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| RESEARCH ARTICLE

Technology-Driven Operational Efficiency and Security in Casinos: An Empirical Analysis of Adoption and Impact

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| ABSTRACT

This study aims to examine the impact of Casino Technology Adoption (CTA) on Operational Efficiency (OE) and Security (S) within the casino industry, with Firm Profile (FP) as a moderating variable. Survey data were collected from casino firms, and Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied to assess direct and moderated relationships. The results indicate that CTA has a strong positive effect on both OE and S, underscoring the role of technology in enhancing casino operations. However, FP did not exhibit a significant moderating effect on the relationships between CTA and OE or between CTA and S, suggesting that firm characteristics such as firm size, years of operations, and net worth may not critically alter the technology-efficiency or technology-security relationship in this context. This finding highlights the direct influence of technology adoption in achieving operational and security improvements, regardless of firm-specific factors. The study provides practical insights for casino firms seeking to leverage technology for efficiency and security gains. It contributes to the literature by exploring the nuances of the impact of technology adoption on the casino industry.

| KEYWORDS

Technology-Driven Operational Efficiency; Security; Casino Technology Adoption

| ARTICLE INFORMATION

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1. Introduction

The general perception of Southeast Asia (SEA), particularly the Philippines, is notable for its vast, sprawling natural habitats, glistening sand beaches, accommodating citizenry, and exotic wildlife. However, the Philippines is quite known for its casino industry. This industry is healthy and has seen much development and investment in entertainment and pleasurable activities (Kanetkar & Autry, 2021; Kim & Lieberman, 2019).

Recent events have destabilized the Philippine casino gaming industry. There are incidents that have compromised customers' security (Rashid & Kader, 2022). Research by Singh and Choi (2021) stated that casino security and top management have also become at the forefront of the industry's concerns, even to the extent of overshadowing the aftermath of the COVID-19 pandemic on the industry. The drastic change that is happening in Casinos across the globe has left the Philippine casino industry in an unusual spot.

The advancement of technology changed the game and operations of Casino firms across the globe. Based on the studies, by adopting sophisticated tools, casino firms have emerged to be foolproof and operationally efficient (Belanger & Begault, 2018; Mccarthy & Hayday, 2020)

The use of analytics, machine learning, and even robotics have changed the usual game which is now the standard of competitiveness. Therefore, the adoption of technology by casino firms in the Philippines should be looked into.

Despite the advancements in casino technology, there remains a notable gap in the literature regarding the significant effects of casino technology adoption on operational efficiency and security, particularly with a nuanced focus on the moderating role of a company's profile (such as firm size, years of operation, and net worth). Previous studies have largely focused on general technological innovations in service-based industries, covering aspects like improved customer experience, operational streamlining, and enhanced data protection (Chang & Chen, 2019; Fong et al., 2021; Takahashi, Muraoka, & Otsuka, 2020). However, specific exploration into the casino sector's unique regulatory and operational landscape has been limited, especially in understanding how advanced technologies affect both operational efficiency and security protocols unique to casinos (Ye & Deng, 2023; Imhanzenobe, 2019; Lipovic, 2022).

Additionally, while some studies examine operational efficiency improvements due to technology in service industries (Tian et al., 2022; Michie et al., 2020), limited research addresses the direct influence of casino technology adoption on operational efficiency outcomes, such as faster transaction times, improved resource allocation, and enhanced workforce management (Smith et al., 2020; Kim & Liu, 2023; Hayes, 2022; Chen et al., 2020). The security implications of technology adoption in casinos—such as real-time monitoring systems, anti-fraud measures, and advanced surveillance—have similarly received inadequate attention, with existing studies focusing more broadly on general surveillance technology and data security within hospitality (Patel & Zheng, 2022; Raza, Wang, & Lin, 2021; Hunt, Agarwal, & Zhuang, 2021). Thus, the limited studies with regard to the connections of technology adoption, operational efficiency, and security in the casino industry is a notable gap for this study. This presents a gap in understanding how technology specifically tailored to casinos addresses unique security concerns, like fraud detection, underage gambling prevention, and customer identity protection.

