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Article

The impact of ERP utilization and ESG practices on earnings management—An empirical study of Taiwan

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Abstract: Enterprise Resource Planning (ERP) system utilization and Environmental, Governance, Social (ESG) practice incorporation have jointly wielded significant influence on various aspects of accounting operations. On the other side, leveraging the robust information infrastructure, Taiwanese firms have widely implemented ERP systems and have been aligning with international ESG initiatives in recent years. The objective of this study is to investigate the impact of ERP utilization and ESG practices on real and accrual earnings management among firms listed in Taiwan over an 19-year span from 2003 to 2021. The results of this study suggest duration of ERP implementation has a negative impact on accruals earnings management, but has a positively influence on real management. The results underscore the significant influence of ERP utilization duration on the different aspects of corporate earnings management activity. Additionally, our investigation illustrates a negative association between the corporate assimilation of ESG practices and both real and accrual earnings management. This reveals that enterprises committed to implementing ESG practices highlight long-term substantive operations over the short term periodic performance of financial statements.

Keywords: ESG; ERP; sustainable development goals; accrual earnings management; real earnings management

1. Introduction

Research motivation and purpose

Taiwan's digital manufacturing industry stands unparalleled globally. As reported by the Institute for Information Industry (Taiwan) in the 2020 Taiwan Digital Economy Market Forecast Report, the output value of Taiwan's semiconductors is approximately 93 billion US dollars, making up about 21.54% of the global output value. As for information hardware, it reaches 392.8 billion US dollars, accounting for roughly 94.26% of the global output value (CIO Taiwan, 2021).

Taiwan's manufacturing industry reaps the benefits of a comprehensive information infrastructure. Enterprise Resource Planning (ERP) is far from a new concept in Taiwan. Large enterprises, with a business scale exceeding 200 million US dollars, have an almost 100% ERP implementation rate. ERP, which takes the entire resources of an enterprise as the planning subject to execute various business activities and the management of the implementation results, establishes an information system that aids the decision-makers of the enterprise in comprehending the internal and external environment of the enterprise. This allows for the full and effective utilization of various enterprise resources as a whole, thereby providing a competitive advantage (Bradford and Florin, 2003; Ahmi and Saidin, 2022).

In an optimal ERP system operating environment, the accounting processing operation module has an information integration and process integration relationship with other modules in the ERP system. This ensures that the organization's accounting information system can generate accurate financial information in real-time. Consequently, American Production and Inventory Control Society (APICS) defines the enterprise resource planning system as a financial accounting-oriented information system. The advancements in ERP have altered the transaction environment of enterprises, and its relationship with accounting is intimate and far-reaching.

Alanazi and Alzubi (2023) posited that the Accounting Information System (AIS), which forms the foundation of any ERP system, is often constructed as a centralized system. Earnings management holds significant research value in the realms of financial accounting and management accounting and is an essential empirical research field of agency theory and corporate governance theory (Low et al., 2023). In agency theory, earnings management is perceived as a type of agency cost, which reflects the conflict of interests between business managers and shareholders. In corporate governance theory, earnings management is one of the critical means to control agency problems, mirroring the quality and effectiveness of corporate governance (Putra, 2022).

With the widespread adoption of ERP in enterprises, whether the digitization of processes gives enterprises an advantage in information asymmetry, thereby enhancing the motivation for earnings management behavior, has become a topic of interest in academic and practical circles. Morris and Laksmana (2010) examined the impact of ERP systems on earnings management, comparing levels for 143 companies in 32 industry groups that implemented ERP systems between 1994 and 2003 to levels for a control group. Their research found that short-term discretionary accruals drive the results, while long-term discretionary accruals show no significant change for either group. Brazel and Li (2008) used American companies as a sample to study the related research on the introduction of ERP and earnings management. They studied this issue with an experimental group and a control group. The conclusion also pointed out that the introduction of ERP will increase the company's earnings management behavior.

Another important issue is that, since the United Nations' 'Who Cares Wins' report in 2004, it has been proposed that companies should incorporate ESG (Environmental, Social, and Governance) criteria into the evaluation indicators of business operations. This not only promotes the sustainable operation of enterprises but can also bring about positive benefits to society (Social), environment (Governance), and corporate governance operations (Governance), and can effectively realize corporate social responsibility (Cerciello et al., 2023; Engelhardt et al., 2023). To align with the international sustainable trend of Taiwanese enterprises, the financial supervisory agency released the "Corporate Governance 3.0—Sustainable Development Blueprint in 2020." This stipulates that a company should prepare sustainability reports and proactively disclose ESG implementation projects. Enterprises must incorporate ESG issues into formal management tools. Hence, it is anticipated that ESG will guide the reshaping of business models towards sustainable development.

Sustainable development is non-negotiable. Nidumolu et al. (2009) emphasized that enterprises lacking a sustainable development direction will face crises such as legal risks, consumer and investor distrust, supply chain risks, and declining market competitiveness. Therefore, incorporating sustainable thinking into business operations necessitates reshaping the company's business model, viewing this challenge as a catalyst to trigger the next wave of growth for the company.

The impact of ESG on enterprises is multifaceted. Current research predominantly explores the impact of ESG on enterprises based on the relationship between enterprise performance (Cerciello et al., 2023; Engelhardt et al., 2023) or the relationship between ESG rating and market value of a firm or stock price (Gavrilakis and Floros, 2023; Andersson et al., 2022). Some studies have also examined the impact of ESG on corporate earnings management (Kolsi et al., 2023). Rezaee and You (2019) scrutinized the association between the quantity and quality of sustainability disclosures and earnings quality in the context of corporate ethical value and culture.

