1. Introduction  
   In today's business world, disruptive technologies have significantly reshaped various sectors, particularly in finance and accounting. The advent of digital transformation has been instrumental in driving value creation and competitive advantage. Technologies such as artificial intelligence, machine learning, cloud computing, blockchain, and robotic process automation (RPA) have particularly impacted the finance and accounting functions, reflecting the rapid evolution in this domain (Moll and Yigitbasioglu 2019).

A pivotal example of such technological influence is the introduction of enterprise resource planning systems (ERP). ERPs have revolutionized financial operations, enhancing cross-functional integration, centralizing control, and advancing automation. (Scapens and Jazayeri 2003; Matolcsy et al. 2005; Nicolaou and Bhattacharya 2008; Kanellou and Spathis 2013). This transformation has led to more efficient financial reporting and transparency, where accounting transactions are easily traceable and financial reports are generated automatically, marking a shift from manual to automated processes (Sutton 2006).

Empirical evidence supports the positive impact of such technologies. The integration of ERP systems has been extensively analyzed, showcasing its diverse impacts on organizations. The immediate value of these systems is evident through positive market responses post-implementation (Hayes et al. 2001). Furthermore, ERP adoption is correlated with enhanced financial performance, indicating its significant economic benefits (Hitt et al. 2002). In terms of operational efficiency, ERP systems have been shown to significantly improve business process effectiveness (Hunton et al. 2003). The strategic implications of ERP on corporate finances, especially in areas like earnings management, have been thoroughly examined, presenting a comprehensive view of its influence beyond traditional performance measures (Morris 2010). Additionally, Paredes and Wheatley (2018) extend this examination by investigating how the increase in managers' access to accounting data via ERP systems influences managerial behavior, particularly regarding real activities manipulation. Their findings suggest that after the implementation of an ERP, earnings management through real activities declines, indicating that ERP implementations enhance the quality of financial reporting by constraining opportunistic managerial behavior. This underscores the multifaceted benefits of ERP systems, not only in improving financial and operational performance but also in promoting more transparent and reliable financial reporting practices.

Despite extensive research on ERP systems, Robotic Process Automation (RPA) in accounting is a nascent field. Current literature predominantly explores theoretical aspects and potential impacts of RPA on accounting and auditing, primarily utilizing secondary data to understand its role in the digitization of accounting and interaction with related technologies (Tiron-Tudor et al. 2023). Although recent studies have ventured into qualitative analyses, examining motivations for RPA adoption and its broader implications for the accounting profession (Fernandez and Aman 2018; Moffitt et al. 2018; Zhang 2019; Asatiani et al. 2020; Korhonen et al. 2021), studies employing quantitative methodologies are conspicuously sparse.

This research examines the effect of Robotic Process Automation (RPA) on different facets of earnings management, specifically focusing on real activities manipulation (denoted as RM) and accrual-based earnings management (denoted as AM), which are key aspects of financial integrity and corporate governance. Our multivariate regression analysis reveals a nuanced impact of Robotic Process Automation (RPA) on EM. We find a significant reduction in RM with RPA implementation, suggesting its role in promoting ethical financial reporting by automating processes and enhancing transparency. However, there's no direct link between RPA and AM. Interestingly, firms utilizing RPA with restrained AM practices also show lesser RM, indicating an indirect influence of RPA on promoting broader ethical financial practices. Furthermore, our study uses various proxies and employs the propensity score matching method in our regression analysis to ensure the robustness of our findings. This approach helps to mitigate potential biases and provides a more accurate assessment of RPA's impact on RM.

This pioneering empirical study utilizing model regression analysis to explore RPA's impact on EM highlights its significance for various stakeholders, including industry professionals, policymakers, and academic researchers. For industry professionals, the findings suggest integrating RPA can lead to more ethical financial practices. Policymakers may consider these insights to guide regulatory frameworks that encourage transparency and integrity. For researchers, this study opens new avenues for investigating RPA's effects across business sectors. It underscores the importance of RPA in advancing financial transparency and integrity in the digital age, marking a significant contribution to both academic dialogue and practical application.  
  
The remaining sections of this study is as follows: The second section is literature reviews and development of hypotheses; the third part is sample selection and research design; the fourth section is the univariate and multivariate results, the fifth section is additional analyses; and the last section is the conclusion of this study.

