Assessing the Impact of the B-EST Digital Tax System on Business Tax Revenue in Muntinlupa City: A Difference-in-Differences Analysis

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Abstract

This study evaluates the impact of the Business E-payment System (B-EST), a digital tax payment system implemented by the local government of Muntinlupa City, on business tax revenue collection. Introduced during the COVID-19 pandemic to facilitate contactless transactions and to improve administrative efficiency, B-EST represents a broader shift toward digital governance in local fiscal administration. While existing literature suggests that digital tax systems enhance transparency, reduce transaction costs, and improve compliance, empirical evidence at the local government level in the Philippines remains limited.

Using annual business tax revenue data from 2014 to 2023, this study employs a Difference-in-Differences (DiD) econometric model that compares Muntinlupa City (treatment group) with Las Piñas City (control group). The analysis includes pooled Ordinary Least Squares (OLS) and Two-Way Fixed Effects (TWFE) models to isolate the impact of the implementation of B-EST while controlling for time-invariant city characteristics and common macroeconomic shocks.

The study contributes to the growing literature on digital tax administration in developing economies by providing localized empirical evidence. It highlights the importance of complementary investments in digital infrastructure, taxpayer education, and institutional capacity to maximize the fiscal benefits of e-governance reforms.

Acknowledgement

First and foremost, I offer my deepest gratitude to God for His guidance while undergoing the writing of my thesis. His presence gave me strength during the most difficult times in my life. To my parents and siblings, thank you for your unwavering support, sacrifices, and encouragement. Your constant belief in my capabilities and your frequent sacrifices served as the fuel to my fire. To my girlfriend, thank you for your support and constant presence during the long nights of my academic endeavors. Your presence gave me the strength that I needed to carry on.

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To my lola, I am still wounded by your passing. Not a day goes by where I do not wish that you could see me graduate and fulfill the promises that I made to you. I pray that you watch over me while I fulfill the promises that I made. I am sorry. Finally, to myself, may this section serve as a stark reminder to never forget those who bled and cried with you during the countless battles that you have faced. It is our duty to honor their sacrifices and belief in us by never giving up. You are who you are because you always refused to give up. *Audentis Fortuna Iuvat*.

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Chapter 1

Background of the Study

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Introduction

Government services digitization is one of the most important means of enhancing public administration's efficiency, accessibility, and transparency. Through ease and convenience of making tax payments, electronic tax payment systems reduce administrative costs, enhance compliance, and promote financial inclusion.

Such a worldwide revolution is represented by Muntinlupa City's Business Electronic Service Tool or B-EST program. In facilitating both taxpayer and businessman's online payments for taxes, B-EST reduces the process of collecting the city's tax while avoiding face-to-face meetings. The objective of the program is to escape traditional tax paying outlets' disadvantages such as the congestion of queues, unnecessary paperworks, costly transactions, and poor collection.

Initially, B-EST was established to avoid face-to-face interactions during the pandemic. Due to the restrictions implemented by the Philippine government during the pandemic, B-EST was created to provide an alternate method of completing the necessary business transactions for Muntinlupa City’s taxpayers. Moreover, the tax system will also increase the convenience and

accessibility on the part of the taxpayers due to B-EST's partnership with other partner banks and over-the-counter payment options to provide a broader platform for Muntinlupa City taxpayers (Hicap, 2020).

Quezon City has acknowledged the importance of the digitalization of their services. In lieu of this, Quezon City later implemented the online business tax collection of their citizens in 2022. The rationale of the establishment of their online business tax collection system is also similar to Muntinlupa City's, which is to expand the accessibility of their services while improving the convenience of their tax administration (Quezon City Government, 2022).

Nevertheless, scholarly writing on the administration and impacts of the establishment of digitalized tax systems is limited. Electronic tax systems such as B-EST can shift firm investment, consumption patterns by consumers, and tax compliance through reducing transaction costs and enhancing ease.

It examines the effect of the implementation of the B-EST program on the tax revenue collection in Muntinlupa City. Specifically, it considers how the B-EST system has affected the tax revenue collection of Muntinlupa by comparing the business tax collection of Muntinlupa before its implementation. In doing this, the research aims to contribute to the understanding of the implications of the digitalization of tax systems, specifically on business tax revenue collection, and offer insights that may be useful for potential future implementations of policy.

Statement of the Problem

The primary aim of this study is to assess the impact of the implementation of the B-EST system in Muntinlupa City. While existing studies highlight the administrative advantages of

digital tax systems, there is a need to compare and evaluate the period after its implementation and before its implementation. Specifically, this study seeks to answer the following questions:

1. How was Muntinlupa City's B-EST System designed and implemented?

2. How impactful were the changes implemented by the B-EST system on Muntinlupa City's tax collection?

3. What policy recommendations are applicable to improve the impact of the B-EST implementation?

By using these specific questions, the researcher aims to understand and analyze how the changes of the implemented B-EST system have changed the business tax revenue collection of Muntinlupa city.

Research Objectives

General Objective

To evaluate the impact of the B-EST system on Muntinlupa city's business tax revenue collection using a difference-in-differences approach.

Specific Objectives

- To document Muntinlupa City's historical business tax revenue collection from 2014 to 2023.
- To describe the design, implementation, and features of the B-EST system.
- To assess the impact of the B-EST system on business tax revenue using a difference-in-differences approach.

- To compare the tax revenue trends of Muntinlupa with a comparable control city that has not implemented an online business tax payment system (Las Piñas).
- To propose policy recommendations for improving the B-EST system.

The research seeks to present an insight into how the implementation of Muntinlupa city's digitalized tax system has impacted the tax revenue collection of Muntinlupa city.

Significance of the Study

This research is significant for several key stakeholders:

- **Local Governments and Policy Makers:** The findings will serve as a benchmark for governing bodies and serve as a basis for future adjustments toward the B-EST system depending on the findings of the study. The findings may also help other local government units in adjusting or implementing their own digitalized business tax systems.
- **Academia and Researchers:** The study will be able to contribute to the collection of literature studying similar subjects while offering empirical evidence on how digitalization impacts public administration. Additionally, the paper will also contribute insights on how the impacts of the digitalization of business tax systems could affect local government administration and developing nations.
- **Public Administration Practitioners:** The research can serve as a reference for other local government units in the Philippines and other developing nations that aim to digitalize their tax systems.

Scope and Delimitations

Scope:

This study focuses exclusively on Muntinlupa City's implementation of the B-EST system. The study will utilize business tax revenue data as it is one of the major sources of local government income. The study will analyze individual and business taxpayers who utilize the system while analyzing the business tax revenue data of Muntinlupa and Las Piñas city to discern the real impacts of digitalization in the context of the Philippines.

Delimitations:

Geographical Focus: The study is limited to Muntinlupa city and Las Piñas city. It does not compare it with other local government units except for Local Government Units (LGUs) as the primary analysis of the D-i-D analysis will be focused on Muntinlupa city's B-EST system.

Time Frame: The research assesses the impact of B-EST by assessing the base business tax revenue collection of Muntinlupa and Las Piñas city before and after B-EST's implementation. The panel data analysis will be limited from 2014 to 2023.