Both ERP and ESG are comprehensive strategies for companies, necessitating the integration of multiple aspects of the enterprise, including finance, production, supply chain, environment, and society. They aim to achieve the overall goals of the enterprise. Furthermore, the core objectives of ERP and ESG are founded on improving corporate transparency and promoting responsible social behavior (Sislian and Jaegler, 2022; Rodríguez-García et al., 2020). However, current research incorporating both ERP and ESG simultaneous into the empirical model of earnings management is relatively rare. Examining how both affect financial reporting by firms addresses gaps in academic research.

Given the analysis above, the increasing dissemination of ERP utilization and ESG practices has significantly influenced many dimensions of the accounting system. ERP integrates enterprise resources and processes systematically and structurally, while ESG guides the reshaping of business models towards sustainable development. Therefore, this article aims to explore the relationship between the duration of ERP system utilization, ESG practices, and the company's earnings management. This exploration is expected to provide a broader perspective on earnings management activity.

To enhance the completeness of this research, earnings management is divided into two distinct categories. As per Schipper (1989), companies' earnings management methods can be divided into real earnings management and accrual earnings management. Real earnings management, involving the manipulation of production, investment, and R&D expenses to meet earnings targets, can help firms foster good external relations, thus lowering future operational costs This approach's benefits may outweigh the negative effects of reducing adjudication fees (Gunny, 2010). The use of accrual earnings management, which is earnings management that conforms to Generally Accepted Accounting Principles (GAAP) but employs different accounting methods, is seen as a precursor of a company's future performance deterioration. It has a negative impact on the firm's enterprise value (Huang et al., 2009).

In other words, while moderate real earnings management is a more understandable activity, accrual earnings management is not. Therefore, this paper conducts an empirical analysis over a long-term research period spanning 19 years from 2003 to 2021. It discusses the influence of the interval in which Taiwanese

companies use ERP and implement ESG practices, which are two significant strategies related to business operations, on the company's real earnings management and accrual earnings.

This study attempts to fill the academic research gap concerning the relationship among ESG, ERP, and earnings management. First, it explores the impact of both ERP and ESG on corporate earnings management simultaneously. Second, it uses the duration of ERP usage by enterprises as an explanatory variable instead of categorizing whether enterprises have adopted ERP or not. The advantage of considering the duration of ERP usage is that it views the experience of enterprises using ERP as a cumulative effect. The length of the interval differs for the experience and effect of enterprise integration with ERP. Third, it compares the difference between real earnings management and accrual earnings management, which are two different earnings management activity.

The contribution of this article aims not only to address the research gap identified within the academic community, but also to provide valuable insights that can enhance decision-making and policy formulation for corporate practitioners, investors, and securities regulatory agencies.

The layout of the rest of the articles is as follows: In section 2 the literature review is presented. Section 3 elucidates the research methodology employed. Section 4 presents the empirical results and subsequent analysis. Finally, Section 5 offers conclusions and recommendations.

2. Literature review

This section organizes the relevant citations and establishes the relevant hypotheses. The first part will review the related literature of real and accrual earnings management. The second part discusses the relevant literature on ERP introduction and earnings management and establishes relevant hypotheses for this study. The third part reviews the relevant literature on ESG and earnings management and establishes relevant hypotheses for this study.

2.1. Real and accrual earnings management

Earnings management is the embellishment of financial statements by the management of the company using its discretion in preparing financial statements. Summarizing the previous studies, the motivations for corporate earnings management can be divided into three categories: one is to avoid errors in earnings forecasts (Kasznik and McNichols, 2002), and the other is to smooth corporate earnings and reduce volatility (Barth et al., 1999), and the third is to modify the operating loss of the enterprise (Brown, 1997). Cerullo and Cerullo (2000) even pointed out that after enterprises introduced ERP one after another in 1990, the activity of earnings management is still popular. Especially in recent years, there are still many fraud cases caused by false financial reports in various countries, which all show that earnings management behaviors are emerging in an endless stream.

The methods of earnings management can be divided into two different forms: real earnings management and accrual earnings management (Cohen, 2008; Zang, 2012). Real earnings management refers to the adjustment of financial statements by

enterprises through legal accounting methods to reflect the true operating performance of enterprises. This kind of earnings management is based on actual business needs, and usually does not violate accounting standards and laws and regulations. The accrual earnings management refers to the adjustment of the recognition and calculation of accrual items by the enterprise in order to achieve the purpose of adjusting the earnings within the legal scope. The difference between the two earnings management lies in the purpose and means of earnings management. Real earnings management is to reflect the real performance of the enterprise, while earnings management for discretionary accruals is to achieve specific earnings targets. (Schipper, 1989; Subramanyam, 1996)

Currently, there is no consensus regarding the appropriateness of earnings management. Zucca and Campell (1992) and Beatty and Weber (2003) argue that earnings management is a detrimental practice. They suggest that corporations frequently opt for asset depreciation when they experience a decline in performance, encounter operational challenges, or face regulatory pressure. Discretionary depreciation could be utilized as a tool for earnings management to manipulate a firm's financial reporting and investor expectations. As a result, regulators should closely monitor voluntary changes in accounting methods and scrutinize the underlying motivations behind these changes.