1. Literature Review & Development of Hypotheses
   1. What is RPA?  
      Robotic Process Automation (RPA) is a transformative technology that automates manual, rule-based, and repetitive tasks by mimicking human interactions with digital systems. According to UiPath, leading RPA software provider, RPA is designed to operate across various applications and systems without modifying existing infrastructures, emphasizing efficiency and productivity enhancements by automating mundane tasks (UiPath Website). This aligns with Jędrzejka (2019), who discusses RPA's role in automating tasks that were traditionally manual, enhancing operational efficiency and allowing employees to focus on more strategic tasks.  
        
      The finance and accounting sector, as outlined by Jędrzejka (2019) and supported by Fernandez and Aman (2018), has been the primary adopter of RPA technologies. This sector has utilized RPA to automate tasks such as transaction processing, audit preparation, and financial reporting, driven by the sector's need for precision and the high volume of repetitive transactions. The accounting department, in particular, benefits from RPA's ability to execute tasks with high accuracy and efficiency, addressing the industry's challenge of managing routine, error-prone tasks.  
        
      RPA's benefits, particularly in finance and accounting, are manifold. Jędrzejka (2019) and Le Clair (2017) highlight RPA's potential to reduce operational costs, enhance process speed, and improve accuracy. RPA's ability to operate continuously, its scalability, and ease of implementation make it a valuable tool for the sector. These benefits directly address the needs of the accounting department, emphasizing RPA's role in transforming the industry by making operations more efficient and reducing the likelihood of errors in financial reporting.
   2. Automation Tools: from ERP to RPA  
      Enterprise Resource Planning (ERP) systems have been foundational in automating business processes, as discussed by Shehab et al. (2004) and Al-Jabri and Roztocki (2015). These systems have enabled significant improvements in productivity, data sharing, and decision-making across organizations. ERP systems have streamlined financial data integration, inventory management, and resource planning, contributing to operational efficiency and improved decision-making capabilities. (Jędrzejka 2019; Sutton 2006).  
        
      In terms of finance and accounting, as noted by Jędrzejka (2019), ERP systems have facilitated an unprecedented level of cross-functional integration, centralized control, and automation. This has led to considerable efficiency improvements, revolutionizing how accounting transactions are managed. Specifically, ERP systems have enabled the detailed tracking of accounting transactions to individual employees or specific events, such as scanning a barcode, enhancing accountability and traceability within financial operations. Moreover, the automation capabilities of ERP systems have transformed the generation of financial reports. As highlighted by Sutton (2006), financial reports, which traditionally required intensive manual effort by teams of accountants, are now increasingly generated automatically. This shift results from ERP systems' ability to encode procedures and rules into the software, thereby streamlining the reporting process. This evolution has not only improved efficiency but also reduced the potential for human error, leading to more accurate and reliable financial reporting.   
        
      However, ERP systems' limitations become apparent in handling highly repetitive, rule-based tasks requiring interactions with multiple systems, often necessitating manual intervention (Tiron-Tudor et al., 2023). RPA addresses these limitations by automating such tasks without the need for direct system integration, serving as a complementary technology to ERP. This combination enhances the automation capabilities within finance and accounting departments, particularly in improving data processing transparency and data quality, essential for financial reporting and earnings management (Jędrzejka, 2019; Al-Jabri and Roztocki, 2015).

Namely, RPA acts as a vital extension and complementary role to ERP systems, specifically targeting the automation of tasks that ERP systems struggle with due to their rigid structure, particularly in handling specific, repetitive tasks like data entry and report generation. By operating at the user interface level, RPA seamlessly fills this flexibility gap without the need to modify existing systems, ensuring tasks are performed with greater speed and accuracy. This capability enhances organizational efficiency, data accuracy, and transparency in finance and accounting, thereby supporting earnings management and boosting competitiveness. Importantly, both ERP and RPA technologies are united by their core objective to elevate operational efficiency and data accuracy within organizations. While ERP systems provide a comprehensive integration and automation of core business processes to ensure data consistency and aid in decision-making, RPA complements these functions by addressing the automation of rule-based, repetitive tasks, minimizing errors, and liberating human resources for more strategic roles. (Jędrzejka, 2019; Shehab et al., 2004).