Furthermore, there is limited exploration of the moderating effect of a firm's profile on these relationships. Some research hints that larger companies with stronger financial positions and more comprehensive compliance departments may experience distinct impacts from technology adoption compared to smaller or less financially secure casinos (Li & Wong, 2022; Clark & Wilson, 2021; Zhang & Choi, 2023). However, empirical studies investigating how firm profile aspects such as firm size, years of operation, and net worth moderate the effects of casino technology adoption on operational efficiency and security are scarce. Addressing these gaps would provide casino industry stakeholders with deeper insights into optimizing technology investments based on organizational characteristics and offer guidance for future research on industry-specific technology adoption effects (Brown et al., 2021; Morgan & Riley, 2023; Lee & Tang, 2022).

In light of the discussed issues present in the academic literature, this study aims to resolve these prominent gaps by diving into the current state of affairs of Philippine gambling organizations through an empirical model. Moreover, the study aims to formulate a framework for casino gaming automation which may impact operational efficiency and security.

2. Review of Related Literature and Hypothesis Development

2.1 Theoretical Underpinnings

The theoretical framework for this research integrates three key theories— Technology-Organization-Environment (TOE) Framework and Contingency Theory—to provide a comprehensive approach to the effect of technology adoption on operations efficiency and security, particularly in the Casino industry. Technology-Organization-Environment (TOE) Framework explains how technology adoption is influenced by factors within an organization's internal environment (e.g., technological and organizational factors) and external environment (e.g., regulatory and market factors). It has been widely applied to study operational efficiency improvements and security implications. The TOE framework, introduced by Tornatzky and Fleischer (1990), is pivotal in understanding the adoption of technology in organizations. It posits that the adoption of technological innovations is shaped by three critical factors: technological, organizational, and environmental contexts. Technological factors include the availability and complexity of security technologies, organizational factors involve the structure and readiness of casino firms to integrate new technologies, while environmental factors encompass the competitive landscape and regulatory environment (Baker, 2012; Oliveira & Martins, 2011). Casinos, by adopting advanced technologies, can enhance both their operational efficiency and security systems. Meanwhile, the Contingency Theory suggests that the effectiveness of technology adoption on operational efficiency and security varies depending on the organization's context, such as size, industry, or regulatory environment. As discussed by Donaldson (2001) and Lawrence and Lorsch (1967), asserts that there is no one-size-

fits-all approach to organizational structure or technology adoption. Instead, organizations must adapt their strategies and structures to their unique environments and situations. In the context of casinos, Contingency Theory suggests that factors such as firm size, market conditions, and the specific challenges a casino faces (e.g., high security risks or operational inefficiencies) will influence the type of technology adopted. For instance, larger casinos may adopt more sophisticated security technologies due to greater financial resources and the complexity of operations, while smaller casinos may focus on cost-effective security measures (Hartono et al., 2019). Thus, the theory emphasizes the need for a tailored approach to adopting technology to optimize operational efficiency and security.

2.2 *Casino Technology Adoption*

Casino Technology adoption has become a significant driver of productivity and sustainability across various industries, offering critical insights for the casino industry, where technological advancements are increasingly central to operational efficiency and competitive advantage. The role of technology adoption in boosting organizational productivity is well-documented, as shown in studies like Lakhwani et al. (2020) and Anzoategui et al. (2019), which highlight how technology adoption enables firms to streamline operations and improve performance metrics. While most studies, including Al-Emran and Griffy-Brown (2023), Chavas and Nauges (2020), Janssen et al. (2020), and Toufaily et al. (2021) explore the positive impacts of technology adoption on sustainable development, gaps remain in understanding its specific impacts on service-oriented sectors like casinos, where operational complexities differ substantially from other industries such as manufacturing or agriculture.