Data Limitations: The research assesses the impact of B-EST by assessing the base business tax revenue collection of Muntinlupa before and after B-EST's implementation while comparing it to Las Piñas city which has only recently digitalized the business tax payment system. Secondary data gathered from the Business Processing and Licensing Office of Muntinlupa and Las Piñas which will help in factoring the uniformity of external shocks.

Chapter 2

Review of Related Literature

The gathered literature within this chapter will shape the *a priori* expectations of the researcher in this paper. It is vital to understand the implications of digitalizing the tax payment systems. Furthermore, the impacts of implementing a digitalized tax payment system must be closely observed from the perspective of tax collection and tax compliance to evaluate the impact that necessitates from the digitalization.

The global trend towards digitalization in tax administration has increasingly been positively framed as a possible avenue to promote efficiency, transparency, and more reliable revenue generation. This can also be observed in the context of the Philippines with policymakers promoting e-government systems and digital payment platforms as tools to reduce inefficient processes whilst reducing the intervention of corruption. The World Bank (2025) describes digital transformation as "a transformative force that can drive productivity-led growth and enhance the efficiency of critical services," positioning digital governance as a cornerstone of national development. This makes digital governance a key part of national development. These arguments have led to empirical research investigating the functionality of electronic platforms—such as the Bureau of Internal Revenue's Electronic Filing and Payment System (eFPS), the Online New e-Tax Transaction (eONETT), and various local government e-business tax portals. A growing body of cross-national research reinforces this direction, showing that the integration of ICT in tax administration is generally associated with higher reported tax revenues, largely through improved compliance mechanisms (Nose, et al. (2025)

Digitalization in Tax Administration

Significant investments have been made to enhance the effectiveness of tax administration through digitalization. The digitalization of tax administration has started by automating its basic functions such as e-filing and registration. Further enhancements may be associated with the introduction of an online accounting system linked to the online tax collection systems (Asian Development Bank, 2022).

The success of traditional tax systems relies on the compliance of the taxpayers who must accomplish an active tax report while they calculate and pay their taxes. Thus, the OECD (2020) proposes that governments embed their tax administration into the systems that people are used to access such as online banking systems and online payment systems. However, governments must also ensure that the digitalization of tax systems must be established with security and transparency to encourage the taxpayers to utilize the new systems.

As outlined in the gathered literature, the digitalization of tax administration is characterized by its integration of automated systems driven by data to encourage tax compliance while ensuring transparency and efficiency while minimizing the costs placed on the taxpayers. By implementing the tax system into systems that taxpayers commonly use, governments may help ensure that the administration of their taxes can be run seamlessly and more efficiently. These on-going innovations will not only reduce the burdens on taxpayers but also enhance the government's capability to provide transparent tax administration.

Scholars agree that ICT platforms can reshape tax administration by strengthening efficiency, transparency, and compliance. The Bureau of Internal Revenue (BIR) has pursued a long-term digital transformation agenda by introducing digitized processes that are designed to streamline interactions between taxpayers and the government (World Bank, 2025). Beyond

convenience, these systems generate standardized digital audit trails that curb leakages by limiting opportunities for evasion, fraud, and informal payments. A study conducted by Okunogbe and Pouliquen (2022) found that the introduction of e-filing systems in Tajikistan reduced compliance time by about 40% and doubled tax payments among firms that previously underreported, while simultaneously lowering bribe payments that plague tax administration. Their findings highlight that digitizing tax administration reduces inefficiencies that are brought by long processing times and corruption.

In the Philippines, even narrative reviews affirm the sweeping potential of digitizing tax procedures. Dela Pena et al. (2025) suggest that the shift from traditional to digital tax payment opens pathways to greater transparency, a wider tax base, and fewer opportunities for collusion between taxpayers and frontline personnel. Romanda and Salapa (2025) voice similar opinions by highlighting how digital technologies can strengthen tax administration and enhance domestic revenue mobilization, drawing on examples from other countries that study the consistent link between digital tools to improve tax compliance. These insights echo broader reforms taking shape across the Philippines as national and local governments have begun to incorporate digital infrastructure into fiscal administration. Local governments have taken steps to deploy online business tax payment portals to modernize business permit and licensing systems. Davao City introduced an electronic business tax payment portal back in 2019 supported by extensive taxpayer education campaigns to help solidify awareness and ensure the utilization of the business tax payment portal.

Nose et al. (2025) estimate that a one-standard-deviation increase in firm-level digitalization combined with digital tax administration can increase tax revenue by three percentage points of GDP. However, early experiences in the Philippines may not necessarily

suggest that this impact is universally applicable. In Davao City, Romanda and Salapa (2025) found that newly implemented e-payment and e-filing systems initially expanded the taxpayer base and garnered a sense of transparency from the public, yet overall usage declined by 39.34% in 2023 due to economic challenges and limited access to digital services. The evidence suggests that while e-filing and e-payment systems hold strong potential to strengthen revenue collection their effectiveness is shaped by contextual constraints that may include macroeconomic conditions, technological accessibility, and taxpayers' learning curves which may hinder their measurable fiscal impact.

Impact of E-Governance on Public Administration Efficiency

The primary reason for the continuous advancement of technology is to increase the efficiency of humans in all their endeavors. This can be empirically observed in the digitalization of public administration, where Tano (2024) focused on utilizing information technology to enhance fiscal public administration matters. The results of the data analysis conducted revealed that the utilization of information technology on fiscal policy in the Philippines has shown a high impact in terms of efficiency, transparency, accessibility, and tax compliance, among others. The high impact on the different dimensions of fiscal public administration establishes the importance of integrating technological advancements in the field of public administration.

Public administration can be identified as a major beneficiary in the technological advancements currently being made. This is a central premise that Krasnykov et al. (2024) based their study on. Their study utilized a correlational analysis on the different variables that indicated public administration efficiency and the level of development in electronic services. The results derived from their conclusion indicated that e-government initiatives positively

impacted the public administration efficiency on a managerial level. The study's comprehensive findings provide additional insights that support the assessment that technological innovation does positively impact public administration.

The recent trend of digitizing public administration has reshaped and streamlined various processes of the governments that chose to undertake this bold and beneficial improvement. Insights retrieved from the study of Hidayat & Defitri (2024) included the reshaping of tax compliance that is derived from digital transformation. The findings detail accounts that automation and data analytics may improve tax administration by improving accuracy and reducing costs. However, the authors also necessitate that additional steps must be taken to safeguard the sensitive data that may be collected through this innovation, thus underscoring both the opportunities and challenges that may be associated with this implementation.

In recent years, Filipinos have taken a liking to the accessibility offered by digitalized payment systems due to the accessibility that they offer. The growing dependence of the Philippines on electronic payment systems only proves how handy they are, particularly for Filipinos who don't have that much time to do important financial transactions. In addition, because mobile apps now enable bill payments and fund transfers with ease, the use of friendly apps and numerous payment options can also encourage Filipinos to accept digital transactions (Ching, 2017).