* 1. Earnings Management with automation tools  
       
     Exploring the Robotic Process Automation (RPA) and EM relationship opens a novel research avenue. With scant direct empirical evidence linking RPA, especially to EM, we're charting new territory rather than facing a traditional limitation. RPA's role in boosting operational efficiency and data accuracy in finance mirrors the documented benefits of Enterprise Resource Planning (ERP) systems. Although prior studies have shed light on ERP's effects on EM, RPA's specific impact awaits thorough exploration. Viewing RPA as an ERP extension, especially in tasks challenging for ERP, frames this gap as an alternative research path. This stance enables leveraging ERP studies as a base, while considering RPA's unique potential in EM. The subsequent sections will detail prior ERP and both types of EM research and propose hypotheses connecting RPA to earnings management. This approach not only bridges the current knowledge gap but also sets the stage for future work, aiming to broaden our grasp of automation's role in financial practices.  
     1. Accrual-based earnings management with automation tools  
        The first hypothesis of this study explores the potential impact of Robotic Process Automation (RPA) on financial reporting quality, particularly focusing on discretionary accruals and internal control weaknesses. Reflecting on the documented benefits of Enterprise Resource Planning (ERP) systems in enhancing the quality of financial reporting—as demonstrated by Morris (2010), who found ERP implementation to lead to reduced AM—we propose a similar investigative lens for RPA. ERP systems have been shown to offer more efficient and effective information processing, leading to improved financial reporting quality (Morris 2010). Incorporating the viewpoint of internal control weaknesses, research findings suggest that ERP implementation can enhance internal control systems, making it less likely for firms to report internal control deficiencies (Morris 2011). This enhancement is crucial since weaknesses in internal controls are often associated with increased levels of EM (Chan et al. 2008; Ashbaugh-Skaife et al. 2008). Given RPA's role in automating financial transactions and processes, like ERP systems, it stands to reason that RPA could also contribute to the strengthening of internal controls and the reduction of EM through more accurate and transparent financial reporting.  
          
        H1: The firm with RPA implementation will be less likely to engage in AM.
     2. Real activities manipulation with automation tools  
          
        Given that Lenard et al. (2016) identified a positive relationship between firms reporting internal control weaknesses (ICWs) and real activities manipulation, and those firms utilizing RM to meet earnings benchmarks exhibit lower performance in subsequent years, it is evident that ICWs significantly contribute to the propensity for RM as a form of EM. This inclination towards RM among ICW-firms underscores the challenge of maintaining robust internal controls to mitigate earnings management through operational means.  
          
        Morris (2011) complements this understanding by showing that firms implementing ERP systems are less likely to report ICWs compared to non-ERP-implementing firms. This suggests that ERP systems might enhance internal control quality, thereby reducing the likelihood of RM by improving the accuracy and reliability of financial reporting and operational efficiency.  
          
        H2: The firm with RPA implementation will be less likely to engage in RM.
     3. Interaction between two measures of EM in terms of RPA implementation  
          
        From the insights of Zang (2012) and the complementary hypothesis by Chen et al. (2012), our hypothesis development for RPA's influence on EM practices considers the trade-offs between AM and RM. Given the relative costs and benefits highlighted in prior research, we hypothesize that the implementation of RPA in firms may alter the cost-benefit dynamics of AM and RM, potentially leading to a shift in how these tools are utilized. Specifically, we propose to explore whether RPA implementation makes one form of earnings management more favorable over the other or if it encourages the complementary use of both, without specifying the direction due to the novelty of RPA in this context:

H3: In the realm of RPA implementation, variations in AM practices are associated with variations in RM practices, reflecting the evolving cost-benefit considerations of earnings management tools.

1. Sample Selection and Research Design
   1. Main interest of variable: RPA implementation Indicator   
      Building on this foundation, our study specifically targets the domain of RPA technology adoption. The approach mirrors the document analysis strategy utilized by Paredes and Wheatley (2018) in their examination of ERP implementations through 10-K SEC filings. Their meticulous analysis, which highlights the insights that can be garnered from corporate disclosures despite potential biases, serves as a methodological benchmark for our work.  
        
      Employing a systematic keyword search strategy within the digital annual reports of firms listed on Taiwan Stock Exchange (TSE) or Gre Tai Securities Market (OTC), we aim to compile an exhaustive dataset on RPA implementation. This strategy is enabled by the digital accessibility and legal requirement for these firms to submit their annual reports electronically, which facilitates a more efficient and accurate data extraction process. The search terms included "Robotic Process Automation," "RPA," and its Mandarin counterpart "機器人流程自動化," ensuring that our identification of relevant disclosures was as precise as possible.  
        