Research focusing on network-based technology adoption, such as that by Beaman et al. (2021), Hooks et al, (2022), and Kumar and Ayedee (2021) underscores the importance of social influence in accelerating the adoption rate, which may have parallels in casinos where customer and staff interactions drive rapid technology utilization. Although there is extensive literature on technology adoption across different sectors, including government (David et al., 2023; Takahashi, Muraoka, & Otsuka, 2020; Skare & Soriano, 2021) and supply chain management (Kamble et al., 2019; Mitzner et al., 2019; David et al., 2023), the casino industry's distinctive technological challenges have not been deeply explored, particularly regarding operational efficiency and enhanced security.

2.3 *Operational Efficiency*

Operational efficiency is a critical focus for businesses aiming to maximize resource utilization and enhance profitability, and this goal is especially pertinent in the casino industry, where seamless service delivery and financial stability are paramount. Operational efficiency has been shown to directly affect financial sustainability, as evidenced in the work of Imhanzenobe (2019), Cai et al. (2019), and Safitri et al. (2020), which found that efficient operations were strongly correlated with the financial resilience of casino firms. Moreover, achieving operational efficiency can not only drive profitability but also improve customer satisfaction and regulatory compliance, given the high-volume, service-oriented nature of the industry (Iris & Lam, 2019; Dobslaw & Ortlinghaus, 2020)

The financial ratios commonly used to assess operational efficiency, such as return on sales and gross profit margins, provide valuable metrics for evaluating casino performance. Leeds (2021) and Vaidya (2022) discuss these ratios as tools for analyzing financial health, suggesting that an efficient operation in casinos could be measured by similar ratios to understand revenue generation relative to operational expenses. Hayes (2022) and Zhang et al. (2020) further emphasize the importance of profitability ratios, which casinos can employ to benchmark their performance against industry standards, thereby identifying areas of potential improvement (Liu et al. 2020; Safitri, Sari, & Gamayuni, 2020; Suryadevara, 2021).

2.4 *Security*

Dibaji et al. (2019) and Collins (2022) state that security is a foundational concern in the casino industry, where vast amounts of financial transactions and sensitive data, along with physical security needs, pose complex challenges. Casino security extends beyond traditional physical measures, incorporating digital technologies and cybersecurity to protect assets and ensure a safe environment for guests and staff (Wang et al., 2022; Malik, 2020). According to Lipovic (2022), casino security plays a critical role in managing the on-site risks associated with theft, fraud, and customer safety, highlighting the importance of robust on-the-ground security protocols. However, with the increased digitization of casino operations, reliance on physical security alone is no longer sufficient.

The integration of Industry 4.0 technologies, as explored by Ghobakhloo (2020), offers casinos opportunities to enhance security through automation and real-time monitoring systems. These technologies can improve operational efficiency and facilitate rapid response to potential security threats, but they also introduce new cyber vulnerabilities. Emerging digital realms

like the metaverse, which casinos may explore for interactive gaming experiences, bring added security and privacy challenges, as outlined by Wang et al. (2022) and Chen et al. (2022). These studies suggest that as casinos adopt virtual platforms, they must address issues such as data privacy and virtual asset protection to maintain trust and safety within these digital environments (Dibaji et al., 2019; Collins, 2022; Di Pietro & Cresci, 2021).

2.5 Relationship between Casino Technology Adoption and Operational Efficiency

The relationship between technology adoption and operational efficiency is increasingly important in industries where real-time data and advanced digital tools offer competitive advantages, making it particularly relevant for casinos (Thuan et al., 2022; Michie et al., 2020). Operational efficiency, often measured by profitability ratios (Hayes, 2022), can be significantly enhanced by adopting technologies that streamline processes and reduce manual intervention. Chen et al. (2020) found that internal auditing functions leveraging technology adoption improved operational efficiency by ensuring more accurate financial oversight, which can be highly beneficial for casinos managing extensive cash flows. Additionally, in a study on ship operations, Kim et al. (2020) and Thuan et al. (2022) demonstrated that big data technology could effectively improve operational efficiency through enhanced tracking and resource management, a concept translatable to casinos that rely on monitoring real-time player activity and resource allocation across the casino floor (Hasan et al., 2020; Tian et al., 2022).