According to Putrevu and Mertzanis (2023), the extensive adoption of digital payment systems relies on addressing significant issues of trust, security, and accessibility. It is essential to ensure reliable internet connectivity and device availability, particularly for underserved groups such as the elderly, those in remote areas, and low-income households. Increased

inclusiveness must be promoted by closing the gap created by the difference of levels of technological literacy through educational programs that are tailored to support the marginalized. Increasing trust in digital payments, addressing privacy concerns, and ensuring system reliability are needed to counter customers' preference over cash payments.

The utilization of e-payment avenues for the payment of income taxes is largely determined by the perceived advantage taxpayers associate the digitalized systems on convenience compared to the traditional methods of paying taxes. Aguilar (2023) states that most are ready to adopt new technology despite lack of exposure to it before and consider e-payment systems to be beneficial in terms of managing taxation.

Impact of Digital Systems on Tax Collection

The main premise of having a digitalized tax payment system is its supposed impact on the tax collection system. In a research conducted by Mbise and Baseka (2022), they found that the digitalization of tax administration positively impacts tax compliance among SMEs. Their findings support that digitalizing tax administration improves compliance and, thus, tax collection.

The abovementioned research delves into the impacts of a digitalized tax system on tax compliance. To clarify the impact a digitalized tax system has on tax collection, Ramzi (2024) conducted research wherein he found that 50% of the associated costs to collect one dinar in taxes. Ramzi attributed this reduction to streamlined procedures and reduced errors that would have been caused by traditional tax collecting errors which led to greater efficiency in tax administration. Apropos to operational efficiency, Ramzi emphasized that the digitalization of

the tax payment system lowered the time required to complete the necessary procedures compared to traditional methods.

The related literature has given insightful knowledge on how digitalized tax payment systems can improve tax collection. Tax collection and administration are being transformed by the rapid evolution of digital technologies, which significantly enhance service delivery, efficiency, and transparency while promoting greater tax compliance. Ongoing technical innovation, improved regulations, and greater public awareness and education are all needed to overcome these issues (Agustina, Harmono, & Sitinjak, 2024).

A study conducted by Yang, Lei, Sun, Shu, and Kan (2022), has posited that the digitalization of the economy has also reshaped the landscape of the administration of taxes. Digitalization has changed the traditional setup of businesses by introducing new strategies that may also complicate how they are taxed. These changes make the traditional approach of tax systems struggle with the presence of these new elements. The authors highlight the need for governments to digitalize their tax systems as these new challenges may only be addressed by adapting to the status quo.

The *a priori* expectations that tax revenues will increase due to the digitalization of the tax system is strongly supported as evidenced in the case of Rwanda. Mugabe (2021) analyzed data from 2013 to 2019 following the digitalization of the tax system where there was a 1.5% to 1.6% growth in the yearly revenue of Rwanda per year. The study attributes this increase to enhanced taxpayer compliance from the improved quality of services and the reduction of cases from tax evasion and fraud.

The gathered literature on the impact of digitalized systems on tax collection solidifies the assumption that digitalization can positively impact tax collection. The gathered literature also presents significant impacts on the tax compliance of SMEs while also ensuring that human errors are eliminated while hastening the processing of tax payments. The changing landscape of the digital economy also presents tax systems with new opportunities and challenges that can only be explored through the adoption of technological advancements in administrative systems.

Other studies portray that the immediate impacts of digitized systems are modest in the short-term due to some factors. Even in countries whose ICT upgrades are sweeping the traditional systems away, the measurable impacts often remain somewhat modest. Bellon et al. (2022), studying Peru's national shift to mandatory electronic VAT invoicing, showed that the reform increased the declared VAT payments by only about 2–3% rise in VAT receipts despite the scale of the intervention. Their findings suggest that while digitalization may improve accuracy and reporting discipline, the upward trend tends to be present in small margins.

Not all the research on tax reforms shows outcomes. Some firms underuse the systems. Some major revenue streams such as property tax do not move fully to platforms. In Tajikistan Okunogbe and Pouliquen (2022) carried out a rollout of e filing. The rollout showed that digital tax reforms can raise revenue for firms that historically evaded taxes a lot. The digital tax reforms also lowered payments from firms that already complied. The authors say that the drop happened because there were chances for bribery. The dynamic shows a cleansing effect. The digital transparency cuts fees. Digital transparency reduces recorded revenue even when genuine compliance improves. The broader literature shows that the digital tax systems raise revenue. The digital tax systems raise revenue mainly by widening the tax base and by finding activity that was not reported before (International Monetary Fund, n.d.). Still, the overall magnitude of

these fiscal gains is typically modest—especially in the early stages of implementation—and is strongly conditioned by local economic conditions, administrative capacity, and taxpayer awareness.

Challenges Faced by Digitalized Payment Systems

Despite the weighed benefits of the e-payment system, there are also challenges that this innovation is facing from the perspective of safety and user-friendliness. According to Ching (2016), the adoption and implementation of electronic payment systems in the Philippines face significant challenges including poor digital literacy and safety of divulged personal data. The findings of this literature provide insights into the relative role of managing security risks and digital literacy when implementing this system.

The claims of Ching (2016) are also supported by a study conducted by Putrevu & Mertzanis (2023). In their analysis on the challenges that hinder digitalized payment systems, they have identified that a responsible and user-friendly implementation and the safety of the users must be prioritized. The study also determined that network unreliability and perceived user trust will also serve as hindrances to successfully implementing the digitalized payment systems. It is important to understand the inherent risks associated with establishing e-payment methods, and it is all the more important to address these issues to integrate the answers that will help solve these underlying problems.

Furthermore, a study by De Castro et al. (2015) analyzed the level of awareness among Small and Medium Enterprise (SME) owners in Batangas City regarding taxpayer awareness on the Electronic Filing and Payment System (eFPS) implemented by the Bureau of Internal Revenue (BIR). The study concluded that SME owners were generally aware about the BIR's e-

payment system; however, the level of awareness and interaction by the SMEs on the e-payment system varied depending on the age and the digital literacy of the taxpayers. This opens the issue of government intervention on the challenges faced by the implementation of digitalized payment systems in the Philippines. A need to advertise and educate the relevant stakeholders on the e-payment systems is presented in this study to support e-governance efforts in the Philippines (Aguilar, 2023).

Chapter 3

Theoretical Framework

This chapter will introduce the theoretical framework which establishes the conceptual framework utilized by the researcher that encompasses the different theories used, operational framework, assumptions and hypotheses, and the definition of terms that is vital to forming the backbone of this study.

Conceptual Framework

In analyzing the socioeconomic impact of the B-EST system in Muntinlupa City, it is imperative to utilize different economic theories that will explain the impact of the digital tax system on its perceived efficiency. The study will incorporate theories such as the Technology Acceptance Model (TAM), Diffusion of Innovations Theory, Transactional Costs Economics (TCE), Economics of Choice Theory, and Public Choice Theory to explain the subject.

These theories will provide valuable insight into understanding how digital taxation will influence the economic behavior of taxpayers while improving the efficiency of tax administration in Muntinlupa City.