      In addition, our methodology assumes continuity in RPA initiatives; if a firm reported RPA adoption in one year, we marked it as continuing its RPA engagement (indicator denoted as 1) in the following year, even if the subsequent report did not explicitly mention RPA. This approach acknowledges the ongoing impact of RPA projects, if once a firm embarks on RPA, the effects and implementations are sustained over time. This assumption allows for a deeper analysis of the influence and permanence of RPA technology within firms.
   2. Sample  
      The data collection commenced by gathering firm-year observations from the Taiwan Economic Journal (TEJ) database spanning 2017 to 2022. To ensure relevance, I focused on firms continuously listed on Taiwan Stock Exchange (TSE) or Gre Tai Securities Market (OTC) until the end of 2023. The choice of initiating the sample period in 2017 stems from the absence of any annual reports disclosing RPA implementation before that year. After addressing missing variables and the minimum observation threshold of AM/RM proxies calculation, final sample comprises 9,780 firm-year observations originating from 1,730 firms across 28 distinct industries based on TSE industry codes.  
      (Insert Table1)  
        
      Samples from TEJ database from 2017 to 2022 given still alive before 2023 year end: 10,780

Less: Missing data of finance or audit related variables: 10,105

Less: Sales at year t or t-1 since the denominator of RD/ADV variable: 10,100

Less: Calculation for AM/RM proxies given at least 15 observations for each industry-year regression: 9,780   
  
In our dataset, the financial industry's observations are pivotal due to the distinct adoption trends of ERP and RPA technologies. While ERP systems were initially embraced by manufacturing sectors, RPA has found significant traction within finance and accounting, a field characterized by repetitive, rule-based tasks. (Where are we with RPA, auxis 2018 survey report) This divergence is reflected in our data: financial industry observations constitute only 2.6% of the total, but this figure surges to 21% when focusing on RPA implementation instances.

* 1. Accrual-based Earnings Management

In the analysis of AM, the absolute value of discretionary accruals is employed as a proxy, reflecting the dual potential for managers to manipulate earnings both upwards and downwards. This choice is supported by seminal studies (e.g., Jones 1991; Becker et al. 1998), emphasizing the significance of capturing the full spectrum of AM activities. The estimation of these discretionary accruals is conducted using the cross-sectional modified Jones model (Dechow et al. 1995), which compares actual total accruals against forecasted figures from an accrual prediction model. The differences are considered to represent the discretionary component of accruals (see Appendix A for details), thereby serving as an indicator of AM. This methodology underscores the nuanced understanding that earnings manipulation can involve both overstatements and understatements, aiming to provide a comprehensive measure of such practices.

* 1. Real Activities Manipulation

Drawing upon established research, this study employs proxies for RM as delineated by Roychowdhury (2006), with further refinement and validation by Cohen and Zarowin (2010). These proxies—abnormal cash flow from operations (ABCFO), production costs (ABPROD), and discretionary expenses (ABEXP)—serve as indicators of managerial strategies aimed at influencing financial reports to meet earnings expectations. (see Appendix A for details) This framework identifies key manipulative tactics, including sales acceleration, overproduction, and discretionary spending cuts, as mechanisms for short-term earnings enhancement at potential long-term detriment.  
  
Moreover, this study introduces a combined measure (RM) that aggregates the three proxies to offer a comprehensive view of managerial manipulation impacts on financial reporting. This approach, rooted in the methodologies of Kim et al. (2012), aims to provide a nuanced understanding of real activities manipulation and its consequences for financial integrity and governance. Through this analytical lens, the research aspires to contribute to the discourse on corporate ethics and regulatory practices, emphasizing the importance of transparency and fairness in financial reporting.

* 1. Empirical Models  
     To capture the relationship between EM and RPA implementation, the regression models are performed with AM and RM respectively:

We estimate Equations (1) and (2) with multiple regressions. Firms are likely to employ a combination of AM and RM to manage reported earnings, with the choice between the two mechanisms influenced by their relative costs (Cohen et al. 2008; Zhao et al. 2012; Paredes and Wheatley 2018). To address the substitutive nature of these EM methods, we include the absolute value of discretionary accruals (ABSDA), a proxy for accrual-based earnings management, as a control variable in the RM (RMPROXIES) regressions to adequately address the endogeneity present in earnings management activities. Conversely, a proxy for RM is included as a control variable in the AM regressions.  
  
