The Nexus between Board Composition and the Optimization of Working Capital Management Efficiency: An Empirical Study on the Egyptian Stock Exchange

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الملخص

الغرض: يهدف البحث إلى دراسة العلاقة بين خصائص مجلس الإدارة وكفاءة إدارة رأس المال العامل. تشمل هذه الخصائص التولي المزدوج للرئيس التنفيذي، حجم المجلس، تكوين المجلس، لجنة المراجعة، اجتماعات لجنة المراجعة، واجتماعات المجلس كمتغيرات مستقلة. والمتغير التابع هو كفاءة إدارة رأس المال العامل، والتي يتم قياسها من خلال دورة تحويل النقد (CCC) واحتفاظ النقد، مع التركيز على النتائج المقارنة. يتم إجراء الدراسة على عينة من الشركات المصرية المدرجة في البورصة.

التصميم / المنهجية: استخدمت الدراسة برنامج STATA 16 للتحقيق في صحة الفرضيات المقترحة التي تستكشف تأثير خصائص مجلس الإدارة على كفاءة إدارة رأس المال العامل في شركات التصنيع المدرجة في البورصة، وقد جمع البحث البيانات من ٤١ شركة تصنيع مدرجة في البورصة المصرية. لفترة ٥ سنوات، مما أدى إلى إجمالي ٢٠٢ ملاحظة.

النتائج: أظهرت الدراسة نتائج مختلفة لتأثير كل متغير مستقل على كل متغير تابع حسب سياسة الشركة واستراتيجيتها. لذا فإن العلاقة بين خصائص مجلس الإدارة وكفاءة إدارة رأس المال العامل تستند إلى السياسة التي تتبعها الشركة في إدارة رأس المال العامل.

الكلمات الرئيسية: تكوين مجلس الإدارة ، كفاءة إدارة رأس المال العامل ، البورصة المصرية.

ABSTRACT

Purpose: The research objective is to examine the correlation between the characteristics of the board of directors and the efficiency of working capital management. These board characteristics include CEO duality, board size, board composition, audit committee, audit committee meetings, and board meetings as independent variables. The dependent variable is the efficiency of working capital management, measured by the cash conversion cycle (CCC) and cash holding, with a focus on comparative results. The study is conducted on a sample of Egyptian companies listed on the stock exchange.

Design/Methodology: The study used STATA 16 software to investigate the validity of the proposed hypotheses that explore the influence of board characteristics on the efficiency of working capital management in Egyptian manufacturing firms listed on the stock exchange, the research has collected panel data from 41 manufacturing companies listed over a span of 5 years, resulting in a total of 202 observations.

Findings: The study showed different results for the effect of each independent variable on each dependent variable according to the company's policy and strategy. So the relationship between board characteristics and working capital management efficiency is based on the policy that the company follow it in managing working capital.

Keywords: Board Composition, Working Capital Management Efficiency and Egyptian Stock Exchange.

1- Introduction

Effective working capital management and efficient cash holding are critical factors for the financial health and success of a company. They directly impact a firm's liquidity, profitability, and overall operational efficiency. While various factors influence these aspects, one crucial determinant is the characteristics of the board of directors. Board characteristics play a significant role in shaping the working capital management efficiency and cash holding decisions within an organization. The board of directors serves as the governing body responsible for overseeing and guiding the company's strategic direction and financial decisions. Its primary function is to represent the interests of shareholders and ensure the long-term sustainability and value creation of the organization. In the context of working capital management and cash holding, the board's characteristics and practices influence the decision-making processes, risk management strategies, and overall effectiveness of the organization's financial aspects.

This paper aims to explore the importance of board characteristics in relation to working capital management efficiency and cash holding decisions. By understanding the specific ways in which the board's composition and attributes impact these areas, companies can gain insights into how to enhance their financial performance, optimize working capital management, and improve cash flow management.

The subsequent sections will delve into the various dimensions through which board characteristics affect working capital management efficiency and cash holding. It will highlight the significance of board members, board composition, audit committee, audit committee members, board size, board meeting and the duality of the managerial level (CEO duality), in achieving efficient working capital management and optimal cash holding levels.

Working Capital management (WCM) involves the management of current assets and liabilities, as well as the handling of short-term finance (Gill and Biger, 2012). It is crucial for companies to ensure the effectiveness of their working capital management. This effectiveness is achieved by minimizing expenditures and maximizing the speed of collections (Nobanee, et al. 2011). The management of working capital is vital for the survival and success of any business. Achieving effective working capital management is a fundamental requirement for financial prosperity (Abuzayed 2012; Ghosh and Maji 2004). Efficient and effective working capital management ensures that a company can

sustain its operations and generate sufficient cash flow to meet short-term debts and upcoming operational needs (Altaf and Shah, 2018). Therefore, working capital management is considered a critical aspect of financial decision-making that can impact liquidity and contribute to value creation within an organization (Bagchi, Chakrabarti et al., 2012). As a result, enhancing the efficiency of working capital management has become a crucial objective for companies in the short term.

In their review of working capital management (WCM) theories, Aminu and Zainudin (2015) highlight several theories that support the relationship between the variables under consideration. One such theory is the Agency theory proposed by Jensen and Meckling (1976), Fama (1980), and Fama and Jensen (1983). According to this theory, a fundamental conflict or divergence of interests exists between the principal, who are the shareholders, and the agent, who is the manager. Managers may not always act in the best interests of the shareholders, which can disrupt the smooth functioning of the organization. This lack of alignment between the agent and the principal can result in miscommunication, inefficiency, and financial losses.

One way to mitigate the agency problem is by implementing stringent corporate policies. Corporate governance can be employed to establish new rules and regulations that govern the actions of the agent, thereby aligning their behavior with the interests of the principal (Cadbury, 2000). Aminu et al. (2015) emphasize the application of agency theory to working capital management. In this context, the financial manager, who often acts as an agent on behalf of the company's owners (principals), plays a crucial role in making key decisions regarding the company's short-term assets and liabilities. This includes overseeing decisions related to receivables, payables, inventories, and liabilities.

Moreover, Resource-Based theory suggests that a company's resources, including human and material resources, play a vital role in its survival and success. When evaluating a company's resources, it is important to differentiate between resources and capabilities (Aminu et al., 2015). Resources serve as the fundamental building blocks as they are inputs into the production process, while capabilities refer to a group's capacity or ability to carry out specific activities or tasks. It is implied that resources serve as the foundation for a firm's capabilities (Grant, 2001). In this context, the resource-based theory is applied to consider the cognitive abilities of individual managers in effectively managing the company's short-term assets, namely working capital (Alvarez & Busenitz, 2001).

Corporate governance plays a critical role in the management of any firm by acting as a check on the behavior of managers in utilizing the firm's resources (Isshaq et al., 2009). It establishes mechanisms and strategies that compel managers to act in the best interests of shareholders, ensuring efficient management of both short-term and long-term resources (Wambua, 2010). On the other hand, poor corporate governance can result in inefficient working capital management, which negatively impacts shareholders' wealth due to the ineffective utilization of the firm's resources. The efficiency of working capital management is significantly influenced by the quality of corporate governance (Gill and Biger, 2013). In summary, corporate governance acts as a safeguard to ensure proper resource management within a firm. It enhances strategies that promote managers' accountability and alignment with shareholders' interests. Effective corporate governance is crucial for efficient working capital management and ultimately contributes to the enhancement of shareholders' wealth.

In general, acknowledging the crucial role played by the board of directors in financial matters can enhance companies' decision-making processes and optimize their strategies for managing working capital. This, in turn, can lead to improved liquidity, financial stability, and overall business performance. Furthermore, this study builds upon previous research that explored the correlation between efficiency in working capital management and corporate governance. The findings of this research can assist management in formulating effective policies and fostering a culture of transparency and credibility within the organization. Conducting research in this area holds significant importance, particularly in a country like Egypt, where developing nations encounter numerous challenges in implementing governance practices within their communities. Additionally, there is a scarcity of studies examining the impact of corporate governance on working capital using Egyptian data. Thus, the objective of this research is to analyze the effect of board characteristics, specifically CEO duality, board size, audit committee, audit committee meetings, board meetings, and board composition, on the efficiency of working capital management. This will be assessed using two indicators: the cash conversion cycle and cash holding. The research aims to identify which board characteristic has the most significant impact on working capital management efficiency in Egypt.

2- Literature review and Hypothesis development

3-1 Board characteristics and Working Capital Management Efficiency:

Governance mechanisms play a crucial role in preventing corrupt practices associated with cash holding within a firm. By implementing internal and external monitoring systems, these mechanisms aim to safeguard against misuse of cash. According to Jensen (1986), managers may exploit low levels of monitoring to derive personal benefits from additional cash reserves. In such cases, managers may prioritize holding cash to gain control rather than distributing dividends to shareholders, as highlighted by Opler et al. (1999). Numerous studies have investigated the correlation between corporate governance and the efficiency of working capital management. However, the relationship between cash holding and corporate governance has yielded mixed results, indicating that the impact of governance on cash holding practices may vary across different contexts or firms.