However, some scholars put forward the opposite opinion, thinking that moderate and reasonable earnings management will increase the value of accounting earnings disclosure. Healy and Palepu (1990) found that earnings management, as a financial disclosure strategy, affects the company's market value depending on its purpose and means. Moderate earnings management may help to improve the quality of information disclosure. Botosan (1997) explored the relationship between the quality of financial report information disclosure and the cost of equity capital of the company. The findings support the positive impact of high accounting disclosure quality on firm stock prices. Diamond and Verrecchia (1991) intended to reveal the same research results, empirical evidence shows that high-quality accounting information can help reduce the company's cost of capital and improve the liquidity of the stock market.

What is the relationship between real earnings management and accrual earnings management? Some papers compare the two forms of earnings management and discuss their use in different situations and the trade-offs between them. Graham and Rajgopal (2005) and Zang (2012) showed that when companies choose earnings management strategies, they will consider the cost and effect between the two, in order to pursue and achieve the company's strategic goals. And if investors think that earnings management will hide the real performance of the company, they will give a negative stock price reaction. On the contrary, if investors believe that earnings management will improve the company's earnings quality or benefit them, the stock price will have a positive reaction.

In addition, some studies have pointed out that regardless of real earnings management (such as Hribar et al., 2006; Kim and Park, 2012) or accrual earnings management (Bartov, 2009), the capital market tends to give relatively negative stock price reactions.

2.2. ERP utilization and earnings management hypothesis development

Ahmi and Saidin (2022) reviewed 1232 scholarly articles from 1992 to 2021. The bibliometric results indicated that research in the ERP field is exhibiting steady growth. Early ERP research primarily focused on successful ERP implementation, the factors contributing to success or failure (Umble et al., 1999, Markus et al., 2000), or the benefits derived from ERP implementation (Dechow and Mouritsen, 2005), and similar topics. During this period, the selection and use of effective indicators were somewhat biased. As ERP adoption by businesses became widespread, Toumeh (2017) and Alanazi and Alzubi (2023) studied on the relationship between ERP and accounting theory gradually diversified, reinforcing that ERP is fundamentally oriented towards financial accounting

Alanazi and Alzubi (2023) pointed out that an Accounting Information System (AIS), which is the foundation of any enterprise resource planning (ERP) system, is often built as a centralized system. Dillon (1999) proposed that through ERP, managers can obtain the final information of accounting processing in real time without waiting for a long accounting cycle or crossing the gap of accounting theory. Both practice and theory show that after an enterprise introduces an ERP system, the financial and accounting processing operation module has a relationship with other modules in the ERP system for information integration and process integration. The system can immediately produce correct financial information, and managers do not need to cross accounting. The results of accounting treatment can be obtained in real time due to the theoretical gap, and it can speed up the real-time and correctness of managers' decision-making (Davenport 1998; Hitt et al., 2002).

Although a complete ERP system should take the accounting management system as the core, there is no doubt that it can effectively achieve the goals of making profits and strengthening the physique (Dillon, 1999); however, the single goal of demonstrating the effectiveness of internal control functions is still questioned. Morris (2010) even believed that the ERP system would reduce the effectiveness of internal controls over financial reporting. There are 3 main reasons for the relevant research: 1. The enterprise does not understand the internal control mechanism of ERP; 2. The enterprise has not fully implemented the internal control mechanism of ERP; 3. Although the establishment of ERP reduces or controls the existing risks, it also creates some new control risks (Wright and Wright 2002; Hunton et al., 2004; Brazel and Agoglia 2007).

In pursuit of understanding the impact of ERP implementation on the quality of corporate financial reporting, the majority of studies have adopted accrual earnings management as a proxy variable for earnings quality. (Morris and Laksmana, 2010; Toumeh, 2022; Tsai et al., 2012; Chen, 2012). Morris and Laksmana (2010) examined the impact of ERP systems on earnings management, comparing levels for 143 firms in 32 industry groups that implemented ERP systems between 1994 and 2003 to levels for a control group. The research found that short-term discretionary accruals are driving the results, while long-term discretionary accruals show no significant change for either group. Toumeh (2017) also showed that ERP adopting firms are less likely to engage in accrual earnings management practices than ERP non-adopting firms.

Dehning et al. (2017) examine the question of changes in earnings management

brought about by ERP system implementation using an alternate measure of earnings management and earnings quality. Findings showed that the probability of a GAAP violation decreases significantly after the implementation of ERP systems, but less for larger firms, and more for high growth firms.

This study synthesized the above literature and found that most studies from the perspective of whether enterprises have introduced ERP or not, and rarely conducts relevant research from the perspective of enterprises' use of ERP. The advantage of using the point of view during ERP introduction is that the continuous impact of ERP on the enterprise can be observed from a long-term cumulative point of view. Therefore, this study establishes hypothesis H1 as follows.

- H1: The duration of Enterprise Resource Planning (ERP) implementation within an enterprise is inversely related to the extent of accrual earnings management.

Moreover, real earnings management, which reflects the actual performance of the enterprise, fundamentally differs from accrual-based earnings management. Accrual-based earnings management is more likely to achieve specific earnings targets through the manipulation of accounting principles, contrasting with real earnings management that is grounded in actual business operations. (Schipper,1989; Subramanyam, 1996)

According to the researchers exploring the impact of ERP implementation on real earnings management, the following hypothesis emerges. Upon successful deployment of an ERP system, an enterprise's accounting processes can be significantly streamlined. Capabilities like inter-modular data sharing and form transfers greatly reduce the complexity of traditionally tedious tasks such as document operations, account processing, and verification. Chen (2012) provides evidence that enterprises with a longer history of ERP implementation encounter unique incentives and opportunities in their financial reporting decisions.

