. Considerably, the significant positive correlation between perceived benefits and adoption intention further reinforces the importance of demonstrating the advantages of new technologies to producers. When producers clearly understand how technology can improve their efficiency, productivity, profitability, or working conditions, they are more likely to embrace it. Extension services and pilot programs showcasing the tangible benefits of specific technologies relevant to tinapa production can be instrumental in driving adoption. This strong positive correlation suggests that access to essential resources, including financial capital, infrastructure, and technical support, is a crucial enabler of technology adoption. Even if producers perceive the benefits and possess the know-how, a lack of resources can act as a significant barrier.

Addressing resource constraints through financial assistance programs, infrastructure development, and providing access to relevant tools and equipment is essential for translating intention into actual adoption. Conversely, perceived risk (ρ = -0.295, p = 0.065) did not show a statistically significant relationship to adoption, thus not supporting H2. While the negative correlation suggests that higher perceived risk might slightly deter adoption, the lack of statistical significance implies that, in this context, concerns about potential risks associated with technology adoption, such as financial losses, technical failures, and uncertainty, do not significantly influence producers' intentions. This could be due to several reasons: perhaps the perceived benefits outweigh the risks in their assessment, or they may lack sufficient information to evaluate the potential risks, or other factors may simply be more dominant in their decision-making process. Overall, the findings suggest that producers' inclination towards technology adoption is primarily driven by their perception of the advantages, their self-assessed technological competence, and the availability of necessary resources. At the same time, perceived risks do not significantly impede this intention.

Table 9. Correlational Results

Category	Rho Value	p-Value	Results	Decision
Perceived Benefits	0.619	< 0.001	Significant	H_1 is Supported
Perceived Risk	-0.295	0.065	Not significant	H_2 is Not Supported
Technological know-how	0.823	< 0.001	Significant	H_3 is Supported
Resources Available	0.798	< 0.001	Significant	H_4 is Supported

Thematic Results

The considerable inclination among Tinapa producers to maintain established practices and their reluctance to embrace change is supported by several interrelated elements. A profound connection to conventional methods, frequently inherited across generations and regarded as central to their cultural identity, generates substantial inertia against the implementation of novel approaches. This resistance aligns with observations that deeply ingrained traditional practices, particularly in food production, often act as significant barriers to the adoption of new technologies (Rogers, 2003). This inertia is compounded by the conviction in the retention of traditional flavor,

as producers worry that any alteration to their customary techniques will negatively affect the distinctive taste characteristics of their tinapa. This concern reflects a common challenge where producers prioritize the perceived quality and authenticity associated with established methods, potentially outweighing the perceived benefits of innovation (Guerrero et al., 2009). The business serves as a familial inheritance and source of pride, representing both economic sustenance and heritage, introducing an emotional dimension to this resistance. This makes any alteration to the existing system challenging to contemplate. Small producers often base their assessment of success on current operations and trusted familial methods, which can inherently limit their drive to explore and implement innovative changes (Amoako & Matlay, 2015). Lastly, a limited recognition of the necessity for change, arising from the view that current methods are sufficient for their present production volume and market reach, lessens any motivation to investigate or invest in new technologies. Tinapa producers may not perceive a significant enough benefit to justify the risks or investments associated with change (Rogers, 2003). Factors such as an experienced but potentially less digitally native workforce and limited awareness of modern production techniques, as observed in various sectors including food production, can further hinder the adoption of innovations (Parungao et al., 2024). Hence, the firm's adherence to traditional Tinapa production methods, driven by cultural values, flavour perceptions, familial legacy, perceived adequacy, limited growth ambitions, and workforce characteristics, impedes the adoption of innovations necessary for enhanced efficiency, quality, and sustainability in the industry.

Table 10. Strong Adherence to Tradition & Resistance to Change

Theme Sub-Theme	Key Reasons for Resistance to Change	Qualitative Responses (Participants Code Number)
Attachment to Traditional Practices	Methods passed down through generations; a core part of identity and heritage; familiarity and comfort with existing methods.	*"Back then, we used sawdust, and we still do." (1), "The original is still better." (2), "This is a legacy, a legacy from my mother." (1), "We prefer the methods we're used to..." (3), "It's already a legacy for us. Yes, it's hard to change." (13)*
Preservation of Traditional Taste	The belief is that deviating from traditional methods will compromise the unique taste and quality of their tinapa.	*"If we change the tools or process, there's a chance the taste will change too." (4), "That's how we've always made tinapa, and that's the original Salinas tinapa, which gives it its authentic flavor." (5)*
Legacy and Family Business	The tinapa business is a family legacy, a source of livelihood and pride; and reluctance to disrupt the established order.	*"This is a legacy, a legacy from my mother." (1), "It's already a legacy for us. Yes, it's hard to change." (13)*
Lack of Perceived Need for Change	Current methods are considered "effective" and "good enough" for their current scale of production and market; no strong incentive to explore new technologies.	*"We prefer the methods we're used to because we're already familiar with them." (3), "That's how we've always made tinapa..." (5), (Implied in some responses)*