Dittmar et al. (2003) conducted a study on the relationship between international corporate governance and corporate cash holdings. Their findings supported the idea that corporate governance enhances firm value and plays a significant role in determining a firm's cash policy. The study also revealed that firms with poor governance tend to hold more cash. Similarly, Kalcheva and Lins (2007) found that firms with weak governance structures tend to maintain higher levels of cash reserves. It suggests that the presence of strong corporate governance can influence a firm's cash holding practices. Managing working capital involves striking a balance, which requires attention from management and robust corporate governance, as highlighted by Dittmar and Mahrt-Smith (2007). Harford et al. (2008) examined the relationship between corporate governance and firm cash holdings in the US. Their research concluded that weak corporate governance is negatively associated with firm value, particularly when it involves excessive cash holding. Further research conducted by Aghajari, Mousavi et al. (2015) revealed a negative correlation between institutional ownership and the average collection period.

On the other hand, Ahmed et al. (2018) explored the impact of increasing executive president ownership on the cash conversion cycle. Their findings demonstrated that higher executive president ownership can reduce the cash conversion cycle by 50.1%. Moreover, a study investigating the relationship between working capital management

efficiency and corporate governance in the manufacturing sector of Pakistan, as conducted by Ahmed et al. (2018), suggested that implementing suitable policies and optimizing the size of the board and audit committee can improve working capital management efficiency.

Furthermore, Gill and Shah (2012) propose that specific corporate governance characteristics, particularly board characteristics such as CEO duality and board size, have a significant influence on maintaining an optimal level of working capital. Their study analyzed data from Canadian firms. Similarly, Gill and Biger (2013) examined the impact of corporate governance on the efficiency of working capital management in American manufacturing firms. Their findings indicated that corporate governance practices have some effect in improving working capital management efficiency. The study focused on 25 manufacturing firms listed on the Colombo Stock Exchange from 2007 to 2011.

In a related study, Meshack (2015) investigated the effect of corporate governance mechanisms on the efficiency of working capital management in industrial firms. The research revealed that corporate governance indicators, represented by variables such as board framework, internal accuracy, and shareholder care, have an impact on the efficiency of working capital management. Specifically, the board framework and internal accuracy exhibited a positive relationship with working capital management efficiency. In addition, Sathyamoorthi et al. (2018) conducted a study in Botswana to examine the impact of corporate governance on working capital management. Their findings revealed a significant relationship between corporate governance and the efficiency of working capital management. Specifically, they found a positive and significant impact of corporate governance on the cash conversion cycle and inventory management. This highlights the importance of corporate governance for the firm ‘sustainability.

Similarly, Prasad et al. (2019) investigated the influence of corporate governance on working capital management using a sample of 323 Indian non-financial firms listed on the Bombay Stock Exchange from 2007 to 2017. Their findings indicated that among the board characteristics, only CEO duality had a significant negative effect on working capital management. Also, Kayani et al. (2018) conducted a study that explored the effect of both working capital management and corporate governance on firm performance. Using the system generalized method of moments (SGMM) to control potential

endogeneity, the study found that both corporate governance practices and working capital management have an impact on firm performance.

Tanui and Omare (2021) conducted research on the correlation between various board characteristics (such as board size, board independence, board committee, and board gender) and the management of working capital. They analyzed a sample of 14 construction and manufacturing companies listed from 2008 to 2017. The findings revealed a noteworthy positive association between working capital management and both board gender and board size. Additionally, a significant negative relationship was observed between working capital management and board composition. However, the correlation between board independence and working capital management was found to be insignificant. Thus, the results suggest that board size and gender diversity play a supportive role in working capital management.

Contrarily, Achchuthan et al. (2013) found that there was no substantial difference in the efficiency of working capital management (WCM) concerning corporate governance characteristics such as board committees, board meetings, and the proportion of non-executive directors. Similarly, Kamau and Basweti (2013) discovered that there was no significant relationship between the board of directors and the efficiency of working capital management. Wasiuzzaman and Arumugam (2013) also concluded that there was no statistically significant association between board size and board independence with respect to working capital investment. Furthermore, there was no significant relationship found between the number of board meetings and net working capital. Likewise, a study conducted in Brazil by Palombini and Nakamura (2012) demonstrated no correlation between ownership concentration ratio and the ratio of board independence with the management of working capital. The researchers utilized metrics such as the cash conversion cycle, stock preservation time, and accounts payable repayment period to assess working capital management.

2-1-1 The effect of CEO duality and Working Capital Management efficiency.

CEO duality refers to the practice of an individual simultaneously holding the positions of CEO and chairman of the board of directors (Krause et al., 2014, p.256). One way to maintain board independence is by separating the roles of Chairman and CEO (Dalton and Dalton, 2011). According to agency theory, when the same person occupies both positions, the monitoring of top management becomes ineffective as that individual tends to dominate the board. In contrast, stewardship theory suggests that the CEO and board of directors act as stewards, prioritizing the firm's interests over their own (Mulini and Wong, 2011). In cases where the CEO is also a board member, this duality can facilitate decision-making regarding investment projects without being hindered by bureaucratic processes (Kyereboah-Coleman, 2007). Consequently, CEO duality has the potential to enhance the efficiency of working capital management.

Based on agency theory, several studies have indicated a negative impact of CEO duality and board size on net working capital. For instance, Gill and Shah (2012), who analyzed Canadian enterprises from 2009 to 2011, found such negative influence. Similarly, Francis et al. (2015) established a negative relationship between CEO duality and firm performance in their research. Across different countries, the majority of studies suggest a positive association between CEO duality and cash holdings (Boubaker et al., 2015; Drobetz and Grüninger, 2007; Gill and Shah, 2012; Hsu et al., 2015). According to agency theory, CEO duality hampers effective monitoring (Deman et al., 2018; Hsu et al., 2015). When the CEO also holds the position of board chair, it concentrates significant power in one individual's hands, leading to potential conflicts of interest and opportunistic behavior (Jensen and Meckling, 1976). This arrangement increases the risk of the dominant individual abusing their position, particularly in relation to the rights of minority shareholders, which could be subject to expropriation. In such situations, it is plausible to assume that CEOs have substantial control over the board of directors (Bertoni et al., 2014). Consequently, they have an interest in retaining excess cash holdings to pursue their own objectives (Hsu et al., 2015), which ultimately has a negative impact on working capital management efficiency. Building on the existing literature, we propose the following hypotheses.

H1: CEO duality has a significant effect on Working Capital Management efficiency.

2-1-2 The effect of board size and Working Capital Management efficiency.

As previously mentioned, the board of directors plays a crucial role in implementing corporate governance in modern companies, making the size of the board a topic of interest for researchers. Numerous empirical studies have examined the relationship between board size and cash holdings, yielding varying findings. From an agency perspective, theories suggest that firms with larger boards may tend to hold higher levels of cash reserves (Chen & Chuang, 2009). Other studies aligned with this perspective have indicated that companies with a higher number of directors on their boards face significant agency issues and lower investor protection. The presence of larger boards may lead to reduced monitoring activities, resulting in cash holdings being inadequately monitored or weakly monitored. This situation can potentially lead to the misuse of cash for personal purposes instead of maximizing investor wealth, thereby negatively impacting the efficiency of working capital management from an agency theory standpoint (Hsu et al., 2015).

Chen and Chuang (2009) conducted a study that revealed a positive correlation between the size of the board of directors and the amount of cash held by organizations. The empirical analysis focused on a sample of high-tech companies in the United States and also indicated that firms with larger boards tend to face more significant agency issues and have lower levels of investor protection. Furthermore, as mentioned earlier, Gill and Shah (2012) found a negative impact of board size on net working capital, highlighting the critical role of board size in determining the optimal proportion of working capital required by an organization. Additional empirical evidence supports the notion that there is a significantly negative relationship between board size and corporate performance, suggesting that board size may influence the quality of board monitoring activities (Boubaker et al., 2015; Chen, 2008; Rossi et al., 2015). Based on these findings, we propose the following hypothesis.

H2: Board size has a significant effect on Working Capital Management efficiency.

2-1-3 The effect of Audit committee and Working Capital Management efficiency.

An audit committee is a subcommittee of the board of directors of an organization that is responsible for overseeing financial reporting, internal controls, risk management, and the auditing process. The committee is typically composed of independent directors who have financial expertise and are not involved in the day-to-day operations of the company. In order to oversee the accounting, reporting, and auditing of financial statements, it is essential for the board of directors to establish an audit committee. This committee plays a crucial role in implementing checks and balances that assist shareholders in monitoring a company's management (Wanjau, 2007). The presence of an effective audit committee has been found to contribute to the early detection of financial and accounting errors. To ensure independence, the audit committee should be separate from the management and board of directors. This independence supports the efficiency of working capital management by conducting audits of cash accounts, accounts receivable, accounts payable, and inventory accounts. By doing so, it helps minimize agency problems and associated costs (Gill and Biger, 2012). Bansal and Sharma (2016) further highlight the significant influence of the audit committee in corporate governance. Prominent regulatory bodies have recommended the adoption of audit committees on a global scale due to their direct impact and positive effect on the quality of financial management. Based on these considerations, we propose the following hypothesis.