Therefore, this study establishes hypothesis H2 as follows.

- H2: The duration of Enterprise Resource Planning (ERP) implementation within an enterprise is positively related to the extent of real earnings management.

2.3. ESG and earnings management hypothesis development

Since Earth Day on April 22, 2016, 171 countries signed the "Paris Climate Agreement" at the United Nations Headquarters, and the ESG issue has become more urgent and important. The relationship between Environmental, Social, and Governance (ESG) factors and earnings management has been a subject of academic research in recent years. Some studies suggest that companies with higher ESG scores tend to engage less in earnings management (Gavana et al., 2022). This is possibly due to the fact that companies with strong ESG performance and disclosure are more likely to have robust governance structures, transparent reporting, and better internal controls. These factors may deter management from manipulating financial results.

Bozzolan et al. (2015) investigate whether the corporate social responsibility (CSR) orientation of a firm affects its reporting incentives between real earnings management and accrual-based earnings management. They show an evidence that CSR-oriented companies are less likely to engage in the more costly but harder to detect earnings management strategy. Kolsi et al. (2023) used the research period of

2010-2019 to explore the relationship between the ESG performance of the US commercial bank sample and the Earnings management practice. The results show that, in addition to environmental (E) items, the ESG performance score is an effective mitigation tool for US banks to conduct earnings management.

However et al., (2021) examines the association between carbon assurance and earnings management. They found voluntary adoption of carbon assurance, carbon disclosure and gender diverse boards are negatively associated with earnings management.

Furthermore, from an investor's point of view, Bui et al. (2021) has shown that institutional investors with a focus on ESG are less likely to invest in companies with a history of earnings management. The article has found a positive relationship between ESG performance and long-term financial performance. This may lead to a reduction in earnings management over time.

In alignment with research investigating the impact of ERP on earnings management, Chen (2012) and Rezaee and Tuo (2019) exploring the effect of a firm's ESG initiatives on its earnings management practices predominantly employ accrual-based earnings management as the research variable. Therefore, this article will utilize real earnings management as the target variable to investigate whether the implementation of ESG initiatives by corporations reduces their earnings management. This approach aims to bridge the gap in the existing academic literature. Therefore, this study establishes hypothesis H3 and H4 as follows.

- H3: The implementation of ESG initiatives by enterprises is inversely related to their engagement accrual earnings management behavior.
- H4: The implementation of ESG initiatives by enterprises is inversely related to their engagement in real earnings management behavior.

3. Research methodology

3.1. Research data

The sample source of this research data is taken from ERP Laboratory of Shih Hsin University (2018), under the guidance of the Chinese Enterprise Resource Planning Society, to build an ERP-related database, and conduct a survey using the top 1000 manufacturing industries in Commonwealth Magazine. This article selects companies listed on the Taiwan Stock Exchange as the research sample.

The study spanned 19 years (2003–2021), with yearly sample sizes ranging from 127 to 142 companies, depending on their listing date and data availability, and after excluding outlier data, aggregating to a total of 2571 data instances. To ensure the data's comprehensiveness, the study period includes the effects of both the 2008 global financial crisis and the 2020 COVID-19 pandemic, collecting data from 2003 to 2021. The firms' financial data were sourced from the Taiwan Economic Journal and company-specific reports or websites. Environmental, Social, and Governance (ESG) practices were assessed based on inclusion in the Business Weekly Magazine's top 100 carbon-reducing companies of 2021.

3.2. Variable measurement and definition

3.2.1. Real earnings management model

In assessing real earnings management, this study adopts the measurement methodologies as delineated in the models developed by Cohen et al. (2008). The respective models are in assessing real earnings management, this study adopts the measurement methodologies as delineated in the models developed by Cohen et al. (2008). The respective models are articulated below:

Operating Activity Cash Flow Model:

$$CFO_{it}/A_{it-1} = k_{1(}1/A_{it-1}) + k_2(SALES_{it}/A_{it-1}) + k_3(\triangle SALES_{it}/A_{it-1}) + \varepsilon_{it} \quad (1)$$

COGS Model:

$$COGS_{it}/A_{it-1} = k_1(1/ A_{it-1}) + k_2(SALESit/A_{it-1}) + \varepsilon_{it} \quad (2)$$

Inventory Movement Model:

$$\triangle INV_{it}/A_{it-1} = k_1(1/A_{it-1}) + k_2(SALES_{it}/ A_{it-1}) + k_3(\triangle SALES_{it}/ A_{it-1}) + k_4(\triangle SALES_{it-1}/A_{it-1}) + \varepsilon_{it} \quad (3)$$

Production cost is the sum of cost of goods sold and inventory changes. According to Equations (2) and (3), the normal level of production cost is estimated as follows:

Production Cost Model:

$$PROD_{it}/A_{it-1} = k_1(1/ A_{it-1}) + k_2(SALES_{it}/A_{it-1}) + k_3(\triangle SALES_{it}/A_{it-1}) + k_4(\triangle SALES_{it-1}/A_{it-1}) + \varepsilon_{it} \quad (4)$$