In our study, we examine the relationship between Robotic Process Automation (RPA) implementation and EM, utilizing a set of control variables (CVs) to delineate the effects of various firm-specific and market factors. These CVs include Leverage (LEV) and Market-to-Book Ratio (MTB) to gauge financial structure and growth opportunities, Operating Cash Flows (OCF) for the firm's liquidity impact on EM, firm size (LGTA) for size effects, and the big four audit firm indicator (BIG4) to evaluate the influence of audit quality on EM practices. (Becker et al., 1998)  
  
To address the costs associated with RM following Zang (2012), industry-year market share (MS) and the percentage of institutional investors (INST) are included. Moreover, we also control the relation between firm performance and abnormal accruals by including industry-adjusted ROA (ADJROA). R&D Intensity (RD) and advertising intensity (ADV) are also incorporated as measures of a company's commitment to innovation and marketing, reflecting the firm's strategic orientation towards CSR/ESG initiatives and their potential influence on financial reporting practices, as discussed in the literature (Kim et al., 2012; Tanveer et al., 2022). Through this comprehensive set of control variables, our analysis aims to provide a nuanced understanding of how RPA implementation might influence EM, considering a wide array of factors that could affect this relationship.

1. Univariate and Multivariate Results
   1. Descriptive statistics  
      The table2 presents descriptive statistics results. Panel A shows the summary statistics of full sample with 9,780 observations. All continuous variables are winsorized at the top and bottom 1 % of their distribution. The sample means (medians) of ABSDA and RM are 0.05594 (0.03971) and -0.00044 (0.01133). Besides, the mean of BIG4 is 89%, showing that almost ninety percent of our sample are audited by big four audit firms. Panel B shows the comparison between RPA and non-RPA observations. Among earnings management measures, there exists no significant difference between RPA and non-RPA observations in all RM proxies, while AM is significantly less in RPA observations compared to non-RPA observations indicating that the negative relation between RPA and AM. As for control variables, with exception of AGE, MTB, and OCF, all the other control variables exhibit a significant difference between RPA and non-RPA observations. We observe that RPA observations featured higher percentage of institutional investors, higher market share, better ESG (CSR) performance, higher leverage, larger size, and lower intensity of R&D or advertising than non-RPA observations. Panel C shows the correlation matrix for all continuous variables. RPA is positively associated with ADJROA, INST, MS, ESG, LEV, and LGTA, while RD and ADV are significantly and negatively related to RPA.   
      (Insert Table2)
   2. The relation between RPA implementation and AM  
        
      The table3 presents the multivariate results of the absolute discretionary accruals analyses. We find no evidence showing the relation between RPA implementation and the extent of the accrual-based earnings management, ABSDA, which reject our hypothesis1.   
        
      The significant positive RM proxy (P < 0.05) highlights a complementary effect between accrual-based and real activities manipulation, consistent with findings from both Paredes and Wheatley (2018) and Chen et al. (2012). Furthermore, Chen et al.'s work, specifically employing Taiwan data, delves deeper into this phenomenon, attributing the complementary usage of AM and RM strategies to Taiwan's low reporting and litigation costs.  
        
      Nevertheless, the interaction term between RPA and RM is not significant, which is not supporting H3a. We cannot conclude that the relationship between RM and AM is moderated by RPA, such that the presence of RPA amplifies the positive effects (or mitigates the negative effects) of real activities manipulation on accrual-based earnings management in full sample.  
        
      As for the other control variables, we find that OCF, LGTA, AGE, BIG4, and ESG are all negatively significant at 1% significant level, suggesting that the firms with more operating cash flow, larger scale, older, and audited by big four audit firms are less likely to involve in AM. Consistent with Kim et al. (2012), firms with better ESG(CSR) performance will be less likely to engage in accruals management.  
        
      On the other hand, we also find that INST at 5% significant level, MS, MTB, LEV and ADJROA are significantly positively associated with absolute discretionary accruals at 1% significance level, indicating that firms with higher percentage of institutional investors, higher market share, higher market-to-book ratio, higher leverage, larger industry-adjusted ROA will be opt for performing AM approach.  
        