H3: Audit committee has a significant effect on Working Capital Management efficiency.

2-1-4 The effect of Audit committee meeting and Working Capital Management efficiency.

An audit committee meeting is a scheduled gathering of the members of the audit committee, a subcommittee of the board of directors, typically comprised of independent directors with financial expertise. The purpose of an audit committee meeting is to discuss and review matters related to financial reporting, internal controls, risk management, and the auditing process of the organization. The primary function of the audit committee is to engage in continuous monitoring of cash accounts, aiming to reduce agency costs and mitigate agency problems through

regular meetings (Gill and Biger, 2013). By providing investors with accurate and timely information, the audit committee and their periodic meetings have the potential to alleviate the agency problem within a firm (Al-Mamun, 2014). This, in turn, leads to an enhancement in the quality of financial management within the company. In light of these considerations, the following hypotheses are proposed.

H4: Audit committee meeting has a significant effect on Working Capital Management efficiency.

2-1-5 The effect of Board Meeting and Working Capital Management efficiency.

Board meetings refer to the frequency of meetings held by the board of directors within a given year. It is considered one of the key aspects of corporate governance practices within firms (Kajananthan, 2012). The impact of board meeting numbers on working capital efficiency is not clearly defined. Achchuthan et al. (2013) found no significant relationship between the level of working capital management efficiency and board meetings. Similarly, Kamau and Basweti (2013) discovered that there is no significant relationship between board meetings and the levels of working capital management efficiency, although the two variables exhibit an insignificant negative correlation. This suggests that as the number of board meetings increases, companies may invest more funds in current assets, leading to inefficient working capital management. According to Mohammad et al. (2016), the board of directors serves as the most crucial mechanism of corporate governance. Consequently, regular board meetings play a vital role in ensuring the overall effectiveness and efficiency of the board's operations. Based on these observations, the following hypothesis is proposed.

H5: Board Meeting has a significant effect on Working Capital Management efficiency.

2-1-6 The effect of Board Composition and Working Capital Management efficiency.

Board composition refers to the proportion of non-executive board members relative to the total number of board members, as highlighted in previous studies on corporate governance (Kyereboah-Coleman, 2008; Zariyawati et al., 2010; Kieschnick et al., 2006; Palombini & Nakamura, 2012; Kuan, Li, & Chu, 2011). The composition of the board plays a crucial role in creating value for shareholders by addressing agency problems and serves as an important mechanism for controlling such issues (Lipton

and Lorsch, 1992; Yermack, 1996; Kyereboah-Coleman, 2007; Gill and Shah, 2012; Mishra and Mohanty, 2014; Rachagan et al., 2015). It represents the presence of non-executive directors on the board, indicating the degree of independence from executive management (Dalton et al., 1999).

According to agency theory, the inclusion of independent directors in a company serves to reduce agency problems. Having a higher number of non-executive directors on boards, as highlighted by Kyereboah-Coleman (2008), is crucial in addressing managers' opportunistic behavior, in line with the principles of agency theory. This helps to decrease conflicts of interest and ensures the board's independence in effectively monitoring management. Empirical evidence from Kieschnick et al. (2006) supports the negative relationship between the cash conversion cycle (CCC) and U.S. firms. Independent directors play a vital role in enhancing the monitoring and control capabilities of the board of directors over executive management. They ensure that management acts in the best interest of shareholders and evaluate the performance of executives, aligning with the theories proposed by Jensen and Meckling (1976), Fama and Jensen (1983), Dalton et al. (1999), Coles et al. (2008), and Krause et al. (2014). Based on these considerations, the following hypothesis is proposed.

H6: Board Composition has a significant effect on Working Capital Management efficiency.

3- Research methodology.

In the present study, the focus is on investigating the validity of the proposed hypotheses that explore the influence of board characteristics on the efficiency of working capital management in Egyptian manufacturing firms listed on the stock exchange. This section of the research entails the presentation of descriptive statistics, diagnostic statistics, and hypothesis testing to assess the relationships of interest. To carry out the necessary statistical analyses, STATA 16 software is utilized

The research model aims to test six hypotheses using a sample of 41 companies from the manufacturing sector of Egyptian listed firms. The data for the study is obtained from two main sources: the Thomson Reuters database and corporate governance disclosures available on the firms' websites. These sources provide the necessary information to examine the relationships and variables of interest in the study. The hypotheses will be tested based on this data to gain insights into the impact of board characteristics on working capital management efficiency in the context of Egyptian manufacturing firms.

Descriptive statistics were conducted on the panel data to provide an overview of the basic properties of a large set of observations included in the study. This analysis helps to summarize and understand the characteristics of the data set.

Furthermore, appropriate statistical techniques were chosen to analyze the data based on the specific characteristics of the variables included in the study sample. The selection of these techniques ensures that the data is analyzed using appropriate and effective statistical methods.

In addition to descriptive statistics, the frequencies of all discrete variables were examined. This analysis helps to understand the distribution and occurrence of different categories or values within each discrete variable in the data set. By examining the frequencies, researchers can gain insights into the patterns and proportions of various discrete variables in the sample

In order to detect significant differences between aggressive and conservative strategies regarding working capital investment and financing, a two-sample t-test with equal variances is conducted. This test helps determine whether there are statistically significant differences between the two groups.

To ensure the validity of the analysis, diagnostic tests are performed to assess the assumptions of the t-test. These tests help evaluate the reliability of the results and identify any potential issues that may affect the accuracy of the analysis.

Additionally, normality tests, such as the Shapiro-Wilk test, are conducted to examine the distribution of variables, specifically the cash conversion cycle and cash holding. The Shapiro-Wilk test assesses whether the data follows a normal distribution. By examining the normality of the variables, researchers can determine if any transformations or adjustments are necessary to ensure the validity of the analysis.

To determine whether the cash conversion cycle (CCC) and cash holding are static or dynamic phenomena, an optimal lag selection test is conducted. This test examines whether the current levels of CCC and cash holding are influenced by past events or previous values of these variables.

Three commonly used criteria, namely the Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Information Criterion (SBIC), are employed to determine the optimal lag length. These criteria evaluate the trade-off between model complexity and goodness of fit.

By assessing these criteria, researchers can identify the lag length that provides the best balance between capturing the dynamics of CCC and cash holding and avoiding unnecessary complexity. This helps ensure that the analysis accurately captures the relationships and patterns in the data and provides reliable insights into the nature of these variables.

Pearson's correlation coefficient is utilized to assess the direction and strength of the linear relationship between two variables in the current research. This statistical test measures the degree to which the variables are linearly associated, ranging from -1 to +1. A value close to +1 indicates a strong positive correlation, a value close to -1 indicates a strong negative correlation, and a value close to 0 indicates a weak or no correlation.

In addition to examining the relationship between variables, Pearson's correlation coefficients are also useful in detecting multicollinearity between independent variables included in the same regression model. Multicollinearity refers to the presence of high correlations among independent variables, which can lead to issues in the regression analysis, such as unstable coefficient estimates and difficulties in interpreting the results.

By examining the correlation coefficients between independent variables, researchers can identify potential multicollinearity and take appropriate measures, such as excluding or transforming variables, to mitigate its impact on the regression analysis.

In the hypotheses testing of the CCC models and cash holding models, the Hausman test is employed to determine whether the fixed effect model or the random effect model is more appropriate for the data. The Hausman test helps in selecting the most suitable model by examining the difference between the estimated coefficients from the two models.

The fixed effect model assumes that the individual entities (such as firms) in the panel data have specific characteristics that affect the dependent variable, while the random effect model assumes that these entity-specific effects are uncorrelated with the independent variables.

By comparing the estimated coefficients from both models, the Hausman test assesses whether the individual entity effects are correlated with the independent variables. If the test indicates a significant difference between the coefficients, it suggests that the fixed effect model should be chosen as it accounts for the entity-specific effects. On the other hand, if there is no significant difference, the random effect model may be preferred as it assumes the absence of correlation between the entity-specific effects and the independent variables.

The Hausman test aids in determining the appropriate modeling approach for the CCC models and cash holding models, ensuring that the selected model accurately captures the relationship between the variables and provides reliable and valid results

Finally, the Goodness of fit indices was conducted before accepting the results of fixed effect and random effect models, some goodness of fit tests should be conducted to confirm that the statistical techniques applied in the current study best fit sample data of the CCC and cash holding models: (Group-wise Homoscedasticity test- Cross-sectional dependence-Absence of serial correlation test).