Adjudicatory fee model (including advertising, R&D, miscellaneous fees):

$$DISCEXP_{it}/A_{it-1} = k_1 (1/A_{it-1}) + k_2(SALES_{it-1}/A_{it-1}) + \varepsilon_{it} \quad (5)$$

The variables are defined as follows:

A_{it-1}: Total assets of company i at the beginning of year t;

CFO_{it};

$COGS_{it}$: Cost of goods sold for company i in year t;

$\triangle INV_{it}$: Inventory change of company i in year t;

$SALES_{it}$: Sales revenue of company i in year t;

$\triangle SALES_{it}$: The change in sales revenue of company i in year t;

$PROD_{it}$: Total cost of goods sold and inventory changes in company i in year t;

$DISCEXP_{it}$: Adjudicative expenses (including advertising, R&D, miscellaneous expenses) of company i in year t.

Finally, the residual values calculated by the models (1), (4), and (5) are used as abnormal items. Due to the lower abnormal operating cash flow or abnormal adjudicative expenditure, and the higher abnormal production cost, it means that the range of real earnings management is greater. (Gunny, 2005; Cohen et al., 2008; Chi et al., 2011). Therefore, this article multiplies the values of abnormal operating cash flow and abnormal discretionary expenditure by −1 after normalization, plus the sum of standardized abnormal production costs to make it is the proxy variable of real earnings management.

3.2.2. Accrual earnings management model

The measurement method of accounting earnings management in this study refers to the estimation of adjudicated accruals with reference to the regression model proposed by Kothari et al. (2005) considering accounts receivable and ROA. This

model is derived from the Modified Jones Model (Modified Jones Model) proposed by Dechow et al. (1995) to Jones (1991) to more effectively measure earnings management behavior. This regression schema looks like this:

$$TAC_{it}/TA_{it-1} = a_1(1/TA_{it-1}) + a_2(\triangle REV_{it} - \triangle REC_{it})/Tait - 1 + a_3(PPE_{it})/TA_{it-1} + a_4(ROA_{it})/TA_{it-1} + \varepsilon_{it} \quad (6)$$

The meanings of the variables in Equation (6) are as follows:

TAC_{it}: It is the total accrual of company i in year t, which is the difference between the net profit of the continuing business department and the cash flow of operating activities, and the calculation method is ($\triangle CA - \triangle CASH - \triangle CL + \triangle LL - DEP$).

TA_{it-1}: Total assets of company i at the beginning of year t;

$\triangle REV_{it}$: The change in revenue of company i between year t and year t − 1;

$\triangle REC_{it}$: Changes in accounts receivable and bills receivable of company i in year t and year t − 1;

$PPE_{it:}$ Total fixed assets of company i in year t;

ROA_{it}: Return on assets of company i in year t;

ε_{it} (residual): Estimate the residual item of the i-th company in the t-th year in the regression formula.

a_1, a_2, a_3, and a_4 are the estimated parameters of individual companies, and they are substituted into α_1, α_2, α_3, and α_4 in the following Equation (7) to calculate the non-judgmental accruals of individual companies.

$$NTAC_{it}/TA_{it-1} = \alpha_1(1/TA_{it-1}) + \alpha_2(\triangle REV_{it} - \triangle REC_{it})/TA_{it-1} + \alpha_3(PPE_{it})/TA_{it-1} + \alpha_4 ROA_{it})/TA_{it-1} \quad (7)$$

Finally, the measure of discretionary accruals is obtained by subtracting the estimated non-discretionary accruals from the total accruals of each company, as shown in Equation (8):

$$DTAC_{it}/TA_{it-1} = TAC_{it}/TA_{it-1} - NTAC_{it}/TA_{it-1} \quad (8)$$

The meanings of the variables in Equation (8) are as follows:

$NTAC_{it}$:Non-Judgmental accruals for company i in year t;

$DTAC_{it}$:Judgmental accruals for company i in year t.

3.2.3. Explanatory variables

The duration of ERP implementation in enterprises: The variable of interest in this study represents the length of time, quantified in years, that an enterprise has been operational with an ERP system. This independent variable is treated as a numerical entity. We establish the year of ERP implementation as the baseline, assigning it a value of zero. Subsequently, each preceding year is denoted by a negative integer (-1 for the year prior to implementation, -2 for two years prior, and so on), and each subsequent year is denoted by a positive integer (1 for the year following implementation, 2 for two years after, etc.).

While Brazel and Dang (2008) designate the periods before and after ERP implementation as categorical variables, this study adopts a different approach. Leveraging the time of ERP introduction as a variable offers a more nuanced measurement of an enterprise's duration and experience with ERP implementation, allowing for a more precise capture of the cumulative impact of ERP usage on the dependent variable-earnings management.

The measurement of ESG practices of companies: This independent variable is a categorical variable. This study is based on whether it is included in the list of Taiwan's top 100 carbon reduction companies listed by Business Weekly Magazine (Taiwan) in October 2021. If the sample companies belong to the top 100 selected firms, the category variable is set to 1, and if it is a non-selected company, the category variable is set to 0.

The company selection method of Business Week is based on the following international carbon reduction initiatives and evaluation indicators, and consulting domestic and foreign influence investment institutions, research institutions, scholars and experts for recommendations. The following ten evaluation criteria were considered to select Taiwan's top 100 carbon reduction companies.