H1: Casino Technology Adoption on Operational Efficiency

2.6 Relationship between Casino Technology Adoption and Security

The adoption of technology has a critical impact on security within various industries, including the casino sector, where robust security measures are essential for protecting both financial assets and customer data (Knight, Yuan, & Bennett Gayle, 2024; Mattson, Aurigemma, & Ren, 2023). Raza et al. (2021), Adenle, Wedig, & Azadi, (2019), and Berlilana et al. (2021) discuss the role of technology in enhancing energy security and ecological sustainability, showing that similar principles of efficiency and protection can apply to casino security where operational sustainability and data protection are priorities. Hunt et al. (2021) and Malabayabas et al. (2023) explore technology adoption in airport security, particularly balancing transparency with confidentiality to prevent security breaches—an approach directly relevant to casinos, which similarly face challenges in maintaining secure yet publicly accessible environments. Salleh and Janczewski (2019) and Al Hadwer et al. (2021) point out that security considerations are central when adopting big data solutions in sectors with significant financial transactions, such as banking, and this principle directly translates to the casino industry, where real-time data usage requires vigilant security measures to safeguard data integrity (Alqahtani & Erfani, 2021; Al Hadwer et al., 2021).

H2: Casino Technology Adoption on Security

2.7 Moderating Effect of Firm Profile in the Relationship between Casino Technology Adoption and Operational Efficiency

The moderating effect of firm profile—specifically, factors like firm size and years of operation—on the relationship between technology adoption and operational efficiency is critical in industries that are heavily reliant on data and customer interaction, such as the casino industry (Hernández et al., 2020; Yin et al., 2022). Corvino et al. (2019) highlight that firm size can significantly influence how relational capital contributes to firm performance, suggesting that larger casinos may see greater operational benefits from technology adoption due to their ability to leverage expansive relational networks. Larger casinos, with more substantial resources, are often better equipped to implement complex technological systems, which can drive operational efficiency through improved customer management and data analysis (Salah et al., 2021; Hartono et al., 2019).

H3: Firm Profile has a mediating effect on the Relationship between Casino Technology Adoption and Operational Efficiency

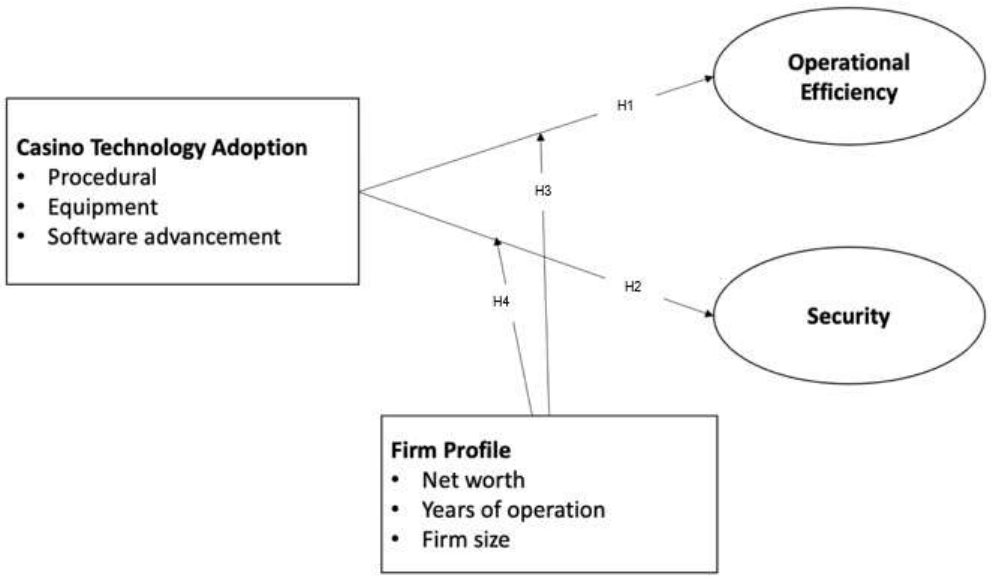
2.8 Moderating Effect of Firm Profile in the Relationship between Casino Technology Adoption and Security