3.1 Measures of study variables

The following table (3-1) illustrates the variables used in the analysis and presents their measurements and the expected relationship between board characteristics and working capital management efficiency management proxies used:

Table (3.1)

Variables	Symbol	Measures
Dependent Variables		
Efficiency of working capital ($WCAP_{it}$)	CCC	Average collection period + Inventory collection period – Average Payment Period
	CH	Log of Average cash
Independent Variables		
CEO duality	CD	Measured by assigned value 1 if same person occupied the post of chairperson and the CEO and 0 for otherwise
Board size	BS	Number of directors serving on board
Audit Committee	AC	Number of audit committee members
Audit Committee Meetings	ACM	Based on the No. of meeting; 1-5 has been represented as 1; 6-10 has been represented as 2; 11-15 has been represented as 3.
Board Meetings	BM	Based on the No. of meeting; 1-5 has been represented as 1; 6-10 has been represented as 2; 11-15 has been represented as 3; 16-20 has been represented as 4; 21-25 has been represented as 5
Board Composition	BCOM	Ratio of non-executives to total number of board members
Control Variables		
Asset Tangibility	TANG	Ratio of fixed assets to total assets in a firm
Capital Expenditure	CAPEX	(Net PPE + depreciation)/ total assets
Managerial Ownership	MOWN	Dummy variable :(1) if managers own shares in the company , otherwise (0)
Operating cash flow	OCF	Opertating cash flow / total assets
Firm Value	Tobin's Q	(market value of outstanding common shares + the value of preferred stocks plus total debt) / total assets

3.1.1 Dependent variable:

According to Moolchandani and Kar (2021), Weidemann (2018), and Vural et al. (2012), the efficiency of working capital management (WCM) is evaluated using two indicators: cash holding (CH), which is measured by the logarithm of the average cash, and cash conversion cycle (CCC), which is calculated as the average collection period plus the inventory collection period minus the average payment period.

3.1.2. Independent variable:

According to Gill and Shah (2012), Fiador (2016), and Allam (2018), board characteristics are assessed through several factors, including CEO duality (CD), board size (BS), audit committee (AC), audit committee meetings (ACM), board meetings (BM), and board composition (BCOM). CEO duality is determined by assigning a value of 1 if the same person occupies the positions of chairperson and CEO, and 0 otherwise. Board size is measured by the number of directors serving on the board. Audit committee is quantified by the number of audit committee members. Audit committee meetings are categorized into groups: 1-5 meetings represented as 1, 6-10 meetings as 2, and 11-15 meetings as 3. Board meetings are also grouped: 1-5 meetings represented as 1, 6-10 meetings as 2, 11-15 meetings as 3, 16-20 meetings as 4, and 21-25 meetings as 5. Board composition is measured by the ratio of non-executives to the total number of board members.

3.1.3 Firm control variables

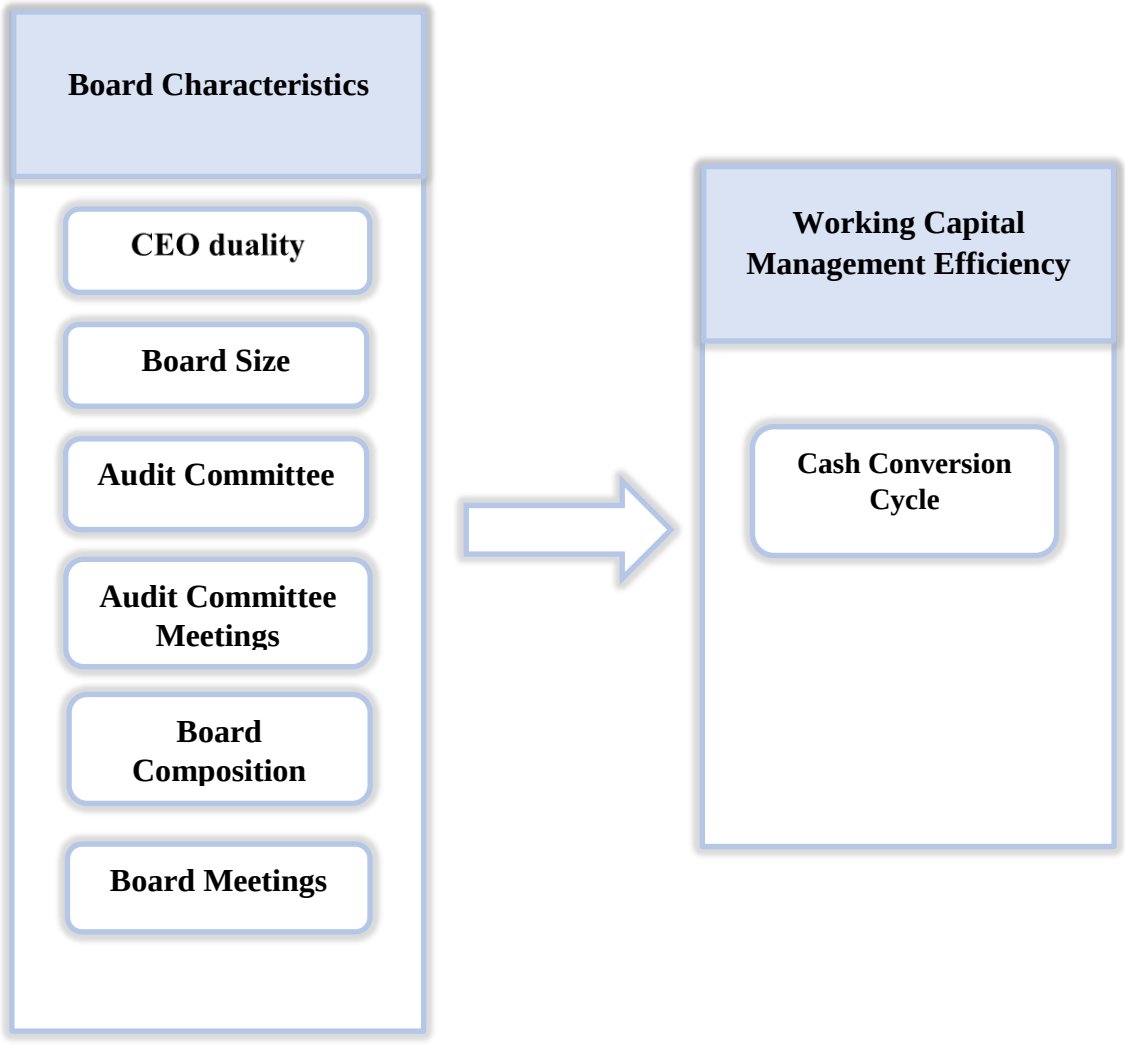
In order to examine the influence of board characteristics on working capital management efficiency, several control variables were incorporated based on previous studies, including firm value, operating cash flow, capital expenditure, managerial ownership, and asset tangibility (Bansal and Sharma, 2016; Fatimatuzzahra and Kusumastuti, 2016; Moussa, 2019; Murhadi and Herlambang, 2022). Operating cash flow (OCF) represents the net inflow and outflow of cash from a company's operating activities, and it holds significance in the cash flow statement (Moussa, 2019). Asset tangibility (TANG) refers to the physical collateral available to investors when investing in a company. Generally, companies with tangible assets find it easier to secure external financing compared to those without such collateral. Hence, Kurniasari et al. (2016) considered asset tangibility as a factor influencing capital structure.

Capital expenditure (CAPEX) refers to expenditures made to enhance quality or acquire assets that will yield future benefits (Yanti et al., 2019). In the research conducted by Yanti et al. (2019) and Arfan et al. (2017), capital expenditure is calculated by dividing net property, plant, and equipment (PPE) by total assets. Firm value, represented by Tobin's Q, is measured by dividing the sum of the market value of outstanding common shares, the value of preferred stocks, and total debt by total assets. Hill et al. (2010) suggested that the efficiency of working capital management reflects stock market performance. Final, managerial ownership (MOWN) is assessed as a dummy variable, taking a value of 1 if managers own shares in the company and 0 otherwise. Managerial ownership serves as an important aspect of corporate governance and may impact working capital. As the research focuses on the impact of board characteristics, managerial ownership is considered a control variable.

3.2 Design of study model

The variables under study are analyzed using regression analysis. The model regress board characteristics in addition to the included control variables on the dependent variable working capital management efficiency which measured by Cash conversion cycle and cash holding for firm (i) at the time (t). Diagnostic tests, presented later, were used to check the validity of model and the existence of autocorrelation and heterogeneity. Along with the probability of having endogenous variables which leads to inconsistent estimates, a dynamic data panel methodology is used. In this study, we have followed the model used by Gill and Biger (2012) with some modifications. Figure (3.1) below shows the research model variables and model that are used to test each respective research hypothesis.