Technology Acceptance Model (TAM)

The inclusion of digital transformation in tax administration is generally based on the increased quality of the service and system that it enhances. Due to the benefits of digitalizing the tax system, the local government unit of Muntinlupa has decided to implement a digital tax system that can increase the revenues generated by the tax system. This reasoning is aligned with

the Technology Acceptance Model (TAM) as is the case with the paper conducted by Mbise and Baseka (2022) which concluded that digitalizing the tax system increases tax compliance.

Another reason for implementing a digitalized tax system is the reduction of the associated costs with the traditional tax system implementation. Lengthy procedures and human errors negatively impact the tax administration process. As such, adopting the use of digital technology to replace inefficient methods would increase the operational efficiency of the tax administration (Ramzi, 2024).

Acting accordingly with operational efficiency in mind supports the idea of the Technology Acceptance Model (TAM). Considering this, the researcher will also approach the paper in terms of operational efficiency to further discern the impacts of the digitalization of the tax payment system in Muntinlupa, specifically, the B-EST system on the revenue collection of the tax system.

Diffusion of Innovations Theory

The rationale for the government to adopt digitalization in tax systems as mentioned above is based on the benefits that this adoption has given. This is also true from the perspective of the taxpayers. As innovation progresses and is adopted, more people utilize these technological advancements to their benefit due to the benefits that these innovations contribute to the lives of people. This theory is also supported by Tano (2024) as they discuss that the integration of these technologies raises the satisfaction of taxpayers due to the perceived benefits that they bring. B-EST was established to streamline the processes that were deemed costly by the government which led to this system’s conception.

Transaction Cost Economics

This particular theory focuses on the perspective of organizations and individuals to minimize the costs incurred during economic transactions. The need to digitalize the tax administration introduces the importance of streamlining the process on the part of the local government of Muntinlupa City to mitigate unnecessary costs. This aligns with this study's rationale as the researcher will focus on digitizing the tax administration process.

Digitalizing the tax system, as is the case in Muntinlupa City, will significantly reduce the transactional costs of both parties (e.g., time saving, reduction of transportation costs, etc.). The various inefficiencies presented by traditional methods bring forth the need to introduce innovative systems like B-EST to address the issue of transactional costs. Furthermore, the reduction of administrative burdens will also positively impact the related stakeholders (Ramzi, 2024).

Economics of Choice

The economics of choice presents a framework that analyzes how individuals and firms formulate their options, and their decisions based on the given constraints that they are facing. As Aguilar (2023) suggests, the positive perception of the benefits that this digital mode of payment will determine its utilization. This is also supported by the findings of Ching (2017) on how digital payments enhance the satisfaction of users due to the system’s contribution to accessibility and more flexible options. Ultimately, these discuss the different factors that may affect the decision-making process of taxpayers on the utilization of Muntinlupa’s B-EST system.

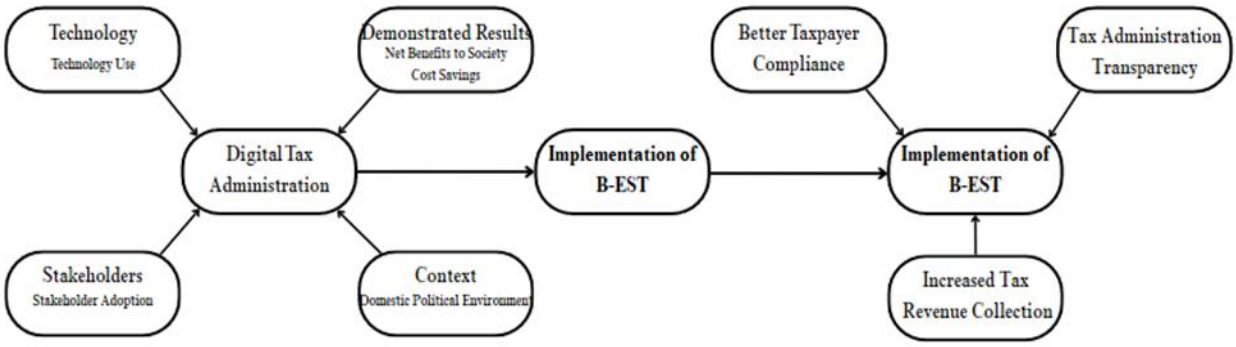
Public Choice Theory

The Public Choice Theory believes in the premise that there are callous roots in the decision-making process of governments which could be linked with the self-interest of the related stakeholders. In the case of e-governance tools such as B-EST, it serves as a potential way to mitigate inefficiencies brought about by bureaucratic actions. Thus, the application of B-EST in this theory comes from the minimization of opportunities to exercise corruption and to improve the accountability of the local government.

Digital Tax Administration

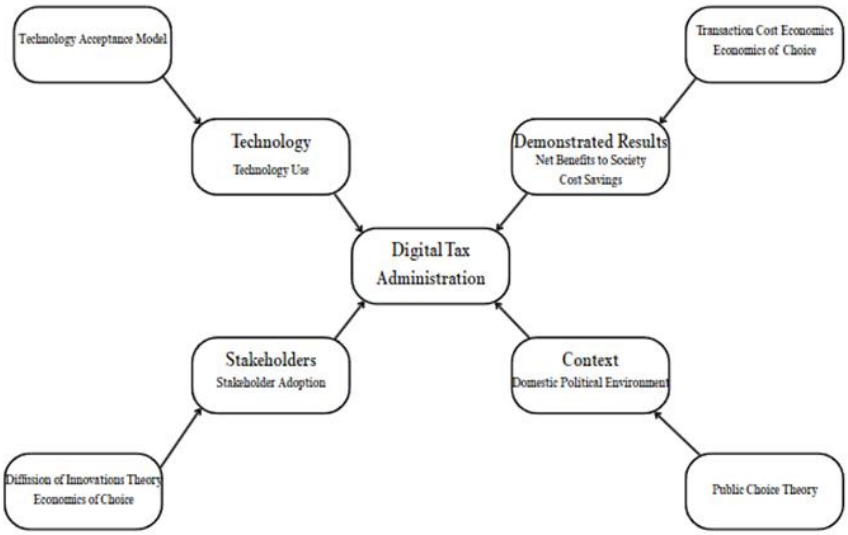
A study conducted by Bassey, Mulligan, & Ojo (2022) provides an enlightening assessment on the implementation of the B-EST system of Muntinlupa City through their framework constructed to fit the conceptual processes of administering digital taxes. The key factors that affect digital tax administration include the context, the stakeholders, the technology, and the demonstrated results.