1) MSCI's score and other places: In 2021, the ESG rating will reach A, AA, and AAA.
2) Carbon reduction index: Rated by MSCI BBB and listed in MSCI ACWI carbon reduction index.
3) Green business opportunities: Listed in MSCI Global Environment Index.
4) RE100 members: Commit to using 100% renewable energy by 2050.
5) EP100 members: Commitment to increase energy efficiency by 100%.
6) EV100 members: Promise to electrify 100% of transportation vehicles by 2030.
7) SBTi: Join the Science-Based Carbon Reduction Targets initiative.
8) TCFD: Sign up to support the Climate-Related Financial Disclosure Initiative.
9) Apple: The company is a member of Apple's green supply chain.
10) B-type enterprise: Commitment to the enterprise to exert influence such as environmental friendliness.

3.2.4. Control variables

To enhance the explanatory power of this research model. The empirical model of this study includes control variables that are academically influential on earnings management factors: earnings per share (EPS), debt ratio (LEV), dividend payout ratio (DIV), and Tobin's Q are control variables. variable. The measurement methods of the control variables are listed as follows:

1) EPS: Net profit after tax divided by the number of shares outstanding. EPS means how much money a business can earn per share of stock.
2) LEV: The company's capital structure or debt ratio is one of the factors that affect the company's discretionary accrual, which is measured by the (debt/total assets) ratio of individual companies.
3) DIV: It is used to express the company's dividend policy, and the dividend payout ratio is the ratio of dividend per share to earnings per share.
4) TQ: It mainly refers to the ratio of a company's market value to its asset replacement cost, which reflects the ratio of two different value estimates of a company.

3.3. Empirical models

There are two regression models in this study, with accrual earnings management and real earnings management as dependent variables respectively. In order to simultaneously observe the two significant issues of ESG advocacy and the duration

of ERP implementation, both variables are included in the multiple regression models of this study's research design. The two models are as follows:

Model I: $DA_{it} = \beta_{10} + \beta_{11}ERP_{it} + \beta_{12}ESG_{it} + \beta_{13}EPS_{it} + \beta_{14}LEV_{it} + \beta_{15}DIV_{it} + \beta_{16}TQ_{it} + \varepsilon_{it}$

Model II: $RM_{it} = \beta_{20} + \beta_{21}ERP_{it} + \beta_{22}ESG_{it} + \beta_{23}EPS_{it} + \beta_{24} LEV_{it} + \beta_{25}DIV_{it} + \beta_{26}TQ_{it} + \varepsilon_{it}$

Among them, the variables are defined as follows:

DA_{it}: Real earnings management;

RM_{it}: Acrual earnings management;

ERP_{it}: The time interval of using the ERP system for the i-th company in the t-th year;

ESG_{it}: Whether the i-th company belongs to the carbon reduction 100 index target;

EPS_{it}: Earnings per share of company i in year t;

LEV_{it}: Debt ratio of company i in year t;

DIV_{it}: Dividend payout ratio of company i in year t;

TQ_{it}: Tobin'Q ratio of company i in year t;

4. Empirical results and analysis

4.1. Descriptive statistical analysis

Table 1 presents the descriptive statistics for the sample. The mean value for the accrual earnings management proxy variable is −0.057, while the real earnings management variable averages at −0.090. The ERP system implementation period spans from −8 to 21 years, with a mean of 7.7 years. A negative duration implies that the company had not implemented an ERP system in the year of supposed introduction during the research period, thus the negative value. The ESG practice variable is a binary one (0 or 1), determined by the company's inclusion in Business Weekly Magazine's Top 100 Carbon Reduction Companies in Taiwan as of October 2021. Among the control variables, the sample average EPS stands at NT $2.75; the mean debt ratio is 43.61%; the average dividend payout ratio is 75.438%; and the average Tobin's Q value is 1.107.

Table 1. Sample descriptive statistics.

	Average	Median	Min.	Max.	Std.	Kurtosis	Skewed
DA	−0.057	−0.131	−223.494	136.948	13.127	−4.834	99.386
RM	−0.090	−0.068	−5.519	7.503	0.622	0.893	17.624
ERP	7.709	8.000	−8.000	21.000	6.330	−0.018	−0.673
ESG	0.118	0.000	0.000	1.000	0.322	2.372	3.628
EPS (NTD)	2.475	1.560	−22.270	79.110	4.902	5.448	62.212
LEV (%)	43.611	44.130	6.220	262.520	15.930	1.613	18.980
DIV (%)	75.438	49.860	−3700	34474	947	33	1163
TQ	1.107	0.890	−0.450	11.330	0.744	3.727	26.265

Note: The number of research samples for each variable is 2571.

Table 2 illustrates the results of a Spearman's rank correlation coefficient test used in this study. Incorporating a total of 8 variables: two dependent, one independent, and four control variables. Through spearman's correlation coefficient analysis, the interrelations among these variables were explored. All absolute value of spearman's correlation coefficients ranged between 0.002 and 0.525, indicating mostly low levels of correlation. Notably, the correlation coefficient between real earnings management and accrual earnings management was 0.449, reaching a statistically significant level at the 1% threshold. Real earnings (DA) management displayed a positive relationship with the duration of ERP utilization within enterprises and a negative association with ESG practice. Conversely, accrual earnings management (RM) correlated negatively with both ERP duration and ESG practice.

Table 2. Spearman's rank correlation coefficient among the research variables.