3.2.1 The conceptual Model (Framework)



3.2.2 Regression equation

Model 1:

$$CCC_{it} = \alpha + \beta_1 CD_{it} + \beta_2 BS_{it} + \beta_3 AC_{it} + \beta_4 ACM_{it} + \beta_5 BC_{it} + \beta_6 BM_{it} + \beta_7 FV_{it} + \beta_8 OCF_{it} + \beta_9 CPEX_{it} + \beta_{10} Mown_{it} + \beta_{11} TANG_{it} + \mu it$$

Model 2:

$$CH_{it} = \alpha + \beta_1 CD_{it} + \beta_2 BS_{it} + \beta_3 AC_{it} + \beta_4 ACM_{it} + \beta_5 BC_{it} + \beta_6 BM_{it} + \beta_7 FV_{it} + \beta_8 OCF_{it} + \beta_9 CPEX_{it} + \beta_{10} Mown_{it} + \beta_{11} TANG_{it} + \mu it$$

Where:

- CCC_{it} : Cash conversion cycle as a proxy for Working capital management efficiency for companies i at the time t.
- CH_{it} : Cash holding as a proxy for Working capital management efficiency for companies I at the time t.
- CD_{it} : CEO duality for a company i at the time t
- $BS_{it:}$ Size of Board of directors for a company I at the time t
- AC_{it} : Audit committee for a company i at the time t
- ACM_{it} : number of audit committee member for a company i at the time t
- BC_{it} : number of external board of directors for a company i at the time t
- BM_{it} : number of board meetings for a company i at the time t
- FV_{it} : Tobin's Q ratio for a company i at the time t
- $OCF_{it:}$ Operating cash flow for a company I at the time t .
- $Mown_{it}$: Managerial ownership for company i at time t.
- $TANG_{it}$: Asset tangibility for company i at time t
- $CAPEX_{it}$: Capital expenditure for company i at time t

3.3 Research sample and Data sources:

3.4.1 Population and Sampling:

The population under study comprises all Egyptian manufacturing firms listed on the Egyptian stock exchange and included in the EGX 10 index. This selection criterion is based on the suggestion made by Lazaridis and Tryfonidis (2006) that non-listed companies in developing countries may attempt to conceal profits to reduce corporate tax, which could impact the validity of the sample.

The final sample consists of panel data collected from 41 firms over a period of 5 years, resulting in a total of 202 observations. Each firm in the sample has been listed in the EGX 100 index for a minimum of 4 years during the research period from 2015 to 2019.

Tabulation of GICS Sector Table (3.2)

GICS Sector	Firms	Obs.	Percent
Population (The EGX 100)	100	500	100%
Less			
Excluded firms	59	295	59%
Included firms			
Consumer Discretiory	6	30	14.85
Consumer Staples	13	63	31.19
Health Care	1	5	2.48
Industrials	5	24	11.88
Materials	13	65	32.18
Real Estate	3	15	7.43
Total sample	41	202	100.00

4- Data Analysis and Hypotheses testing

4-1 Descriptive statistics

The main statistical features of all continuous variables used to test the impact of board characteristics on working capital management efficiency are shown in table (4.1).

Table (4.1)

Descriptive Statistics for Continuous Variables

Variable		Mean	Std. Dev.	Min	Max	Observations
CCC	overall	171.350	111.352	2.246	403.398	N = 202
CH	overall	0.081	0.066	0.001	0.225	N = 202
BS	overall	8.155	2.495	4.000	14	N = 202
BC	overall	0.714	0.170	0.285	1.000	N = 202
BM	overall	2.136	0.859	1.000	4.000	N = 198
AC	overall	3.429	1.137	0.000	8.000	N = 198
AM	overall	1.221	0.587	0.000	3.000	N = 199
TANG	overall	0.394	0.214	0.013	0.885	N = 202
FV_TQ	overall	1.270	0.523	0.511	2.284	N = 202
CPX	overall	17.541	2.250	12.385	22.341	N = 202
OCF	overall	0.043	0.094	-0.145	0.229	N = 202

The cash conversion cycle (CCC) exhibits an overall mean of 171.3 days, with a relatively large standard deviation of 111.3 days compared to the mean. This indicates significant variability in the CCC values across the observed firms.

Regarding cash holding (CH), the overall mean is 0.08, while the overall standard deviation is 0.066. Similar to CCC, the standard deviation is relatively large compared to the mean, suggesting substantial dispersion in the cash holding levels among the firms.

The board of director size (BS) has an overall mean of 8 members, with a standard deviation of 2 members. The standard deviation, although noticeable, is not as significant compared to the mean, indicating moderate variability in board size.

The board of director composition (BC) has an overall mean of 0.714, indicating that the majority of board members are non-executives. The standard deviation is 0.17, which is relatively small compared to the mean, indicating less variability in the composition of the board.

The board of director meetings (BM) has an overall mean of 2 meetings, with a standard deviation of 1 meeting. The standard deviation is moderate relative to the mean, suggesting moderate variability in the frequency of board meetings.

The auditing committee size (AC) has an overall mean of approximately 4 members, with a standard deviation of approximately 1 member. The standard deviation is relatively small compared to the mean, indicating limited variability in the size of the auditing committee.

The auditing committee meetings (AM) exhibit an overall mean of approximately 1 meeting, with a standard deviation of 1 meeting. The standard deviation is relatively high compared to the mean, indicating considerable variability in the frequency of auditing committee meetings.

Assets tangibility (TANG) has an overall mean of 0.4, with a relatively large standard deviation of 0.214 compared to the mean. This indicates a significant amount of variability in the level of asset tangibility among the observed firms.

Firm value, measured by Tobin's Q (FV_TQ), has an overall mean of 1.27. Since FV_TQ is greater than 1, it suggests that most of these firms are overvalued. The overall standard deviation is 0.523, which is moderate relative to the overall mean, indicating moderate variability in firm values.

Capital expenditure (CPX), measured by the natural logarithm of capital expenditure, has an overall mean of 17.54. The overall standard deviation is 2.25, which is relatively low compared to the overall mean. This suggests that there is less variability in capital expenditure levels among the observed firms.

Operating cash flow (CFO) has an overall mean of 0.043. However, the overall standard deviation is 0.094, which is relatively large compared to the overall mean. This indicates a significant amount of variability in operating cash flow levels across the observed firms

4-2 Pearson's Correlation Test

The Pearson's correlation coefficient is a statistical measure that indicates the direction and strength of the linear relationship between two variables in the research. It is also used to identify potential multicollinearity between independent variables included in the same regression model.

Table 4.2 presents the Pearson's correlation coefficients for all the variables studied. Since the correlation coefficients between the explanatory variables are generally below 0.50, it suggests that there is no severe multicollinearity present. This means that the variables included in the analysis have relatively low intercorrelations, indicating that they provide unique information and do not excessively overlap in their predictive power.

Table (4.2) correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) CCC	1.000												
(2) CH	0.111	1.000											
	(0.115)												
(3) BS	-0.140*	0.019	1.000										
	(0.047)	(0.793)											
(4) BC	-0.225*	-0.047	0.292*	1.000									
	(0.001)	(0.508)	(0.000)										
(5) CD	-0.029	-0.046	-0.032	-0.296*	1.000								
	(0.682)	(0.513)	(0.654)	(0.000)									
(6) BM	0.043	0.169*	0.040	-0.001	0.270*	1.000							
	(0.552)	(0.018)	(0.580)	(0.987)	(0.000)								
(7) AC	-0.275*	0.061	0.203*	0.254*	-0.035	0.200*	1.000						
	(0.000)	(0.391)	(0.004)	(0.000)	(0.627)	(0.005)							
(8) AM	-0.039	0.152*	0.049	0.115	0.102	0.391*	0.350*	1.000					
	(0.581)	(0.032)	(0.492)	(0.106)	(0.151)	(0.000)	(0.000)						
(9) TANG	-0.366*	-0.347*	-0.176*	0.220*	-0.016	-0.139*	-0.018	0.063	1.000				
	(0.000)	(0.000)	(0.012)	(0.002)	(0.824)	(0.050)	(0.801)	(0.378)					
(10) TQ	-0.214*	0.140*	0.212*	-0.034	0.193*	0.234*	0.076	0.036	-0.117*	1.000			
	(0.002)	(0.047)	(0.002)	(0.634)	(0.006)	(0.001)	(0.289)	(0.616)	(0.098)				
(11) CPX	-0.166*	0.048	0.206*	-0.104	-0.074	0.114	0.109	0.184*	0.066	0.249*	1.000		
	(0.018)	(0.498)	(0.003)	(0.142)	(0.298)	(0.110)	(0.125)	(0.009)	(0.350)	(0.000)			
(12) OCF	-0.194*	0.233*	0.161*	0.154*	0.002	0.165*	0.287*	0.243*	0.022	0.340*	0.260*	1.000	
	(0.006)	(0.001)	(0.022)	(0.028)	(0.981)	(0.020)	(0.000)	(0.001)	(0.755)	(0.000)	(0.000)		
(13) MO	-0.078	-0.103	-0.056	-0.305*	0.170*	-0.234*	-0.337*	-0.290*	0.035	0.172*	-0.012	-0.006	1.000
	(0.284)	(0.157)	(0.438)	(0.000)	(0.018)	(0.001)	(0.000)	(0.000)	(0.633)	(0.017)	(0.868)	(0.938)	

**** p<0.01, ** p<0.05, * p<0.1*

4-3-1 Hypotheses testing concerning the impact of board characteristics on working capital management efficiency as measured by CCC.