      To sum up, we cannot conclude that the firms with RPA implementation will be more likely to manage their earnings via accounting accruals, which rejects our H1 from the multivariate regression model results in the full sample.  
      (insert Table3)
   3. The relation between RPA implementation and RM   
        
      The table presents the multivariate results of the RM analyses. For the multivariate regression of ABCFO, ABPROD and combined proxy RM, the estimated coefficient of RPA are all negative and significant at 1% significant level, showing that the firms with RPA implementation will less likely to use the measures of RM given the higher (lower) levels of abnormal operating cash flows and overall RM (abnormal production costs).  
        
      Similar results from AM regression models, with the control of AM, the estimated coefficient of ABSDA is significantly positively at 5%, 1%, 1% , and 5% significant level for ABCFO, ABPROD, ABEXP, and RM regression models, consistent with the prior research. (CHF 2012; Paredes and Wheatley 2018) It implies that the firms engage in AM will be more likely to take RM approach at the same time to manage the earnings of the firms.   
        
      Interestingly, the estimated coefficient of the interaction term RPA\*ABSDA, is positively significantly in ABCFO, ABPROD and RM regression models (P<0.01, <0.1, and <0.01), indicating that RPA implementation increases the positive effects (or decreases the negative effects) of AM on RM, which supports the Hypothesis 3. If the firms engage in AM less, it is more likely that they might not use RM as well. On the other hand, once the firms take AM for earnings management, the presence of RPA plays the role to make the firm utilize both approaches of EM.

In terms of control variables, we find that the estimated coefficients of OCF, MTB, ADJROA, RD, and ADV are all significantly negative related to RM regression model at 1% significant level, meaning that the firms with higher operating cash flows, higher market-to-book ratio, higher ADJROA, and higher R&D and advertising intensity will be less likely take RM as a kind of measures to manage earnings. As for INST, MS, and LGTA, on the other hand, are all positively significant between RM proxy (P<0.05, <0.01, <0.01), indicating firms featured with higher percentage of institutional investors, higher market share and larger size may be opt for managing earnings through RM practices.  
  
In summary, we first obtain the evidence shows that RPA-implemented firms use RM to manage earnings less than the firms without RPA implementation, consistent with H2. Importantly, the interaction term with the accrual proxy and RPA supports our hypothesis 3 that a firm with the presence of RPA implementation will be more likely to manage earnings via both measures in a complementary approach.   
(Insert Table4)

1. Additional Analyses
   1. Alternative measures of discretionary accruals   
      Aside from using modified Jones model to calculate discretionary accruals, we rerun our sample data through that from standard Jones model and obtain similar results regarding our testing main interest variables in both earnings management regression models.
   2. Alternative measures of Real activities manipulation

To capture the total comprehensive effects of real earnings management, we follow Cohen and Zarowin (2010) to adopt the two comprehensive metrics of RM activities, RM1 and RM2 respectively. RM1 is defined as the aggregation of ABPROD and ABEXP, whereas RM2 is derived from sum of ABCFO and ABEXP. The testing results remain robust after applying these two measures in the real activities manipulation regression, which still supports the hypothesis 2 and hypothesis 3.

* 1. Propensity score matching  
     Due to the fundamental difference across several aspects such as firm size (LGTA) between RPA and non-RPA observations within our full sample, we take propensity score matching method (PSM) as the robustness testing approach to capture the effect of the RPA on EM. To test this alternative approach, we follow the suggestions and methodology from Shipman et al. (2017). First, we perform logistics regression based on both AM and RM specifications, which regresses the main interest variable RPA on the same independent variables from the specifications. Both matching logistics regression without caliper settings end up matching 328 observations with nearest propensity score. This way, we obtain total samples 656 as matched dataset after PSM with half of RPA implementation observations and half of matching samples without RPA implementation. The matched dataset statistics as following tables. There seems no significant difference in means between the two groups compared with the full sample scope (see table 5, 6), indicating that the two groups are similar in the observable aspects, and our matching process is valid. (see Table 7)  
       
     Consistent with the results via full sample, the rerun regression results about the main interest variable and its interaction terms remain the same.   
       
     (Insert Table 5, 6, 7)

1. Conclusion  
     
   The advent of Robotic Process Automation (RPA) heralds a new era in the technological evolution of finance and accounting Despite the proliferation of empirical research on ERP technologies, the empirical examination of RPA, particularly in its relation to earnings management, remains largely unexplored. This study positions RPA as an innovative extension of ERP, venturing into novel empirical terrain to explore its potential implications on earnings management practices, thereby filling a significant gap in the existing literature.  
     