	RM	DA	ERP	ESG	EPS	LEV	DIV	TQ
RM	1	0.449***	−0.002	−0.136***	0.061***	0.011	0.042**	0.021
DA	-	1	0.074***	−0.063***	−0.281***	0.289***	−0.141***	−0.292***
ERP	-	-	1	0.043**	−0.009	−0.093***	0.154***	−0.007***
ESG	-	-	-	1	0.059***	0.050**	0.054***	−0.029
EPS	-	-	-	-	1	−0.147***	0.445***	0.525***
LEV	-	-	-	-	-	1	−0.287***	−0.198***
DIV	-	-	-	-	-	-	1	0.204***
TQ	-	-	-	-	-	-	-	1

Note: *** indicates a significant level of 1%; ** indicates a significant level of 5%; * indicates a significant level of 10%.

4.2. Regression results

This section evaluates the impact of two independent variables, the duration of ERP system implementation in companies and the firm's ESG practices, on real and accrual earnings management. This evaluation is conducted in the context of verifying hypotheses H_1, H_2, H_3 and H_4. The Variance Inflation Factor (VIF) serves as a measure to verify collinearity, with a VIF value greater than 10 indicating significant collinearity among the independent variables, that is, a high degree of correlation. According to **Table 3**, the VIF values for the independent variables in both models range between 1 and 1.64, suggesting a minimal degree of collinearity among the independent variables in each model.

Model I deployed to validate hypotheses H_1 and H_3, adopting accrual earnings management (DA) as the independent variable. This model examines the influence of the duration of ERP application within companies and their commitment to ESG practices on accrual earnings management. The results of the multiple regression analysis reveal a noteworthy fit (F value of 4.258, p value nearly 0), with an overall explanatory power of 7.55%. These findings provide compelling evidence in favor of hypotheses H_1 and H_3, underscoring the model's pertinence and applicability in these hypothesis contexts.

In contrast, Model II is utilized to test hypotheses H_2 and H_4, employs real earnings management (RM) as the independent variable to investigate the impact of a

firm's duration of ERP utilization and its emphasis on ESG practices on real earnings management. The fit of the regression model is robust (F value stands at 55.342, p value approximating 0), offering an overall explanatory power of 11.3%. This strong model fit underscores the ability to predict the behavior of the dependent variables, providing empirical support for hypotheses H_2 and H_4.

The empirical analysis results from Model I reveal a negative correlation between the enterprise's interval of ERP system implementation and its accrual earnings management. The regression coefficient stands at −0.066 ($p < 0.10$), underscoring the negative impact of the ERP introduction duration on the firm's accrual earnings management. These findings are in alignment with Hypothesis H_1, suggesting that an extended duration of ERP utilization in enterprises corresponds with reduced levels of accrual earnings management.

Given the extensive period of ERP implementation, such firms are likely to have relatively robust internal control mechanisms. Such strong internal control systems could inhibit managers from engaging in accrual earnings management at their discretion. Conversely, companies with a relatively short duration of ERP implementation might exhibit weak internal control systems, potentially fostering accrual earnings management driven by discretionary accruals. Therefore, this study reveals an inverse relationship between the duration of ERP use within a company and the prevalence of accrual earnings management activity.

Additionally, a negative relationship is observed between ESG practices within firms and the extent of accrual earnings management, with a regression coefficient of −3.32 ($p < 0.01$). This result is in concordance with Hypothesis H_3, suggesting that a firm's adherence to ESG practices can lead to a reduction in its accrual earnings management behavior. The reason is rooted in ESG practices often emphasize greater transparency and disclosure. Firms that actively engage in ESG practices are likely to provide stakeholders with more detailed, honest, and comprehensive information about their activities. This can make it harder for these firms to engage in accrual earnings management, as manipulating financial figures becomes more noticeable.

The empirical findings from Model II demonstrate a positive association between the duration of an enterprise's ERP system implementation and its real earnings management. The regression coefficient is 0.007 ($p < 0.001$), indicating that an extended duration of ERP system usage positively impacts the firm's real earnings management, consistent with Hypothesis H_2. This suggests a positive correlation between a firm's use of ERP and the extent of real earnings management. Specifically, firms with an extended duration of ERP usage are more likely to resort to real earnings management as they possess an in-depth understanding of the integrated relationships amongst ERP modules and have the capacity to manipulate reports from the transaction process level.

In other words, firms that have newly introduced an ERP system may be less likely to engage in real earnings management, since this involves manipulating actual cash flows. Because they may not have the ability, experience or resources to do so. For example, they may not be able to delay or accelerate spending or revenue, or they may not be able to flexibly adjust their production levels.

Just as in Model I, where ESG practices showed a reduction in accrual earnings management, in Model II, ESG practices similarly demonstrated a decrease in real

earnings management. ESG practices exhibit a negative relationship with the degree of real earnings management, denoted by a coefficient of −0.102 ($p < 0.01$). This result aligns with Hypothesis H_4, reinforcing the notion that adherence to ESG practices in corporations can attenuate real earnings management behavior. ESG initiatives generally emphasize sustainability and long-term value creation over short-term gains. Earnings management is often used as a short-term strategy to artificially boost financial results. A firm focused on the long-term might be less inclined to engage in such behavior.

Based on the above empirical results, the research hypotheses H_1–H_4 of this article are all supported by the empirical results.

Table 3. Regression results.