Table (4.3) CCC Model (Full Sample) Prais-Winsten regression, heteroskedastic panels corrected standard errors			
CCC	**Coef.**	**p-value**	**Sig**
BS	-8.018	.009	***
BC	-54.881	.195	
CD	-25.795	.029	**
BM	-59.167	.001	***
BM2	12.671	.002	***
AC	-21.165	0	***
AM	66.676	.017	**
AM2	-14.452	.045	**
TANG	-195.163	0	***
TQ	-21.502	.048	**
CPX	-2.653	.251	
OCF	-56.905	.065	*
MO	-34.526	.027	**
industry : base 1	0	.	
2	-139.783	.01	**
3	-107.284	.071	*
5	-130.492	.016	**
6	-57.025	.288	
7	-47.506	.45	
8	-91.646	.119	
10	104.453	.071	*
11	-47.175	.592	
13	-6.295	.909	
14	-191.787	.001	***
Constant	596.247	0	***
Mean dependent	175.635	SD dependent var	115.168

var			
R-squared	0.835	Number of obs	185
Chi-square	1043.982	Prob > chi2	0.000
*** p<.01, ** p<.05, * p<.1			

Table (4.3) shows that Prais-Winsten regression is used to test CCC model to consider the heteroskedasticity and autocorrelation in the tested model. The overall model can be accepted as a reliable model to explain working capital efficiency as measured by CCC because the Prob > chi2 is less than 5%. The result show, a negative significant direct impact of board size (BS) on the cash conversion cycle (CCC), a negative significant direct impact of CEO duality (CD) on the cash conversion cycle (CCC), and a negative significant direct impact of auditing committee size (AC) on cash conversion cycle (CCC). However no significant direct impact of board composition (BC) on the cash conversion cycle (CCC).

- The findings of the Board meeting indicate that there is a non-linear connection between the board meeting and the effectiveness of managing working capital, as measured by the Cash Conversion Cycle (CCC). This suggests that there is an ideal level of CCC that maximizes efficiency in working capital management. Any deviation from this optimal level will result in inefficiencies. The relationship between the board meeting and working capital management efficiency follows a U-shaped curve. Specifically, the parameter related to the board meeting is negative (<0) and statistically significant, while the squared parameter is positive and statistically significant. The optimal level of the board meeting corresponds to the level that maximizes efficiency in working capital management.

  BM = - (59.167)/ (2*12.671) = 2.33 approximately ≈ 3 or 2 board meetings

- Additionally, the results indicate the presence of a curvilinear relationship between auditing committee meetings and the efficiency of working capital management, as measured by the Cash Conversion Cycle (CCC). This suggests that there is an optimal level of CCC that maximizes efficiency in working capital management. Deviating from this optimal level will result in inefficiencies in working capital management.

The relationship between auditing committee meetings and working capital management efficiency follows an inverted U-shaped curve. Specifically, the parameter related to auditing committee meetings (AM) is positive (>0) and statistically significant, while the squared parameter (AM squared) is negative and statistically significant. The optimal level of auditing committee meetings corresponds to the level that maximizes efficiency in working capital management.

AM = - (66.676)/ (2*-14.4525) = 2.31 approximately ≈ 2 Audit meetings

4-3-2 The impact of board characteristics on CCC according to working capital investment strategy

Table (4.4) CCC Model (classified according to investing strategy of working capital)				
CCC	**Aggressive investing policy**		**Conservative investing policy**	
	Coef.	p-value	Coef.	p-value
BS	31.744	0.320	-93.72***	0.001
BS2	-1.3338	0.417	5.021***	0.001
BC	-510.78***	0.000	142.371***	0.008
CD	-32.728	0.113	-56.275***	0.003
BM	-74.080	0.192	-72.153*	0.100
BM2	20.383	0.104	20.765**	0.038
AC	-23.860***	0.000	-45.221***	0.000
AM	5.770	0.760	17.169	0.326
TANG	-31.376	0.683	-364.797***	0.000
TQ	-60.730***	0.003	-39.076**	0.015
CPX	-16.920***	0.000	6.74*	0.100
OCF	84.063	0.440	-183.997**	0.033
Constant	906.5133***	0.000	765.6***	0.000
Obs	88		107	
Number of groups	23		25	
R-squared	0.464		0.48	
Prob>chi2	0.0000		0.0000	

Table (4.4) shows that Prais-Winsten regression is used to test the CCC model as classified by working capital investment strategy to test the significant difference between aggressive working capital strategy and conservative working capital strategy. The overall model can be accepted as a reliable model to explain working capital efficiency as measured by CCC because the Prob > chi2 is less than 5% of the Aggressive and Conservative investing policy of working capital.

- The results indicate that under the aggressive investing strategy, board size does not have a significant effect on the Cash Conversion Cycle (CCC). However, under the conservative strategy, board size has a quadratic impact on the CCC. This suggests the presence of an optimal level of CCC that maximizes efficiency in working capital management. Deviating from this optimal level will result in inefficiencies in working capital management. The relationship between board size (BS) and CCC follows a U-shaped curve. Specifically, the parameter related to board size (BS) is negative (<0) and statistically significant, while the squared parameter (BS squared) is positive and statistically significant. The optimal level of board size corresponds to the level that maximizes efficiency in working capital management.

  BS = - (-93.72)/ (2*5.021) ≈ 10 board members.
- Under the aggressive investing strategy, board composition has a significant negative effect on the Cash Conversion Cycle (CCC), indicating a positive impact on working capital management efficiency. In other words, a favorable board composition is associated with shorter conversion cycles and improved efficiency in managing working capital.
- On the other hand, under the conservative investing strategy, board composition has a significant positive effect on the CCC, implying a negative impact on working capital management efficiency. This suggests that a different board composition, likely more conservative in nature, is associated with longer conversion cycles and lower efficiency in working capital management.
- Under the aggressive investing strategy, CEO duality has no significant effect on the Cash Conversion Cycle (CCC). This implies that CEO duality does not impact the efficiency of working capital management.

- However, under the conservative investing strategy, CEO duality has a significant negative effect on the CCC. This indicates that having the same person serving as both CEO and chairman of the board is associated with a shorter conversion cycle and improved efficiency in working capital management. In this context, CEO duality has a positive impact on working capital management efficiency.
- According to the aggressive investing strategy, board meetings do not have a significant effect on the Cash Conversion Cycle (CCC). This suggests that the frequency of board meetings does not impact the efficiency of working capital management.
- In contrast, under the conservative strategy, board meetings have a quadratic impact on the CCC. This indicates the presence of an optimal level of CCC that maximizes working capital management efficiency. Deviating from this optimal level will result in inefficiencies in working capital management. The relationship between board meetings (BM) and CCC follows a U-shaped curve. Specifically, the parameter related to board meetings (BM) is negative (<0) and statistically significant, while the squared parameter (BM squared) is positive and statistically significant. The optimal level of board meetings corresponds to the level that maximizes efficiency in working capital management.

  BM = - (-72.153)/ (2*20.765) ≈ 2 board meetings
- Auditing committee size (AC) has a significant negative impact on the cash conversion cycle (CCC), which means auditing committee size and working capital efficiency for aggressive and conservative strategies are positively impacted.
- There is an insignificant impact of auditing committee meetings (AM) on the cash conversion cycle (CCC), which means there is no impact of auditing committee meetings and working capital efficiency for aggressive and conservative strategy.

4-4 Testing the Hypotheses concerning the impact of board characteristics on working capital management efficiency as measured by cash holding

Table (4.5) CH Model (Full Sample) Prais-Winsten regression, heteroskedastic panels corrected standard errors			
CH	**Coef.**	**p-value**	**Sig**
BS	-.002	.367	
BC	.402	0. 000	***
BC2	-.297	0. 000	***
CD	-.009	.315	
BM	-.003	.128	
AC	-.057	0. 000	***
AC2	.005	0. 000	***
AM	.016	0. 000	***
TANG	-.122	0. 000	***
OCF	.082	.002	***
2	-.068	0. 000	***
3	-.064	.049	**
5	-.047	.026	**
6	-.049	0. 000	***
7	.021	.262	
8	-.053	.067	*
10	-.04	0. 000	***
11	-.049	.016	**
13	-.068	0. 000	***
14	-.105	0. 000	***
Constant	.18	0. 000	***
Mean dependent var	**0.082**	**SD dependent var**	**0.066**
R-squared	**0.618**	**Number of obs**	**195**
Chi-square	**128.643**	**Prob > chi2**	**0.000**
****** p<.01, ** p<.05, * p<.1***			

Table (4.5) shows that Prais-Winsten regression is used to test the CH model to consider the autocorrelation in the tested model. The overall model can be accepted as reliable to explain working capital efficiency as measured by CH because the Prob > chi2 is less than 5%.