Research into the moderating effect of firm profile on the relationship between technology adoption and security is increasingly relevant for industries that prioritize high levels of security, such as the casino industry. In examining firm size, Corvino et al. (2019) and Salah et al. (2021) suggest that larger firms have an advantage in leveraging relational capital, which can translate to stronger security measures when implementing advanced technologies. This advantage is especially crucial for casinos, where larger operations have the resources to invest in robust security technologies and manage the security complexities associated with high customer volumes and financial transactions (Hernández et al., 2020). Similarly, Hernández et al. (2020) and Hartono et al. (2019) indicate that firm size moderates the impact of corporate social responsibility on economic performance, implying that larger firms can adopt security-enhancing technologies with greater efficiency and public trust. This

is pertinent for casinos, where a strong commitment to security can enhance reputation and customer loyalty, especially as larger firms are more likely to have the infrastructure necessary to support sophisticated security protocols (Corvino et al., 2019).

H4: Firm Profile has a mediating effect on the Relationship between Casino Technology Adoption and Security

2.9 *Conceptual Framework*



As presented in Figure 1, the study aims to hypothesize how Casino Technology Adoption linked with Operational Efficiency and Security. Moreover, this study wants to determine the moderating effect of Firm Profile.

3. Methodology

3.1 Research Participants and Data Collection Procedure

This study prioritized ethical standards to protect participants. Informed consent will be obtained, ensuring participants understand the study's purpose, risks, and their right to withdraw. Data is anonymized to maintain confidentiality, securely stored, and used only for research. This study maintained transparency through ethical compliance and credibility throughout the research process. This study was scrutinized by the University's Ethics Review Board and was modified based on their recommendations.

The respondents of this study were executives or at least held supervisorial positions in casinos under the Philippine Amusement and Gaming Corporation (PAGCOR). They are male and female, with at least 2 to 3 years in the company. Furthermore, a month-long online data gathering was employed through Google Forms from October to December 2023.

Using a statistical power analysis approach with an alpha of 0.05, power of 0.80, and a medium effect size of 0.15, a sample size of approximately 120 participants was recommended. However, 215 casino managers took part in the survey.

The respondents were asked to participate voluntarily in the study through informed consent. They were reached through Google Forms. The researchers assured that the data and information gathered would remain confidential and strictly used for research purposes.

3.2 Instrumentation

To formulate the survey questionnaire, Likert scale items were modified from existing literature to measure the study's variables, as exhibited in Table 1.

Table 1 Questionnaire Items Adapted from Previous Studies

Constructs	Items	Sources
Technology Adoption	The casino continuously adopts new procedures and methods towards efficiency and service quality.	Takahashi, Muraoka, and Otsuka (2020) and Chavas and Nauges (2020).
	The casino is critical of its procedures and continuously adapts to new methodologies.	
	The Equipment and tools being installed are always up-to-date and sophisticated	
	Features and capabilities of equipment and tools in the casino are of the latest technology	
	Software applications for casino operations and gaming is always updated to the latest edition.	
	Software applications are state-of-the-art and not available to all casino firms.	
Operational Efficiency	Based on records, Return of Sales for the past 3 years is increasing.	Leeds (2021), Vaidya (2022), and Srivastav (2022)
	Based on records, Return on Total Assets for the past 3 years is increasing.	
	Based on records, Return on Total Equity for the past 3 years is increasing.	
	Based on records, Return on Total Equity for the past 3 years is increasing.	
	Based on records, Operating Profit for the past 3 years is increasing.	
Security	The casino security of the enterprise depends highly on the personnel assigned to the casino floor.	Lipovic (2022), Ghobakhloo (2020), and Collins (2022).
	The business considers the use of floor personnel as an important security measure.	
	Surveillance systems are highly employed in the casino for the security of the establishment.	
	The establishment's crime deterrence rests on cyber-security hardware and software.	
	The utilization of internal anti-fraud mechanisms is currently adopted by the organization	

The verbal scale used was 1 – Strongly Disagree to 4 – Strongly Agree.

