BOARD CHARACTERISTICS, OWNERSHIP CONCENTRATION AND VALUE-ADDED EFFICIENCY: A MULTI-THEORETIC CONTINGENCY FRAMEWORK

by

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ABSTRACT

The importance of intellectual capital and the management of this resource is increasingly important to value creation owing to the shift from a product-based economy to a knowledge-based economy. The board of directors plays an important role in the management of intellectual capital and performs multiple roles simultaneously. These roles include the monitoring and control role, the stewardship role, the service role and the strategic role. The characteristics of the board of directors influence the performance of these roles and the effectiveness of the management of intellectual capital. Enhanced intellectual capital management has the potential to improve intellectual capital performance and create value for a company. A multi-theoretic contingency model was adopted to acknowledge the multiple roles of the board of directors by applying an integrated approach to agency theory, stewardship theory, resource dependence theory and stakeholder theory.

The multi-theoretic contingency model used ownership concentration as the contingent factor, to examine the relationships between the characteristics of the board of directors and intellectual capital performance, measured as the efficiency of value added by a company from its resources. A deeper understanding was obtained by considering the moderating effect of ownership concentration on these relationships. Ownership concentration may be viewed as a corporate governance mechanism that either reduces or aggravates the agency problem, impacting the resources available for the effective management of intellectual capital by the board of directors.

The estimated generalised least squares method was applied to the regression models, with period seemingly unrelated regressions weightings and using White (diagonal) standard errors and covariance estimation methods. This mitigated the problems associated with autocorrelation and heteroscedasticity. The estimation method was first applied, without any interaction terms, to examine the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources. Interaction terms, which

were created by using ownership concentration as the potential moderating variable, were then individually introduced to the regression models. This was done for the full sample and also for the top industries on the Johannesburg Stock Exchange.

The findings of this study are important for the advancement of corporate governance policies that focus not only on the monitoring and control role, but also the service and strategic roles, of the board of directors. The study indicated that a higher level of ownership concentration had a moderating effect on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources in certain circumstances. However, the findings also indicated that the specific measure of ownership concentration was significant. In addition, the results differed between industries, suggesting that corporate governance policies should not be generic.

DECLARATION AND COPYRIGHT

I, ***Joanne Seligmann***, declare that the research work reported in this thesis is my own, except where otherwise indicated and acknowledged. It is submitted for a PhD (Financial Management Sciences) at the University of Pretoria, Gauteng. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other university. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references.

Joanne Seligmann

Signed at: Pretoria

On this 24th day of August 2021

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Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviation	**Meaning**
AltX	alternative exchange on the Johannesburg Stock Exchange
BBBEE	broad-based black economic empowerment
CEE	capital employed efficiency
CEO	chief executive officer
DGCL	Delaware General Corporation Law
EBITDA	earnings before interest, tax, depreciation and amortisation
EGLS	estimated generalised least squares
EVA	economic value added
HCE	human capital efficiency
ICE	intellectual capital efficiency
JSE	Johannesburg Stock Exchange
NASDAQ	National Association of Securities Dealers Automated Quotations
NYSE	New York Stock Exchange
OLS	ordinary least squares
SCE	structural capital efficiency
UK	United Kingdom
US	United States of America
VAIC	value added intellectual coefficient

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

The importance of intellectual capital has grown with the shift from an industrial product-based economy to a technological knowledge-based economy (Scafarto, Ricci & Scafarto, 2016; Tran & Vo, 2018). The advancements of the Fourth Industrial Revolution, which are characterised by rapid developments in technology, highlight the significance of intellectual capital (Lim & Jung, 2017). Intellectual capital is viewed as a strategic resource that enhances performance and creates value for organisations (Appuhami & Bhuyan, 2015). Consequently, intellectual capital rather than physical capital is currently the driving force behind corporate value and competitive advantage, particularly for knowledge-based industries (Chen, Cheng & Hwang, 2005; Gogan, Artene, Sarca & Draghici, 2016; Shih, Chang & Lin, 2010; Tran & Vo, 2018).

Despite the ability of intellectual capital to enhance performance and generate value, the full potential of intellectual capital will not be realised if it is not adequately managed (Van der Meer-Kooistra & Zijlstra, 2001). Consequently, Keenan and Aggestam (2001) and Safieddine, Jamali and Noureddine (2009) recognised the need to understand the role of corporate governance in attracting, retaining, generating and leveraging intellectual capital. Good corporate governance practices have the potential to ensure that managerial decisions result in the skilful deployment of capital resources to create value for stakeholders (Keenan & Aggestam, 2001; Weimer & Pape, 1999). Boards of directors play a central role in the corporate governance of companies and by way of their knowledge, experience and networking opportunities, members of the board of directors are capable of creating value for companies (Berezinets *et al.*, 2016). This is of significance because the primary responsibility of the board of directors is to create value through positive corporate performance (IODSA, 2009).

Numerous studies examined the association between corporate governance mechanisms (including ownership concentration and characteristics of the board of directors) and performance. Most of these studies were conducted in the United States of America (US) (Pamburai, Chamisa, Abdulla & Smith, 2015; Sami, Wang & Zhou, 2011). These studies generally focus on measures of corporate performance such as return on equity and return on assets (Pamburai *et al.*, 2015). The value creation process has changed, owing to the emergence of a global knowledge-based economy. The change has resulted in many companies depending on intellectual capital. Consequently, there is a need to consider intellectual capital as a driver of value creation.