- This research demonstrates that there is a curvilinear relationship between the size of the auditing committee (AC) and the efficiency of working capital management, as measured by CH. This suggests that there exists an optimal level of CH that maximizes efficiency in managing working capital. Deviating from this optimal level will result in inefficiencies in working capital management. The relationship between the auditing committee size and working capital management efficiency follows a U-shaped curve. Specifically, the parameter associated with the auditing committee size (AC) is negative (<0) and statistically significant, indicating a negative direct impact on working capital management efficiency. Additionally, the squared parameter (AC squared) is positive and statistically significant, indicating a positive impact on working capital management efficiency. The optimal level of auditing committee size corresponds to the size that maximizes efficiency in working capital management
  AC = - (-0.057)/ (2*0.005) = 5 members
- This research has discovered a curvilinear relationship between board composition (BC) and the efficiency of working capital management, as measured by CH. This finding indicates the presence of an optimal level of CH that maximizes the efficiency of working capital management. Deviating from this optimal level will result in inefficiencies in working capital management. The relationship between board composition and working capital management efficiency follows an inverted U-shaped curve. The parameter associated with board composition (BC) is positive (>0) and statistically significant, indicating a positive direct impact on working capital management efficiency. Additionally, the squared parameter (BC squared) is negative and statistically significant, suggesting a negative impact on working capital management efficiency. The specific value of the optimal level of board composition (BC) that maximizes working capital management efficiency would need to be

determined based on the context of the research, the variables involved, and further analysis or interpretation of the data.

BC = - (0.402)/ (2*-0.297) ≈ 68%

- Moreover, the results show a positive significant direct impact of auditing committee meetings (AM) on cash holding (CH), however, an insignificant effect between board size (BS) board member (BM) and CEO duality (CD) impact on cash holding (CH),

4-4-1 The impact of board characteristics on CH according to working capital investment strategy

Table (4.6) CH Model (classified according to investing strategy of working capital)				
CH	**Aggressive investing policy**		**Conservative investing policy**	
	Coef.	**p-value**	**Coef.**	**p-value**
BS	-.025	.162	.022	.334
BS2	.001	.165	-.001	.244
BC	.546	.193	.402*	.055
BC2	-.336	.244	-.326**	.045
CD	.013	.333	-.025	.124
BM	-.009	.414	.012*	.109
AC	-.027	.197	-.048**	.034
AC2	.002	.51	.005*	.069
AM	-.165***	0.000	.078	.113
AM2	.044***	0.000	-.01	.416
TANG	-.018	.57	-.062	.23
TQ	-.022	.126	-.003	.829
CPX	.008**	.015	-.001	.797
OCF	-.011	.847	.18***	.009
Constant	.039	.793	-.042	.75
Obs	**88**		**107**	
R-squared	**0.287**		**0.321**	
Prob>chi2	**0.000**		**0.000**	

According to the aggressive investing strategy

- The findings indicate that board size, board composition, CEO duality, and auditing committee size do not have a significant effect on working capital management efficiency, as measured by CH. However, auditing committee meetings have a quadratic impact on CH, suggesting the existence of an optimal level of CH that maximizes efficiency in managing working capital. Deviating from this optimal level will result in inefficiencies in working capital management. The relationship between auditing committee meetings (AM) and CH follows a U-shaped curve. Specifically, the parameter associated with auditing committee meetings (AM) is negative (<0) and statistically significant, indicating a negative direct impact on working capital management efficiency. Furthermore, the squared parameter (BS squared) is positive and statistically significant, indicating a positive impact on working capital management efficiency. To determine the exact optimal level of auditing committee meetings (AM) that maximizes working capital management efficiency, further analysis and interpretation of the data are required, taking into consideration the specific context and variables involved in the research

AM = - (-0.165)/ (2*0.044) ≈ 2 meetings.

- board size, CEO duality, and AM have no impact on CH, which means it has no impact on working capital management efficiency

- The research findings reveal that board composition (BC) has a quadratic impact on working capital management efficiency, as measured by CH. This implies that there exists an optimal level of CH that maximizes efficiency in managing working capital. Deviating from this optimal level will result in inefficiencies in working capital management. The relationship between board composition and CH follows an inverted U-shaped curve.

specifically, the parameter associated with board composition (BC) is positive (>0) and statistically significant, indicating a positive direct impact on working capital management efficiency. Moreover, the squared parameter (BC squared) is negative and statistically significant, indicating a negative impact on working capital management efficiency. To determine the specific value of the optimal level of board composition

(BC) that maximizes working capital management efficiency, further analysis and interpretation of the data are necessary. The optimal level can be identified by considering the unique context and variables involved in the research

BC = - (+0.402)/ (2*-0.326) = 62%

- Board meetings have a significant positive effect on CH, which means it has a negative impact on working capital management efficiency.

- Auditing committee meetings have a quadratic impact on CH, which means the existence of an optimal level of CH that maximizes working capital management efficiency, and any deviation will lead to inefficiency in working capital management; there is a U shape between them. Where the AC parameter is negative (<0) and significant, and AC squared is positive and significant. The optimal level of AC

- AC = - (+0.402)/ (2*-0.326) = 3 members.

5. Result Discussion

The objective of this research is to investigate the influence of various board characteristics, including CEO duality, board size, audit committee size, audit committee meetings, board composition, and board meetings, on the efficiency of working capital management (WCM). Two measures, namely the cash conversion cycle (CCC) and cash holding, are utilized as proxies to assess WCM efficiency. The study aims to determine how different board characteristics impact WCM efficiency under different company policies.

The findings indicate that the impact of board characteristics on WCM efficiency varies depending on the working capital management policy implemented by each company. Moreover, the results highlight which policy, based on WCM measurement, leads to a more efficient management of working capital. Specifically, the analysis reveals that a company adopting an aggressive investing policy tends to exhibit higher efficiency in working capital management, as measured by the cash conversion cycle (CCC), compared to a company following a conservative investing policy.

The results of the study indicate that CEO duality does not have a significant impact on the efficiency of working capital management (WCM) when using both the cash conversion cycle (CCC) and cash holding (CH) as measures. This finding aligns with previous research conducted by Kamau and Basweti (2013).

When considering the aggressive investing strategy, CEO duality does not have any effect on the efficiency of WCM, regardless of whether it is measured by CCC or CH. This result is consistent with the findings of the aforementioned study.

However, under the conservative investing strategy, CEO duality has a positive effect on WCM efficiency when measured by the cash conversion cycle (CCC). This finding is in line with the research conducted by Kyereboah-Coleman (2007), suggesting that CEO duality enhances the efficiency of working capital management in companies following a conservative investment approach.

Interestingly, when analyzing the relationship between CEO duality and WCM efficiency under the aggressive financing strategy, the study finds no significant relationship when using the cash conversion cycle (CCC) as the measure. However, in contrast, CEO duality has a positive impact on WCM efficiency when the firm adopts a conservative financing strategy.

Overall, these results highlight the influence of CEO duality on WCM efficiency in different investment and financing strategies, emphasizing the importance of considering the specific context and policies of the company in understanding its impact on working capital management

The findings of the study indicate that board size has a positive impact on the efficiency of working capital management (WCM) when measured by the cash conversion cycle (CCC) in the full sample. This result aligns with the research conducted by Gill & Shah (2012) and Ali & Shah (2017), providing consistency in the literature.

Under the aggressive investing strategy and conservative financing strategy, board size does not have a significant impact on WCM efficiency when measured by CCC. This suggests that the size of the board does not play a significant role in determining the efficiency of working capital management in companies following these strategies.

However, under the conservative investing strategy and aggressive financing strategy, board size has a quadratic impact on the cash conversion cycle (CCC). This implies the existence of an optimal level of CCC that maximizes the efficiency of working capital management. Deviating from this optimal level will result in inefficiencies in working capital management. The presence of a quadratic relationship is in line with the idea that an extreme board size, either too small or too large, can have detrimental effects on WCM efficiency. This finding supports the notion that there is an optimal board size that companies should strive for in order to enhance working capital management efficiency.

When efficiency is measured by cash holding (CH) in the full sample, regardless of whether it is under the aggressive or conservative investing strategy, there is an insignificant relationship between board size (BS) and WCM efficiency. This suggests

that board size does not have a significant impact on working capital management efficiency when measured by CH.