3.3 Statistical Treatment

This study used Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze the relationships between Technology Adoption (independent variable), Firm Profile (moderating variable), and Operation Efficiency and Security (dependent variable). PLS-SEM is suitable for complex models with smaller sample sizes and non-normal data (Hair et al., 2017).

In the measurement model, each construct— Technology Adoption, Operation Efficiency, and Security—is assessed through reflective indicators. The model's reliability and validity are tested through criteria like indicator loadings, composite reliability (CR), and average variance extracted (AVE) (Fornell & Larcker, 1981).

The structural model tests the relationships between constructs. Hypotheses include: (1) Technology Adoption positively impacts Operation Efficiency, (2) Technology Adoption positively impacts Security, (3) Moderating Effect of Firm Profile in the Relationship between Casino Technology Adoption and Operational Efficiency, and (4) Moderating Effect of Firm Profile in the Relationship between Casino Technology Adoption and Security Path coefficients are evaluated using bootstrapping, and model fit is assessed with R^2 and Q^2 values (Hair et al., 2019). Moderation analysis confirms the indirect influence of Firm Profile on through Technology Adoption, Operation Efficiency, and Security.

4. Results

4.1 Measurement Model of Evaluation

Table 2. Scale Reliability Statistics

Construct	Items	Cronbach's a	Loadings	Ave. Var. Ext.	Validity	Reliability
Casino Technology Adoption	1	0.862	0.69	0.551	Yes	Yes
	2		0.713			
	3		0.867			
	4		0.716			
	5		0.711			
Operational Efficiency	1	0.818	0.779	0.557	Yes	Yes
	2		0.667			
	3		0.746			
	4		0.653			
	5		0.865			
Security	1	0.709	0.688	0.594	Yes	Yes
	2		0.768			
	3		0.776			
	4		0.844			
	5		0.768			

Cronbach's alpha should be larger than 0.70 for reliability. All loadings must be more than or equal to 0.50 for convergence validity, and all ave. Should be => 0.50 when extracted.

The findings are shown in this table. The required composite reliability standard of > 0.70 was considerably exceeded by all survey questions for each qualified build. They demonstrate composite reliability as a result. In addition, all Cronbach's

alpha values are higher than the acceptable threshold of > 0.70, which provides additional support for the reliability of the constructions.

The target is that all loadings and all Average Variance Extracted (AVE) should be =>0.50 for the validity assessment. The questionnaire items for the relevant constructs exceed these standards as a result of the results shown above. As a result, they are regarded as valid.

Discriminant Validity

Table 3. Discriminant Validity for Reflective Constructs

Construct Matrix	CTA	OE	S	Discriminant Validity
Casino Technology Adoption (CTA)	**0.742**			Yes
Operational Efficiency (OE)	0.411	**0.746**		Yes
Security (S)	0.269	0.352	**0.77**	Yes

The Square Root of AVE (bold figures) should, for Divergent Validity, be higher than the correlations between constructs (diagonal figures).

A test to determine if respondents can distinguish one variable from the other and grasp the differences between the variables is known as discriminant validity, also known as divergent validity. The square root of the AVE (SQRTAVE), shown in bold figures, must be greater than the correlations of each variable to one another for there to be discriminant validity among the constructs. This type of validity test is a measure of whether respondents are able to distinguish one variable from another, as well as identify their differences. Therefore, as exhibited in the table, each construct meets the standard; thus, it means that the constructs meet discriminant validity.

The measurement model is deemed appropriate in light of the findings of composite reliability, convergent reliability, and discriminant validity. Therefore, it is possible to execute the structural model evaluation right then.

Structural Model Evaluation

Structural Path Results

Table 4. Direct Path Analysis

Path	Path Coefficient (β)	SE	p	Interpretation
CTA to OE	0.7795	0.0458	<.001	**H1 Accepted**
CTA to S	0.3132	0.0514	<.001	**H2 Accepted**

Note: If the p-value is lower than 5% or 0.05, it is statistically Significant. If the p-value is greater than 5%, the result is statistically non-significant.