Figure 1. Conceptual Framework for Digital Tax Administration Bassey, Mulligan, & Ojo (2022)



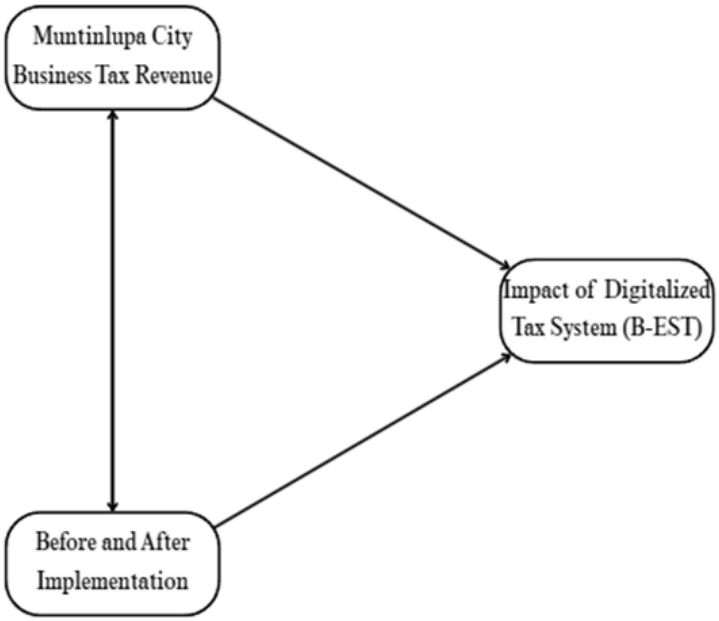
The framework emphasizes that technology is not the sole factor to consider when analyzing digital tax administrations. The four (4) factors included in their framework also align with the various literature and theories that can be found in this paper.

Figure 2. Thematic Conceptual Framework of the Study



Operational Framework

Figure 3. Operational Framework



Assumptions

From what can be gathered from the literature review, the implementation of the digitalized tax payment system of Muntinlupa should have a positive impact on the tax revenue collection of Muntinlupa City after its implementation.

Hypotheses

Ho1: There is no statistically significant difference in the change in tax revenue collection between Muntinlupa and the control city before and after the implementation of the B-EST program.

Definition of Terms

B-EST (Business E-payment System). A digital tax payment system was implemented in Muntinlupa City to implement streamlined tax administration and efficiency.

Tax Administration. Pertains to the enforcement of the tax policies imposed by governments on its citizens.

Administrative Efficiency. The ability of the government to administer their tax laws with minimal costs and delays.

Taxpayer/s. This pertains to the citizens who are complying with the tax policies adopted by their governments.

Chapter 4

Methodology

This chapter includes the research methodology that will be employed in this study, along with the various statistical approaches and strategies that will be used in this research.

Research Design and Strategy

The study will utilize a quantitative research design due to the numerical data that will be used to analyze the issue at hand. As the research will include an analysis on the tax revenues of the treatment group which is Muntinlupa city and the control group, which is Las Piñas city, a quantitative approach to the subject matter will be needed and is essential to the successful analysis of the implementation of B-EST.

Descriptive

This study is descriptive by nature as it aims to identify the historical tax revenue collection of Muntinlupa. By aiming to present and summarize the historical tax revenue collection of Muntinlupa City, we will be able to analyze the baseline state of the different tax revenues, especially the business taxes, before the implementation of the B-EST system in Muntinlupa City.

Comparative

The study utilizes comparative techniques to analyze the impacts caused by the implementation of the B-EST system. This approach will involve an analysis on the tax collection of Muntinlupa City before and after the system's implementation through a

Difference-in-Difference (D-i-D) model. The Difference-in-Difference model will assess the changes in tax collection of Muntinlupa City with Las Piñas City before and after the implementation of B-EST. The rationale behind choosing Las Piñas city is primarily because of its characteristics as a control variable. Las Piñas established its eBPLS back in 2024, in addition to its proximity with Muntinlupa. The utilization of this approach will enable the researcher to isolate and analyze the causal effects of B-EST from other economic trends.

Causal

While the paper will utilize a D-i-D model, the study is also causal at its core. The D-i-D model is crafted to ensure that the causal effect of the treatment in this analysis, which is the implementation of B-EST. The model aims to credit any significant difference in the outcomes of the treatment and the control variables. This approach solidifies the identity of the paper as a causal analysis.

Research Participants and Respondents

This study will rely on secondary data to conduct a quantitative analysis on the subject. The data will be sourced from the City Treasurer's Office of Muntinlupa City and the City Treasurer's Office of Parañaque City. The respective City Treasurer's Office of both cities will provide the data on the annual tax revenue collections that are needed in this analysis.

Measurement and Instrumentation

The study will utilize data collected from official government records to measure the impact of B-EST on local business tax revenues. The main instrument for the measurement will be the annual tax revenue data retrieved from the Business Permit and Licensing Office of

Muntinlupa and Las Piñas City from 2014 to 2023 to accentuate the impact of implementing B-EST on 2020. The study will also use dummy variables to identify the city (1 = Muntinlupa, 0 = Las Piñas) and to indicate the treatment (1 = post-B-EST implementation, 0 = pre-B-EST implementation).

As the data will be sourced from official government records, the data may be perceived as reliable and valid due to standardized reporting practices in the mentioned local governments.

Research Ethics Approaches

The study will strictly adhere to the ethical standards of research. Due to the dependence of the study on official government data, sensitive information will not be gathered in the data collection process. The researcher will ask for permission from the local government units before accessing the data that will be used in this study. Finally, the researcher is adamant in reporting the findings with transparency to provide an honest account of the study's creation.

Data Analysis

The dependent variable in this study will be the business tax revenue, which will be explained by the year and the treatment variables as the explanatory variables of this model. To delve into the relationship of the variables used in this analysis, the researcher will use a Difference-in-Difference (D-i-D) model as the basis for interpreting the causal relationship between the implementation of B-EST and the tax revenue collection. The econometric model for this paper will be:

$$Y_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 (Treat_i \times Post_t) + \epsilon_{it}$$

Where:

- Y_{it} is the business tax revenue for city *i* at time *t*

- $Treat_i$ is Muntinlupa (1) or Las Piñas (0)

- $Post_t$ is 1 if the year is after the implementation of B-EST, and 0 if otherwise.

- $Treat_i \times Post_t$ is the interaction term that will capture the causal effects of the implementation of B-EST.

Chapter 5

Results and Discussion

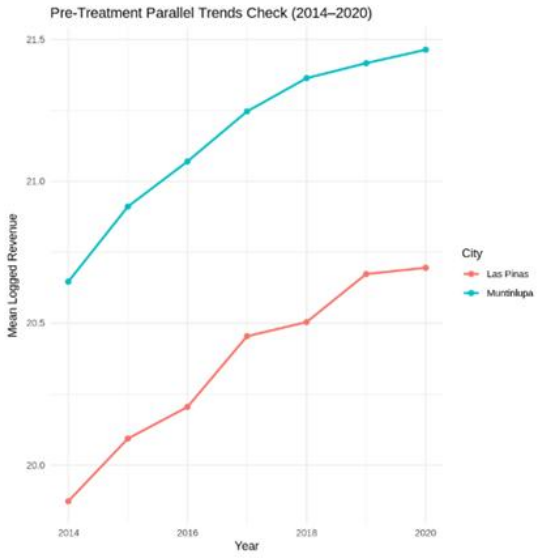
The findings of the Difference-in-Differences (DiD) analysis, which was carried out to assess the causal influence of Muntinlupa City's Business E-Payment System for Taxation (B-EST) on its yearly business tax revenue performance, are presented in this chapter. The study contrasted Las Piñas City, the control group that did not adopt a similar digital taxation system during the same time period, with Muntinlupa City, the treatment group that put the B-EST reform into effect. We used annual data from 2014 to 2023, including years before and after treatment. Two econometric models were used: a Two-Way Fixed Effects (TWFE) model to account for common macroeconomic shocks across years and unobserved time-invariant heterogeneity across cities, and a basic DiD model using ordinary least squares (OLS) estimation.