The traditional production of tinapa is fraught with several key challenges that impact producers' efficiency and well-being. The significant vulnerability to weather dependency shows the reliance on sun-drying, which directly correlates with findings that highlight how environmental conditions critically influence both the quality of the raw fish and the efficacy of the processing methods (Puke & Galoburda, 2020; Belichovska et al., 2019). Rainy periods, as a disruptive environmental factor, can lead to spoilage and income variability, underscoring the sensitivity of traditional methods to climate conditions. Moreover, the labor-intensive nature of tinapa production, encompassing fish preparation and packaging, aligns with studies indicating that traditional smoking methods require substantial manual labor, consequently limiting production capacity and potentially contributing to physical strain and associated health concerns (Abror et al., 2022). Considerably, exposure to smoke during the traditional smoking of tinapa raises significant health risks, particularly respiratory ailments, identifying traditional smoking as a source of harmful substances that pose health hazards to those involved (Mindjimba et al., 2019). Finally, the economic instability faced by tinapa producers due to fluctuating fish prices in which variable costs, such as transportation and storage, as contributors to price volatility in smoked fish production (Osei et al., 2022), with demand shocks and supply chain disruptions further exacerbating this instability (Schmitz & Emran, 2024). Thus, the challenges articulated in the context of traditional tinapa production are not isolated issues but are consistently reflected and justified within the broader body of studies on fish smoking practices and their associated challenges.

Table 11. Navigating the Challenges of Traditional Production

Sub-Theme	Key Challenges	Qualitative Responses (Participants Code Number)
Weather dependency	Reliance on sun-drying makes production vulnerable to rain, leading to delays, spoilage, and income instability.	*"It's hard during rainy weather because it's difficult to dry the fish."* (4)
Labor-intensive processes	Manual processes from preparation to packaging are physically demanding and time-consuming, limiting capacity and potentially causing health issues.	*"We really don't have time...We wrap it. We really don't have time..."* (5)
Exposure to smoke	Traditional smoking exposes producers to significant amounts of smoke, posing risks to respiratory health.	*"The smoke goes everywhere when you open it."* (6)
Fluctuating fish prices	The unpredictable cost of raw materials (fish) impacts profitability and creates financial instability.	*"There are times when the price of fish goes up..."* (2), *"Sometimes, some fish spoil. If the fish are of poor quality, you can't sell them properly."* (8)

The limited understanding of technology among tinapa producers, where it is often equated with financial capital rather than specific production solutions, results in its lower prioritisation compared to immediate concerns such as capital, infrastructure, and labour. This observation aligns with existing literature, which highlights that financial constraints significantly impede the adoption of new technologies, compelling producers to rely on traditional methods (Afandi et al., 2019). Furthermore, a lack of comprehension regarding the advantages and functionality of new

technologies acts as a barrier to their adoption across various communities (Joewono et al., 2024). This challenge is exacerbated in many developing countries where inadequate infrastructure and financial limitations often overshadow the potential benefits of technological initiatives (Prakash et al., 2023). Even in sectors like agriculture, effective management, and financial support are frequently prioritized over technological advancements, underscoring a broader trend where immediate operational needs can lessen the perceived importance of technology adoption for improving efficiency (Ostaev et al., 2018). Hence, it implies a potential for stagnation and missed opportunities for efficiency improvements compared to sectors with greater technological awareness and adoption.

Table 12. Limited Awareness and Understanding of New Technologies

Sub-Theme	Key Observations	Qualitative Responses (Participants Code Number)
A vague understanding of "technology"	Producers often equate "technology" with basic needs like capital, indicating a limited grasp of specific technological solutions relevant to their production.	"*Capital, perhaps you know something...about technology..."* (1)
Technology as a Secondary Concern	Basic needs such as financial capital, infrastructure repairs (roofing), and manpower are the primary concerns, overshadowing any potential interest or focus on technological improvements for their tinapa business.	*Maybe you'd like to help us fix [the roof]"* (1), *"It's real capital, capital for the business."* (9, 10, 11, 12, 14, 15)

Despite a dominant reliance on traditional methods, some tinapa producers are aware of the potential benefits of modernization, recognizing that adopting new technologies could enhance efficiency and production speed, thereby enabling faster fish processing. This aligns with Afandi et al.'s (2019) findings on smoke machines, which not only improve efficiency by reducing moisture content but also create a healthier working environment by decreasing air pollution —a benefit acknowledged by producers in terms of reduced smoke exposure. Furthermore, the producers' recognition of online selling platforms, as emphasised by Tyshchenko (2024), is that online platforms broaden market access, allowing producers to connect directly with consumers, thereby bypassing traditional distribution channels. This is further supported by Afifah et al. (2024) and Biaga (2022), who highlight how e-commerce enables traditional fish producers to overcome local market limitations and reach a broader customer base. Furthermore, Tyshchenko (2024) noted that e-commerce systems facilitate quicker transactions and improved inventory management, potentially leading to increased sales volume, which are advantages that some tinapa producers are beginning to recognise. This suggests an emerging understanding of how technological advancements, from production to marketing, could positively impact their businesses, even within their current preference for traditional practices.