Table 2 displays the direct effects between constructs, with path coefficients (β), standard errors (SE), and significance levels (p-values) for each path. Casino Technology Adoption (CTA) has a strong positive and statistically significant impact on both Operational Efficiency (OE) (β = 0.7795, SE = 0.0458, p < .001) and Security (S) (β = 0.3132, SE = 0.0514, p < .001), indicating that improvements in technological adoption are associated with increased operational efficiency and security.

Table 5. Indirect and Total Effects

Moderating Variable	Coefficients (β)		SE		p	
	CTA to OE	CTA to S	CTA to OE	CTA to S	CTA to OE	CTA to S
Indirect Effects:						
Net Worth	0.0470	0.0632	0.0596	0.0668	0.431	0.345
Years of Operation	0.1107	0.0905	0.0689	0.0773	0.109	0.243
Firm Size	0.0157	0.0647	0.0426	0.1198	0.712	0.590
Total	0.0578	0.0728	0.0570	0.0880	0.4173	0.3927

Table 3 presents the indirect and total effects of the moderation analysis. The moderation effect of Firm Profile on the relationship between CTA and OE is not significant (β = 0.0578, SE = 0.0570, p = 0.4173). Similarly, the moderation effect of Firm Profile on the relationship between CTA and S is not significant (β = 0.0728, SE = 0.0880, p = 0.002), mediating 18.78% of the total effect. The total effect (β = 0.607, SE = 0.081, p = 0.3927), shows the combined impact of both the direct and indirect paths.

The overall structural model is illustrated in Figure 2.

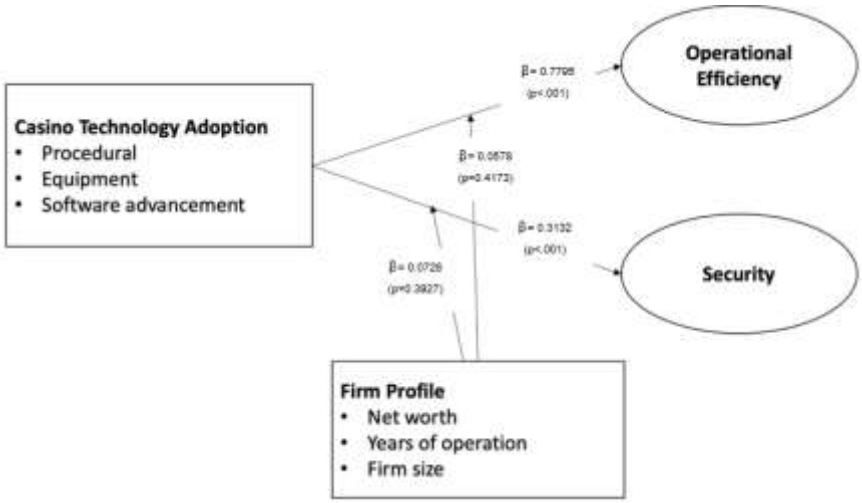


Figure 2. Structural Model

5. Discussion

The findings presented reveal strong and statistically significant direct effects of casino technological adoption (CTA) on both operational efficiency (OE) and security (S) within casino operations. Specifically, the path coefficient for CTA to OE is β = 0.7795, which suggests that improvements in technology adoption are strongly linked to higher operational efficiency. Similarly, the positive path coefficient for CTA to S (β = 0.3132) indicates a moderate but significant positive impact of technology adoption on security enhancements. The significance of both effects (with p <.001) demonstrates the robustness of the relationship.

On the other hand, the moderation analysis results suggest that Firm Profile—encompassing characteristics like firm size, years of operations, and net worth—does not significantly moderate the relationships between CTA and the two dependent

variables (OE and S). The moderation effect on the relationship between CTA and OE has a path coefficient of $\beta = 0.0578$, with a p-value of 0.4173, which is well above the typical threshold for significance ($p < 0.05$). Likewise, the moderation effect on CTA to S ($\beta = 0.0728$, $p = 0.002$) also fails to show a meaningful interaction, with only 18.78% of the total effect being mediated by firm profile.