The DiD framework is used because of its quasi-experimental strength, which allows it to isolate the impact of a policy intervention (in this case, the adoption of digital tax payments) by comparing the outcomes of a treatment group over time to those of a control group (Angrist & Pischke, 2009). The method seeks to determine whether the observed changes in Muntinlupa's revenue trajectory can be ascribed to the B-EST system or to more general economic trends by capturing both temporal and cross-sectional dimensions. By taking this approach, the chapter seeks to empirically demonstrate whether digitalization in tax administration results in observable financial gains at the local government level.

Assumption Validation

Before proceeding with the estimation of the treatment's effect, the statistical integrity and reliability of the data was assessed to ensure that the Difference-in-Differences analysis were valid. Tests will be used to assess the absence of heteroskedasticity from the model itself. This step is crucial as uneven residual variance can distort standard errors which will indicate that the dataset used in the estimation is unreliable.

Figure 4. Parallel Trends Visualization



Parallel Trends Assumption. Figure X shows the log transformed business tax revenue trends, for Muntinlupa City (treatment) and Las Piñas City (control) from 2014, to 2023. The dashed vertical line marks the start of the establishment of the B-EST tax payment system. First Muntinlupa City and Las Piñas City both have revenue lines that rise before 2020. That rise points towards an improvement instead of a change caused by a local policy. It is noticeable that Muntinlupa always shows a higher revenue level compared to the business tax revenue of Las Piñas city. The structural differences in Muntinlupa justify using a method such as Difference-in-Differences to capture the causal effects of B-EST.

Studentized Breusch-Pagan Test. The Studentized Breusch-Pagan test is a formal statistical test that assesses the presence of heteroskedasticity in the regression model.

Table 1: Breusch-Pagan Test

Test	Statistic	df	p-value
Studentized Breusch-Pagan Test for Heteroskedasticity	BP = 3.6186	3	0.3057

The Breusch-Pagan test done on the regression model calculated a test statistic of 3.6186 that has a resulting p-value of 0.3057 which is higher than 0.05 level of statistical significance, thus we fail to reject the null hypothesis. This outcome indicates that there is no evidence of heteroskedasticity in the regression model's residuals. This result assures us that the Ordinary Least Squares (OLS) estimates in the regression model are stable.

Breusch-Godfrey/Woolridge Test. The Breusch-Godfrey/Woolridge test primarily tests if the residuals in the panel data are serially correlated.

Table 2: Breusch-Godfrey/Woolridge Test

Test	Statistic	df	p-value
Breusch-Godfrey/Woolridge Test for Serial Correlation (Panel)	X^2 = 11.623	10	0.3111

The analysis results indicate that the regression model had a chi-squared statistic of 11.623 with 10 degrees of freedom which resulted in a p-value of 0.311. Due to the p-value being higher than the conventional 0.05 level of significance, we fail to reject the null hypothesis. This implies that the Difference-in-Differences model's error terms across time

periods are independent which indicates that the significance levels derived from the regression model are reliable.

ANOVA Analysis

This analysis establishes the foundation of conducting a Difference-in-Differences analysis on Muntinlupa City's B-eST system. ANOVA provides a basic analysis on the baseline levels of business tax revenue between Muntinlupa and Las Piñas. It is important to analyze these initial differences as it provides better insight regarding the structure of variation in the dataset of the regression model to confirm the need of a better econometric model to help explain the impacts of the treatment.

Table 3: ANOVA

Source	Df	Sum Sq	Mean Sq	F-value	p-value
Treatment	1	2.87918	2.87918	38.5814	0.000012
Post	1	0.12716	0.12716	1.7040	0.2102
DiD Interaction	1	0.02270	0.02270	0.3042	0.5889
Residuals	16	1.19402	0.07463	—	—

According to the ANOVA analysis, Muntinlupa city exhibited a highly significant structural difference in business tax revenue compared to Las Piñas as shown by the Treatment variable's F statistic of 38.58 that has a p-value of < 0.001. Conversely, the Post term and the DiD interaction term respectively posted p-values of 0.21 and 0.58 which proves that the impact of Muntinlupa City's B-EST must be regressed with better econometric models that factor causal impacts in order to avoid selection bias. The non-significance of the interaction term in the

ANOVA analysis signifies the need to run the DiD regression model to properly analyze the impacts of the interaction term.

Pooled OLS Difference-in-Differences Analysis

The researcher employed the pooled OLS model as it will help provide an initial view of how the treatment, post-period, and interaction terms are related to the logged business tax revenue before considering the city-fixed effects.

Table 4: Pooled OLS Difference-in-Differences

Variable	Estimate	Std. Error	t-value	p-value
Intercept	20.3600	0.1033	197.10	0.0000
Treatment	0.8030	0.1460	5.50	0.000049
Post	0.2475	0.1885	1.31	0.2080
Treatment x Post	-0.1470	0.2666	-0.55	0.5890

Statistic	Value
R^2	0.7173

The constant term registered a coefficient of 20.36 while having a p-value that is less than 0.001 represents the baseline level of logged revenue for the control city during the analysis on the pre-treatment period which reflects that the baseline business tax revenues were already high to begin with. Moreover, the treatment term had a coefficient of 0.8030 while also having a p-value that is less than 0.001 which reveals that Muntinlupa had substantially greater revenues than that of Las Piñas even before B-EST was implemented. Due to the dependent variable being logged, the results correspond to about 124% higher baseline revenue which confirms that the two cities are structurally different before the treatment period. This reinforces the necessity of a

causal identification strategy like Difference-in-Differences due to the fact that applying simple comparisons would focus on the structural differences of the two cities.

The Post variable also suggests that revenues for both cities increased after 2020 as shown by its coefficient 0.2475, however, the p-value of .188 suggests that the increase is statistically insignificant. Additionally, the interaction term yielded a coefficient of -0.1470 and a p-value of .589 which shows a small and insignificant decline in the logged revenue collected by Muntinlupa city when compared to the control city's logged revenue. The negative coefficient roughly corresponds to a 14% decrease in the business tax revenue collection of Muntinlupa. The imprecision that can be observed from the initial analysis can be attributed to the presence of unobserved differences between the cities' respective environments or for year-specific shocks. Regardless, the model's R^2 of 0.7173 reflects the overall variation accounted for by the model regarding the logged values of business tax revenues. This model acts as a diagnostic test that aims to show us the baseline analysis of the model itself without factoring for city and time-fixed effects. Naturally, utilizing the Two-Way Fixed Effects (TWFE) model properly accounts for city-specific characteristics which will properly account for city-specific characteristics and other external factors to yield and isolate the sole impact of B-EST.