In summary, the study reveals that board size plays a role in determining WCM efficiency when measured by CCC in the full sample, with support from previous research. The impact of board size on WCM efficiency varies depending on the investment and financing strategies employed, indicating the presence of an optimal CCC level under certain strategies. However, when efficiency is measured by CH, the relationship between board size and WCM efficiency is found to be insignificant.

The findings of the study indicate that audit committee size has a positive impact on the efficiency of working capital management (WCM) when measured by the cash conversion cycle (CCC) in the full sample. This result is consistent with the research conducted by Gill and Biger (2013) and Bansal and Sharma (2016), which provides support and agreement with the existing literature.

Regardless of whether firms adopt aggressive or conservative investing strategies, as well as aggressive or conservative financing strategies, audit committee size has a positive influence on WCM efficiency when measured by CCC. This suggests that a larger audit committee size contributes to enhanced efficiency in working capital management in these contexts.

However, when WCM efficiency is measured by cash holding (CH) in the full sample and firms adopt aggressive investing strategies, there is no significant relationship between audit committee size and WCM efficiency. This implies that the size of the audit committee does not play a significant role in determining working capital management efficiency when measured by CH in firms following aggressive investing strategies.

Interestingly, under the conservative investing strategy, audit committee size has a quadratic impact on cash holding (CH). This indicates the presence of an optimal level of cash holding that maximizes WCM efficiency. Deviating from this optimal level will result in inefficiencies in working capital management. This finding aligns with the notion that there is an optimal cash holding level that companies should aim for in order to achieve maximum efficiency.

In summary, the study highlights that audit committee size has a positive impact on WCM efficiency when measured by CCC in the full sample and across various investment and financing strategies. However, the relationship between audit committee size and WCM efficiency is found to be insignificant when efficiency is measured by CH in firms following aggressive investing strategies. Additionally, under the conservative investing strategy, audit committee size has a quadratic impact on CH, suggesting the presence of an optimal cash holding level for maximizing WCM efficiency.

The findings of the study suggest that audit committee meetings do not have a significant impact on the efficiency of working capital management (WCM) when measured by the cash conversion cycle (CCC) in the full sample, regardless of whether firms adopt aggressive or conservative investing strategies. This indicates that the frequency of audit committee meetings does not play a significant role in determining WCM efficiency in these contexts.

However, in firms that adopt aggressive or conservative financing strategies, audit committee meetings have a significant negative relationship with WCM efficiency when measured by CCC. This finding contrasts with most previous studies, which may suggest a unique finding or a deviation from the existing literature. The negative relationship implies that an increased frequency of audit committee meetings is associated with lower efficiency in working capital management. This unexpected result highlights the need for further investigation and consideration of specific factors influencing the relationship between audit committee meetings and WCM efficiency in the context of different financing strategies.

In the case of measuring WCM efficiency by cash holding (CH) in the full sample, audit committee meetings have a significant positive relationship with efficiency. This finding is consistent with the research conducted by Al-Mamun (2014) and Ali and Shah (2017), which also identified a positive impact of audit committee meetings on WCM efficiency. The positive relationship suggests that more frequent audit committee meetings are associated with increased efficiency in working capital management when measured by CH.

Moreover, under the aggressive investing strategy, audit committee meetings have a quadratic impact on cash holding (CH) in firms, indicating the presence of an optimal level of cash holding that maximizes WCM efficiency. This finding aligns with the idea that an extreme frequency of audit committee meetings, either too high or too low, can result in inefficiencies in working capital management. On the other hand, in the conservative investing strategy, there is no significant relationship between audit committee meetings and WCM efficiency, which is consistent with the research conducted by Marn and Romuald (2012).

In summary, the study reveals mixed findings regarding the impact of audit committee meetings on WCM efficiency. While no significant relationship is observed when measuring efficiency by CCC in the full sample and under aggressive or conservative investing strategies, a significant negative relationship is found in firms adopting aggressive or conservative financing strategies. However, when measuring efficiency by cash holding, a significant positive relationship is observed in the full sample, and audit committee meetings have a quadratic impact under the aggressive investing strategy. The results emphasize the need for further research and consideration of specific factors influencing the relationship between audit committee meetings and WCM efficiency in different contexts.

The findings of the study indicate that board composition has a positive and significant impact on the efficiency of working capital management (WCM) when measured by the cash conversion cycle (CCC) in the full sample, as well as in firms that adopt both aggressive investing strategies and conservative financing strategies. This result is consistent with the research conducted by Fiador (2016), providing support and agreement with previous studies.

However, in the context of the conservative investing strategy and aggressive financing strategy, board composition has a negative and significant impact on WCM efficiency when measured by CCC. This suggests that under these specific strategies, a different composition of the board has a detrimental effect on working capital management efficiency.

When efficiency is measured by cash holding (CH), no significant relationship is observed between board composition and WCM efficiency in the full sample and in firms adopting aggressive investing strategies. This indicates that the composition of the board does not play a significant role in determining cash holding levels and its impact on working capital management efficiency in these contexts.

Interestingly, under the conservative investing strategy, board composition has a quadratic impact on cash holding (CH). This implies the presence of an optimal level of cash holding that maximizes working capital management efficiency. Deviating from this optimal level can lead to inefficiencies in working capital management. This finding aligns with the idea that there is an ideal balance in cash holding that companies should strive for to achieve maximum efficiency.

In summary, the study reveals that board composition has a positive and significant impact on WCM efficiency when measured by CCC in the full sample and in firms adopting aggressive investing strategies. However, under the conservative investing strategy and aggressive financing strategy, board composition has a negative and significant impact on CCC. When measuring efficiency by cash holding, no significant relationship is observed in the full sample and in firms adopting aggressive investing strategies, while a quadratic impact is identified under the conservative investing strategy. These results highlight the importance of considering different investing and financing strategies when examining the relationship between board composition and WCM efficiency.

The study findings suggest that board meetings do not have a significant impact on working capital management (WCM) efficiency when measured by the cash conversion cycle (CCC) in the full sample, as well as in firms adopting the aggressive investing strategy and aggressive financing strategy. These results are consistent with the research conducted by Achchuthan et al. (2013) and Kamau and Basweti (2013), indicating agreement with previous studies.

However, under the conservative investing strategy and conservative financing strategy, board meetings have a quadratic impact on CCC in firms. This indicates the presence of

an optimal level of the cash conversion cycle that maximizes WCM efficiency. Deviating from this optimal level can lead to inefficiencies in working capital management. This finding highlights the importance of carefully managing board meetings to achieve the desired level of efficiency in these specific strategies.

In the full sample and under the conservative investing strategy, board meetings show a positive and significant relationship with WCM efficiency when measured by cash holding. This suggests that board meetings play a role in enhancing cash holding levels and thereby improving working capital management efficiency. However, in the aggressive investing strategy, there is no significant relationship observed between board meetings and WCM efficiency when measured by cash holding.

5.1 Conclusion

In conclusion, the study emphasizes the need to consider the company's policy and strategy when assessing the impact of board characteristics on working capital management efficiency. The results demonstrate that the influence of board meetings on efficiency varies depending on the adopted policy and strategy. This highlights the importance of tailoring board practices and decision-making processes to align with the specific context of the company to achieve optimal working capital management efficiency.

Furthermore, the research illustrates the significance of considering the company's policy when overseeing working capital. It demonstrates the link between board characteristics and the efficiency of working capital management. By analyzing how specific board attributes impact the effectiveness of working capital management within the context of the company's policy, this study contributes to existing knowledge. The results of this investigation also pave the way for future research in this domain, enabling a more comprehensive comprehension of the subject matter.

5. 3 Recommendations and Managerial Implications

The study provides valuable insights into the relationship between board characteristics and working capital management efficiency, highlighting the importance of considering the company's policy in managing working capital. This research contributes to the existing literature by exploring the impact of governance mechanisms, particularly board characteristics, on working capital management efficiency while taking into account the company's working capital policy. These findings open the door for further studies in this area, allowing for a deeper understanding of the topic.

Both academics and practitioners can benefit from the study. Academics can utilize these findings as a foundation for future research on the effects of governance mechanisms on working capital management efficiency, considering different perspectives and working capital policies. This encourages the advancement of knowledge in this field.

For practitioners, such as owners and managers of companies, the study offers valuable insights into the characteristics of the board of directors and their impact on working capital management efficiency. By understanding the relationship between board characteristics and efficiency, companies can mitigate corruption, prevent misuse of resources, and align board practices with the company's working capital management policy. Implementing effective board characteristics can lead to improved efficiency in working capital management, benefiting the overall financial health of the organization.

Moreover, the study's findings may be particularly relevant to manufacturing firms, given the sample selection. Additionally, the insights gained from this research can be applied to other developing countries, such as Egypt, due to similarities in their developing market contexts.

Overall, this study provides valuable knowledge and practical implications that can assist both researchers and professionals in understanding the influence of board characteristics on working capital management efficiency and optimizing working capital practices.

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