   This study discusses about association between the presence of RPA and earnings management among 9,780 firm-year observations from 2017 to 2022, sample collected the annual reports. AM is measure by the discretionary accruals from modified Jones model, while RM proxies re calculated from difference between normal levels of cash flows, production costs, and discretionary expenses. From the full sample results, AM seems no difference between RPA and non-RPA observations, on the other hand, the firms with the presence of RPA will be less likely to partake RM as an approach to manage earnings. Most interesting, the third hypothesis of the interaction terms indicates that the strategic choices firms make regarding AM and the adoption of RPA reveal a nuanced landscape. Firms that exercise restraint in AM and are cautious with RPA adoption demonstrate a commitment to transparency and ethical standards, resulting in more reliable financial statements and potentially higher firm valuation. This approach signals a dedication to upholding high governance and ethical practices. Conversely, when firms synergize AM with RPA, it leads to amplified effects to RM, indicating a move towards more aggressive earnings management strategies. This combination of EM tactics and advanced technology poses challenges for stakeholders like policymaker, auditors, or other stakeholders, emphasizing the importance of a nuanced understanding of their collective impact on financial integrity and the need for sophisticated analysis about this RPA application among the firms.  
     
   The limitations of this study can be delineated along two primary dimensions. Firstly, the unavailability of specific contract details necessitated reliance on annual reports as a methodology for gathering data on Robotic Process Automation (RPA), potentially leading to discrepancies when compared to the direct contract information. Secondly, the emergent nature of RPA within the Taiwanese context restricts the breadth and depth of empirical evidence, underscoring the importance of interpreting the findings with caution and indicating directions for future research to build upon these initial insights.  
     
   For subsequent research endeavors that aim to investigate the intersection of RPA with accounting or auditing, focusing on the potential weaknesses in internal controls related to Earnings Management (EM) could provide valuable insights, a topic not directly addressed in this study. Furthermore, given the constraints posed by the limited data availability due to the nascent stages of RPA development, future studies are encouraged to undertake a more detailed examination of RPA implementation levels. Drawing inspiration from the methodology of Brazel and Dang (2008) in their ERP research, which gauges the extent of ERP integration through the count of system modules, the depth of a company's RPA utilization could similarly be evaluated based on the quantity of both attended and unattended licenses, offering a direct measure of RPA's operational engagement.
2. Appendix A

Consistent with the prior literatures, we run the following prediction model for each year within each TSE industry code at minimum of 15 observations. (Zang 2012; Brazel and Dang 2008; Paredes and Wheatley 2018 etc.)

* 1. Accrual-based proxy  
     We use the modified Jones model to calculate the accrual-based earnings management proxy. As described by Dechow et al. (1995), this model is a firm-specific measure based on cross-sectional estimation. According to this model, total accruals are affected by the change in sales, level of property, plant, and equipment:   
     where TA is net income from continuing operations minus operating cash flows; A is total assets; S is net sales; R is sum of net account receivables and note receivables; PPE is gross property, plant, and equipment.
  2. Real activities manipulation proxies
     1. ABCFO  
        Sales manipulations are expected to lead to lower current-period operating cash flows. We use Roychowdhury’s (2006) model to estimate the normal level of operating cash flows:

where CFO is operating cash flows; A is total assets; S is net sales.

* + 1. ABPROD  
       Another measure of real activities manipulation as mentioned from prior studies is abnormal production costs.

where production costs (PROD) are the sum of operating costs and change in inventory; A is total assets; S is net sales. Operating costs is defined as the necessary expenditure incurred to bring inventory to a salable condition and location or ready for production in TEJ database, which is the sum of costs of goods sold, cost- rent expenditure, cost- sale of land, cost- disposal of investment, and cost- investment loss.

* + 1. ABEXP  
       The last measure of real activities manipulation as mentioned from prior studies is abnormal production costs.

where discretionary expenses (EXP) is the operating expense; A is total assets; S is net sales. Operating expenses is defined as expenses incurred by a business from its operating activities in TEJ database, which is the sum of selling expenses, administrative expenses, R&D expenses, other expenses, and expected credit losses (loss) benefit- operating expenses.