Table 13. Acknowledgement of Potential Modernization Advantages

Sub-Theme	Key Advantages	Qualitative Responses (Participants number)
Increased efficiency and production speed	Recognition that new methods could potentially accelerate the production process and enhance overall efficiency.	*"It speeds up production. New methods are faster than the old ones."* (3), "*It's faster—this process is faster."* (15)
Reduced smoke exposure	Awareness that modern technologies could lead to a decrease in smoke emissions, thereby improving working conditions for producers.	*"The biggest issue for us here is the smoke...Machines today don't emit as much smoke."* (4)
Other Advantages	Recognition of other potential benefits such as opportunities in online selling.	*"The advantage now is the rise of online selling...it brought good advantages..."* (2)

Key Insights From Correlation and Narrative Findings

The triangulation of findings reveals a critical dichotomy. While tinapa producers exhibit a foundational motivation to adopt technology driven by recognised benefits, this inclination is significantly constrained by a palpable lack of technological expertise and limited access to essential resources. This situation is complicated by their strong cultural and economic commitment to traditional methods, which creates resistance to change, even when the benefits of modern approaches are recognized. Interestingly, the very challenges inherent in traditional tinapa production, such as weather dependency, labour intensity, and health risks, present distinct opportunities where targeted technological interventions could yield substantial improvements in efficiency, sustainability, and overall profitability. Considerably, overcoming this complex interplay necessitates a strategic focus on comprehensive education and robust support systems, including targeted training to bridge the knowledge gap, financial assistance to alleviate resource limitations, and infrastructural development to create an enabling environment for technology adoption within this culturally significant industry in the Philippines.

Moreover, this study makes a relevant contribution to SDG 8 (Decent Work and Economic Growth) by demonstrating how understanding the perceived technological benefits of tinapa producers can directly enhance their economic productivity, informing policies that promote entrepreneurship and improve working conditions in the informal economy. Concurrently, SDG 9 (Industry, Innovation, and Infrastructure) provides crucial insights into fostering inclusive industrialisation and technological upgrading in the traditional tinapa sector. By identifying adoption barriers such as caution, perceived risks, limited knowledge, and scarce resources, the research informs strategies for developing accessible technologies, targeted training, and micro-financing to modernise these small-scale industries and enhance market access.

CONCLUSIONS

The researchers conclude that tinapa producers' cautious stance toward technology adoption is shaped by a complex interplay of factors, offering valuable insights that both validate and refine established theories of acceptance. While producers recognise potential benefits, such as reduced labour and improved product longevity, their neutral adoption intention stems from perceived financial and operational risks, limited technological understanding, and scarce resources, particularly financial capital. The findings validate the core constructs of TAM, as

perceived benefits (usefulness) and technological knowledge (ease of use) strongly correlate with adoption intention. However, the overall neutral intention suggests that TAM's simplicity may not fully capture the contextual factors that impede definitive commitment. TPB offers a more comprehensive lens: perceived benefits and risks shape attitudes, while technological knowledge and available resources strongly validate perceived behavioral control, highlighting both motivational and enabling factors. The non-significant impact of perceived risk on intention, despite its acknowledgement, suggests that benefits and control may outweigh risk aversion in this context. Qualitative data further contextualises these trends, revealing that cultural commitment to tradition and basic financial needs are influential factors. Furthermore, promoting technology adoption in this traditional sector requires a comprehensive strategy that demonstrates tangible advantages, provides substantial financial and infrastructural support, and offers targeted educational initiatives tailored to the unique challenges and cultural context of tinapa producers in Rosario, Cavite.

LIMITATION & FURTHER RESEARCH

The present study, although providing preliminary insights into technology adoption among tinapa producers in Rosario, Cavite, Philippines, is constrained by a relatively modest sample size, which may limit the external validity and generalizability of its findings to the broader population of tinapa producers within the region and beyond. Furthermore, the cross-sectional research design inherently restricts the capacity to establish causal inferences between the examined variables and to track the dynamic evolution of producers' perceptions and adoption behaviors over time. To address these limitations and advance the current understanding, future research endeavors should prioritize the implementation of longitudinal study designs, enabling the observation of temporal trends and the identification of causal pathways. Expanding the sample size to encompass a more representative cross-section of tinapa producers would enhance the robustness and generalizability of the findings. Future research should assess the adoption and impact of specific technological interventions on key outcomes, such as production efficiency, product quality, market access, and economic viability, within the tinapa sector. It is also important to investigate the significant role of external factors, including government support, financial access, specialized training, and industry organizations. Conducting comparative studies across different regions can provide valuable insights into effective practices and local factors that influence the adoption of technology. Finally, future researchers could explore participatory methods, such as action research or community-based participatory research, to involve tinapa producers directly in the development of new technological solutions.

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