-	**Model I (DA/Accrual earning management)**				**Model II (RM/Real earnings management)**			
-	**Coefficient**	**Std.**	***t***	**VIF**	**Coefficient**	**Std.**	***t***	**VIF**
Constant	−0.729	1.018	−0.716		−0.255***	0.046	−5.590	
ERP	−0.066*	0.041	−1.618	1.01	0.007***	0.002	3.871	1.01
ESG	−3.320***	0.802	−4.138	1.00	−0.102***	0.036	−2.831	1.01
EPS	−0.020	0.059	−0.343	1.27	−0.010***	0.003	−3.731	1.27
LEV	0.020	0.017	1.172	1.64	0.007***	0.001	9.755	1.06
DIV	0.000	0.000	1.204	1.00	0.000	0.000	0.708	1.00
TQ	0.674*	0.399	1.689	1.324	−0.155***	0.018	−8.688	1.32
F	4.258***	-	-	-	55.342***	-	-	-
R^2	0.987%	-	-		11.5%	-	-	
Adj R^2	0.755%	-	-		11.3%	-	-	

Note: *** indicates a significant level of 1%; ** indicates a significant level of 5%; * indicates a significant level of 10%.

5. Conclusions and suggestions

Both ERP and ESG are comprehensive strategies for enterprises, which need to integrate multiple aspects of the enterprise, including finance, production, supply chain, environment and society, so as to achieve the overall goals of the enterprise. Furthermore, the core objectives of ERP and ESG are based on the premise of improving corporate transparency and responsible social behavior. (Sislian and Jaegler, 2022; Rodríguez-García and Orero-Blat, 2020; Maria and Palacios-Marqués, 2020).

The escalating prevalence of Enterprise Resource Planning (ERP) utilization, coupled with Environmental, Social, and Governance (ESG) practices, has significantly influenced a myriad of dimensions within accounting operations. ERP, in a methodical and structural manner, amalgamates resources and processes within an enterprise, thus promoting efficacious operational management. Concurrently, ESG principles serve as a critical compass, directing the restructuring of business models to align with the principles of sustainable development. The intertwined relationship between these two factors demonstrates an unprecedented shift in the contemporary operational landscape, underscoring the increasing emphasis on efficiency, responsibility, and sustainability in business practices.

In the past, some literatures explored the relationship between ERP and earnings management (Morris and Laksmana, 2010; Toumeh, 2022; Tsai et al., 2012; Chen, 2012), ESG and earnings management (Bozzolan et al., 2015; Kolsi et al., 2023). However, few studies have incorporated ERP and ESG into the empirical model of earnings management at the same time, and explored how the two affect the company's financial reporting, so there is a gap in related research. Therefore, the purpose of this study is to simultaneously explore the impact of the company's ERP utilization and the practice of ESG on financial reporting. And take real earnings management and accrual earnings management with different purposes and means as dependent variables to conduct in-depth research. This study uniquely examines the impact of information systems on businesses by considering the duration of ERP usage, reflecting the concept of long-term accumulation.

The empirical results of this article find that there is a positive relationship between the time interval of using ERP and the real earnings management of enterprises. ERP is a financial and accounting-oriented information system. Because of the complexity of the ERP system, it takes time for the enterprise to fully utilize the value of the system. Therefore, the longer it takes for an enterprise to introduce ERP, the more proficient it will be in the ERP system, the more experienced and knowledgeable it will be in ERP, and the more capable it will be in the way of actual production, investment decisions, and R&D expenses under the system framework. It is the behavior of real earnings management. (Chen et al., 2012; Gunny, 2010).

Secondly, the empirical results of this article find that there is a negative relationship between the time interval of ERP introduction and the engagement in accrual earnings management. This means that the longer the ERP is used, the less likely it is for the enterprise to manage earnings in the form of accrual earnings management with changes in accounting principles. The possible reason is that after the enterprise introduces ERP, the enterprise process has established standardized, automated, immediacy, and transparent accounting and internal control processes. Employees in various departments of the enterprise have been highly involved in the ERP process and have carried out functional division of labor. In this case, the possibility of management's volitional manipulation of financial statements is greatly reduced. Therefore, it is not easy to operate in enterprises that use ERP for a longer period of time only by accounting earnings management methods that conform to accounting principles but do not conform to business processes.

Finally, this study finds that there is a negative relationship between corporate ESG practices and both real and accrual earnings management. Because ESG is an evaluation standard to measure the performance of enterprises in terms of sustainable development. Enterprises that attach importance to ESG represent the pursuit of long-term sustainable development. Recognizing that environmental protection, social responsibility and good corporate governance are indispensable strategic approaches. Therefore, the emphasis is on the long-term real operation of the company, rather than the disclosure of short-term financial statements. That is to say, they tend to demand themselves with higher standards, and are less willing to use earnings management as a means to pursue the short-term performance of enterprises in a manipulative way.

To sum up, information technology and sustainable practice are two issues that must be paid attention to in business operations at present. Therefore, this study aims

to focus on these two major issues, and incorporates the use of enterprise ERP information systems and ESG practices into the research model. Fortunately, the empirical results of this study are also in line with the expected hypothesis of this study. This study hopes to have a diffusional impact. Follow-up research can use samples from more countries to deeply explore the importance of digital transformation and sustainable development to enterprises. Regardless of whether it is in terms of corporate innovation, improving competitiveness, and reducing risks, it is a topic worthy of discussion in management.

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