Two-Way Fixed Effects Difference-in-Differences Model

The two-way fixed effects model provides a clearer insight on the impact of the treatment as it removes all time-invariant differences between the two cities and also factors the external shocks that are common to all years used in the regression. Upon considering the impact of the aforementioned effects, the Treatment and Post variables are effectively dropped out of the

model, leaving only the Difference-in-Differences estimate which now cleanly represents the causal effect of the implementation of the B-EST system on logged revenue.

Table 5: Two-Way Fixed Effects Difference-in-Differences

Variable	Estimate	Std. Error	t-value	p-value
Treatment x Post	-0.1470	0.0290	-5.07	0.00097

Statistic	Value
R^2	0.9983

This model's improved specification for the context of the study presented that the estimated effect of the treatment is -0.147 with a standard error of 0.0290 and is statistically significant at the .01 confidence level. This shows a major shift from what was shown in the previous model. The large structural revenue gap between the two cities were absorbed by the city fixed effects which also absorbed the impacts of macroeconomic shocks. The TWFE estimate can be interpreted as the expected change in Muntinlupa city's business tax revenue after B-EST was implemented relative to the supposed effects on Muntinlupa city's business tax revenue if B-EST was not implemented. Consequently, the coefficient corresponds to a 13.67% reduction in business tax revenue. This shows a decline that persists even after adjusting for the differences between the two cities and macroeconomic shocks. Initially, the results may seem unexpected, however, this pattern also aligns strongly with the evidence shown in Peru's context where massive reforms in mandatory VAT e-invoicing only produced a 2 to 3% rise in the declared VAT payments (Bellon et al., 2022).

The results of the analysis reveal a pattern of consistency with the literature on the fiscal impacts of e-governance and digitalization. While the introduction of the B-EST system in Muntinlupa city was expected to increase the tax base, the business tax revenue collected, and enhance the efficiency of tax administration, the regression tells us otherwise. From the results and the literature used in this research, we can infer that short-term challenges plague the immediate success that is promised by employing such tools to enhance efficiency. The pooled OLS model initially suggested that Muntinlupa had significantly higher baseline business tax revenues compared to Las Piñas city. This asserts that the structural differences between the two cities can obscure the impact of the implementation of Muntinlupa city's B-EST. Similarly, Romanda and Salapa (2025) found that Davao city's digital tax payment portal improved transparency and expanded the tax base, yet due to economic and digital accessibility issues, usage declined by 39% by 2023. This shows that the effectiveness of utilizing digital platforms also relies on the capacity of taxpayers to consistently use them.

Using the dataset while introducing log-transformed revenue as the dependent variable revealed that the treatment effect is negative. The pooled OLS model estimated the interaction term at -0.147 with a p-value of 0.589 which is statistically insignificant when heterogeneity is accounted for. However, the introduction of the Two-Way Fixed Effects (TWFE) model boosted the analysis by factoring unobserved city-level and time-specific factors. After introducing the TWFE model, the p-value for the DiD interaction term became statistically significant with a p-value of 0.00097 while retaining the point estimate of -0.147. This means that a -0.147 effect on the logged-transformed revenue translated to a proportional decline in Muntinlupa city's business tax revenue by about -13.6%.

Chapter 6

Conclusion and Recommendations

Conclusion

The result of this study revealed a narrative that is complex rather than the usual expectations that come from digital reforms in public finance. Despite the B-EST system's purpose of streamlining the tax administration and enhancing the overall efficiency of tax administration, the empirical evidence revealed by the study suggests that the immediate fiscal impact is divergent from intuitive assumptions about digitalizing the tax e-payment system. After considering city-specific characteristics and macroeconomic shocks with the utilization of a Two-Way Fixed Effects model, the implementation of the system made a significant decline of 13.6% in Muntinlupa's logged business tax revenue. Despite its result, it does not necessarily mean that the system has failed its purpose but rather, it reflects global experiences where digital systems tend to reshape administrative processes before they generate measurable revenue gains. Such decline is consistently emerging from Davao city as well, where it was seen that digital portals initially strengthened transparency and taxpayer participation but later on revealed a usage drop all because of economic pressures and limited digital accessibility. Moreover, the case of Peru where the sweeping VAT e-invoicing reforms yielded small short-run gains, similarly shows the emphasis for a modest and nonlinear revenue trajectory typical of early-stage ICT reforms.

All together, the results show a broader truth that reflects the international literature stating that digital systems alone cannot transform revenue performance without parallel improvements. In this case, the revenue decline of the B-EST system can be interpreted from the

growing pain of the city that shifted from a familiar, relationship-based transaction, into a more transparent, rule-based digital environment. This can also imply that the decline reflects the compliance cleansing where it is previously inflated or informal payments fall as digital audit trails harden. Other than that, this may all be due to the taxpayer learning curves, temporary disruption in collection cycles, or the uneven transition of firms despite the limited digital literacy. Finally, these early signals should not be interpreted as a failure but as a way or opportunity to refine and improve the implementation strategies so that long-term benefits of efficiency, transparency, and enhanced compliance can prevail.

In this light, this study can be treated not merely in quantifying the treatment effect but also through the experience of Muntinlupa within the evolving digital governance in the country. Just as how digitalization continues to reshape the public service delivery across the world, it is time to look at the city's technological reform as a social and institutional transition that is just a technical one. In conclusion, backed with evidence rather than assumptions, B-EST can still emerge as a cornerstone of a more citizen-centered, transparent, and resilient system of local revenue mobilization.

Recommendations

Strengthen Digital Accessibility and Taxpayer Readiness

Evidence indicates that digital platforms do not yield automatic gains if taxpayer capability and accessibility gaps persist. In this case, Muntinlupa should invest in sustaining taxpayer education programs through mobile assistance from kiosks, a digital helpdesk, and even partnerships with local universities for ICT support. This reflects the recommendations of

Aguilar (2023) and Putrevu & Mertzanis (2023) that emphasizes trust, usability, and digital literacy as prerequisites for successful digital adoption.

To unlock the potential of B-EST, the local government must invest in expansive taxpayer awareness programs to ensure that the system will be fully utilized. This initiative should include digital help desks in every barangay to ensure that every community hub will be exposed and be familiar with Muntinlupa city's digital systems. Posting video tutorials will also help users who struggle with engaging in social interactions.

This recommendation rests on the evidence that digital literacy is a primary factor in determining the utilization of B-EST as a replacement of traditional payment processes. Ching (2016) also emphasized that the adoption of digital payment systems in the Philippines is hindered by low digital literacy of Filipinos. B-EST's capability to transform taxpayer behavior and improve taxpayer participation will be enhanced once the local government will invest in spreading awareness.