6. Conclusion

This study underscores the significant role of technological adoption in enhancing both operational efficiency and security in the casino industry. The strong, positive relationships found between technology adoption and these operational outcomes highlight how essential technological innovations are in modern casino operations. Regardless of firm profile, casinos benefit from adopting advanced technology, suggesting that the efficiency and security improvements driven by technological solutions are largely universal across different types of casinos, whether they are large or small, old or new.

The absence of a significant moderating effect from firm profile (such as firm size, years of operations, and net worth) indicates that, in the context of technology adoption, these characteristics do not play a pivotal role in determining how effectively technology can enhance operational outcomes. For casino managers and industry stakeholders, the key takeaway is that technology adoption should be prioritized as a means to drive efficiency and security, regardless of the firm's profile. This approach not only optimizes operations but also ensures that casinos remain competitive and secure in an increasingly tech-driven industry. Consequently, investments in technology can provide substantial returns in terms of improved operational performance and security, offering casinos a pathway to long-term success.

6.1 Practical Implications

The findings of this study offer several practical implications for the casino industry, particularly in regard to the adoption of technology to enhance operational efficiency and security. First, casinos—regardless of their size, years of operations, and net worth—should prioritize technological investment as a strategic avenue for improving performance. Technological solutions, such as advanced security systems, AI-driven operational tools, and automated processes, have proven to significantly enhance both the efficiency of operations and the robustness of security measures. These advancements can help reduce operational costs, streamline management, and ensure compliance with industry regulations.

Second, the absence of a significant moderating effect from the firm profile suggests that smaller or younger casinos should not shy away from technological investments simply because of their scale or age. While larger casinos may traditionally have more resources to invest in technology, this study indicates that technology adoption is beneficial across the board, and smaller casinos can also leverage these tools to compete more effectively. In fact, smaller firms can potentially see even more substantial returns on their investments as they adopt technologies that scale with their needs, creating opportunities for them to close the gap with larger competitors.

6.2 Theoretical Implications

This study contributes to the theoretical understanding of technology adoption by integrating Technology-Organization-Environment (TOE) framework and Contingency Theory, particularly within the dynamic context of the Casino industry. The study's findings on the effects of technology adoption on operational efficiency and security in the casino industry contribute significantly to the body of knowledge on technology adoption theories such as the TOE framework and Contingency Theory. Specifically, the absence of a significant moderating effect of firm profile on technology adoption outcomes suggests that the relationship between technology adoption and improved performance is largely consistent across casino firms of different sizes, ages, and market positions.

The casino industry, as a highly regulated and security-focused sector, benefits universally from technological investments, suggesting that industry norms and pressures for security and efficiency drive technology's effectiveness more than internal firm differences do. This finding implies that casinos may adopt technology more because of institutional pressures (e.g., regulatory demands) than because of individual firm characteristics.

The study's results also extend Contingency Theory by indicating that the alignment of technology with operational goals, rather than the size or maturity of a casino, may be a more critical factor in determining successful outcomes. This supports the notion that the fit between technology and operational needs is more relevant than the firm profile, highlighting the importance of contextual adaptability within Contingency Theory for casino firms. In summary, the study reinforces the notion that industry-specific requirements can outweigh firm-specific characteristics in moderating the effects of technology adoption, adding depth to existing theories of technology adoption and operational efficiency.

6.3 Limitations and Future Studies

This study has a few limitations that should be acknowledged. First, it focuses specifically on the casino industry, which may limit the generalizability of the findings to other sectors with distinct operational and security dynamics. Second, data were collected from casino firms within a single country, which may introduce regional or regulatory biases that could affect the results. Third, the study relies on self-reported survey data, potentially introducing response bias, as participants' subjective views may affect their operational efficiency and security assessment. Lastly, while a robust PLS-SEM analysis was employed, the study does not account for potential unmeasured variables that could influence the relationships between technology adoption, firm profile, operational efficiency, and security. Future research could address these limitations by including a broader range of industries, exploring cross-country samples, and incorporating additional moderating or mediating variables.

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