Expand and Stabilize Digital Infrastructure

In line with Davao City's declining usage, the city must ensure that the B-EST system is not only available but is consistently reliable. The city must properly address the issue of the system's availability while retaining its reliability. The results presented in the study suggest that the early decline in revenue was likely hampered by the impact of the COVID-19 pandemic, but also by barriers that prevented taxpayers from transitioning to B-EST. The effects of local digital reforms are maximized when they are incorporated in the daily lives of the citizens. Thus, the local government of Muntinlupa city should focus on integrating B-EST with other e-wallet and e-payment systems such as GCash and other banking apps. These integrations will minimize the

psychological and financial costs of helping taxpayers transition from traditional payment systems to e-payment systems. Furthermore, establishing payment kiosks in certain populated areas like barangay halls may help in ensuring equitable access.

This recommendation is grounded in the evidence presented by the literature that revealed that local e-governance reforms only succeed only when the online platforms are integrated with the daily needs of the citizens. A good example would be how Davao City implemented awareness campaigns to increase the taxpayer base during the initial implementation of their e-payment systems (Romanda & Salapa, 2025). Ensuring that B-EST is accessible to the people will help maximize its tax revenue performance.

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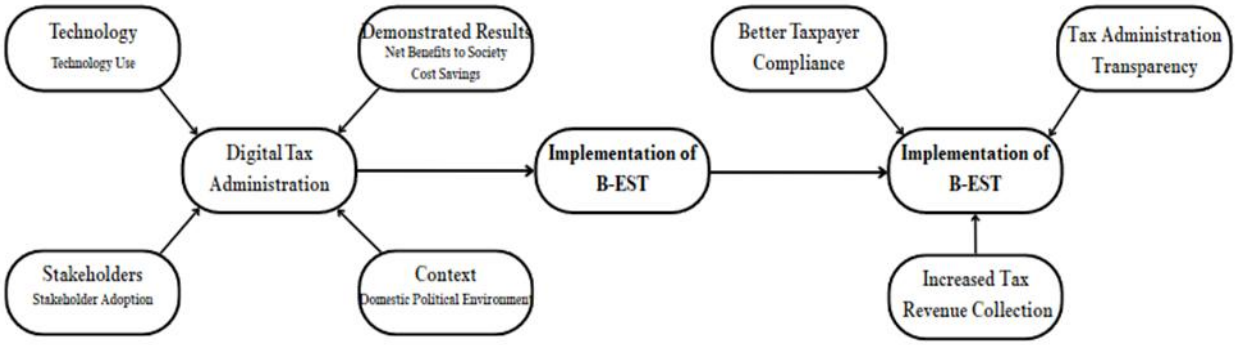
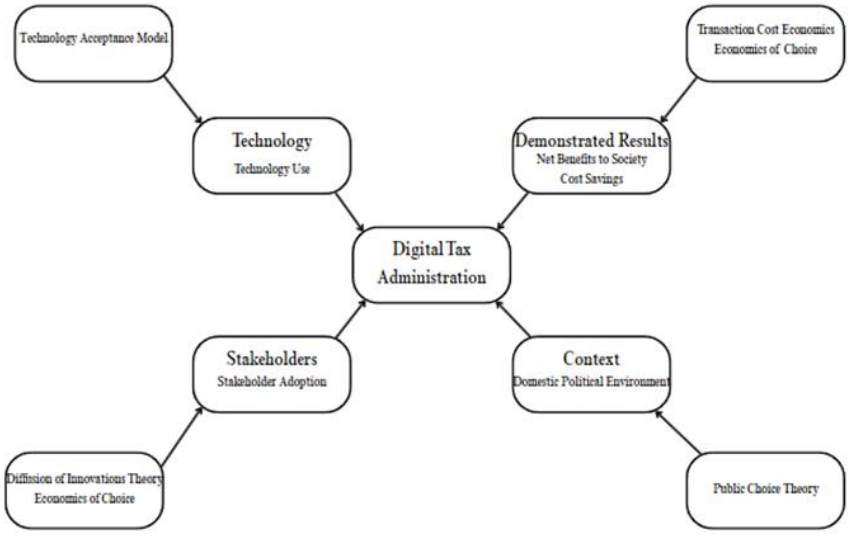
Appendix 1:

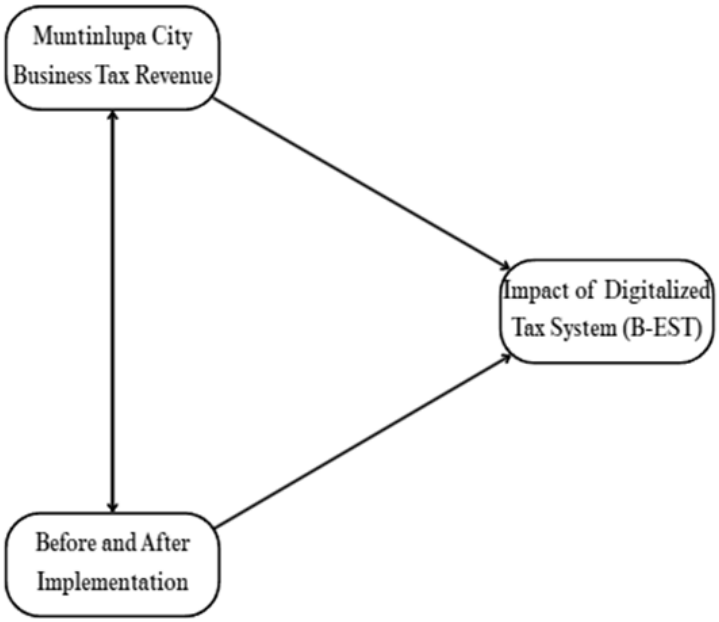
Conceptual Framework for Digital Tax Administration Bassey, Mulligan, & Ojo (2022)



Thematic Conceptual Framework of the Study

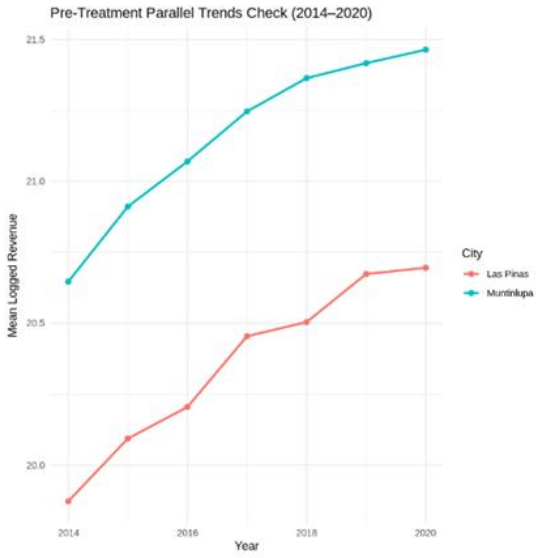


Operational Framework



Appendix 2:

Parallel Trends Visualization



Appendix 3:

Breusch-Pagan Test

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Statistic	Value
R^2	0.7173

Two-Way Fixed Effects Difference-in-Differences

Variable	Estimate	Std. Error	t-value	p-value
Treatment x Post	-0.1470	0.0290	-5.07	0.00097

Statistic	Value
R^2	0.9983