Intellectual capital plays a significant role in creating value for companies, especially those in knowledge-based industries (Chen *et al.*, 2005; Shih *et al.*, 2010). The value added intellectual coefficient (VAIC), developed by Pulic (1998), is a measure of intellectual capital performance, which has increasingly been used in academic studies (Firer & Williams, 2003). It measures the efficiency of value added by a company's key resources, which include physical capital and intellectual capital. Therefore, VAIC acknowledges that both physical capital and intellectual capital contribute to performance. This study adopted VAIC and its components as measures of intellectual capital performance.

Agency theory, which focuses on the monitoring and control role of the board of directors, underpins most empirical research on corporate governance. Governance reforms in many countries also assume the agency model (Gaur, Bathula & Singh, 2015). However, the board of directors serves not only in a monitoring and control role, but also in strategic and service roles (Brennan, 2006). The strategic role of the board of directors is supported by resource dependence and stewardship theories, whereas the service role of the board of directors is the focus of stakeholder theory (Gaur *et al.*, 2015). This study followed a multi-theoretic approach in order to cater for the board of directors' numerous roles. These roles play a part in the management of intellectual capital, which impacts on intellectual capital performance.

Ownership concentration was adopted as the contingent factor in the multi-theoretic approach to gain a deeper understanding of the relationships between characteristics of the board of directors and efficiency of value added by a company from its resources. The relationships of ownership concentration, the characteristics of the board of directors and the efficiency of value added by the company from its resources were also examined for listed companies in each of the top industries on the main board of the Johannesburg Stock Exchange (JSE). Therefore, the study examined the associations of ownership concentration, the characteristics of the board of directors, and the efficiency of value added by a company from its physical and intellectual capital resources for each of the four largest industries represented on the JSE.

1.2 THE SOUTH AFRICAN CONTEXT

Although South Africa may not yet be ready to operate in the knowledge-based economy, the country has made significant progress by improving its preparedness for the knowledge-based economy. The World Bank's Knowledge Economy Index, which was discontinued, measured a country's readiness to operate in the knowledge-based economy. According to this index, out of 146 countries, South Africa's rank improved significantly from 143 in 2000 to 67 in 2012 (Vadra, 2017). This indicates South Africa's progress towards a knowledge-based economy. Sub-Saharan African countries generally perform poorly in terms of knowledge-based economy indices, however South Africa is one of the exceptions in this regard (Ojanperä, Graham & Zook, 2019).

The management of intellectual capital is an important aspect of creating value and competitive advantage (Guthrie, Petty & Johanson, 2001). From a corporate governance perspective, the board of directors plays an important role in the management of intellectual capital (Keenan & Aggestam, 2001). South Africa is a leader in corporate governance and has a well-established corporate governance system (Vaughn & Ryan, 2006) that can potentially contribute to the creation of value through effective management of intellectual capital. Therefore, South Africa presents an interesting setting for this study.

1.3 PROBLEM STATEMENT

Owing to the shift from an industrial product-based economy to a technological knowledge-based economy, intellectual capital rather than physical capital is often the driving force behind corporate value. However, intellectual capital and its capacity to drive value creation is generally not reflected in the financial statements owing to its intangible nature. Some research studies have tried to solve this problem by using the value added intellectual coefficient (VAIC), which uses the efficiency of value added by a company from its resources, as a measure of intellectual capital performance. However, these studies are relatively scarce and the results of studies examining relationships between board characteristics and VAIC are mixed. This suggests the need for a deeper understanding of the relationships between the characteristics of the board of directors and VAIC, which can be obtained by introducing a contingent factor.

Prior studies examining the relationships between the characteristics of the board of directors and VAIC have also tended to draw on a single theory, such as agency theory, stewardship theory, resource dependence theory or stakeholder theory, to advance the understanding of these relationships. This approach ignores the multiple roles of the board of directors, which may be viewed as threefold: the monitoring and control role; the strategic role; and the service role. In addition, it neglects to recognise that the board of directors performs these roles simultaneously.

In order to resolve these problems, this study examined the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources, using a multi-theoretic contingency framework with ownership concentration as the contingent factor. The main research question of this study was as follows:

- Which relationships between characteristics of the board of directors and the efficiency of value added by a company from its resources are moderated by a higher level of ownership concentration?

1.4 PURPOSE

The main purpose of the study was to further the understanding of the moderating effect of ownership concentration on the relationships between characteristics of the board of directors and the efficiency of value added by a company from its resources.

1.5 RESEARCH OBJECTIVES

The research objectives of the study were as follows:

- to empirically establish the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources;
- to empirically determine the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources for each of the top industries represented on the JSE;
- to empirically establish whether a higher level of ownership concentration has a moderating effect on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources; and
- to draw conclusions based on the findings of the study and make recommendations for further research.

The term ‘efficiency of value added by a company from its resources’ refers to VAIC and its sub-components, namely capital employed efficiency (CEE) and intellectual capital efficiency (ICE). The sub-components of ICE, namely human capital efficiency (HCE) and structural capital efficiency (SCE) are also referred to by this term. The distinguishing factor between VAIC and all its sub-components are the resources underlying the efficiency of the value added by a company. For VAIC, the total resources of a company are relevant, whereas physical capital resources, intellectual capital resources, human capital resources and structural capital resources underlie CEE, ICE, HCE and SCE.

1.6 CONTRIBUTION AND BENEFITS OF THE STUDY

Firstly, this study contributes to the literature on corporate governance and the efficiency of value added by a company from its resources. It also contributes to the literature that considers these two subject areas in combination.

Secondly, prior studies relating corporate governance mechanisms to efficiency of value added by a company from its resources generally have not considered the component parts of VAIC separately (i.e. the efficiency of value added by a company from its physical capital and the efficiency of value added by a company from its intellectual capital, which consists of human capital and structural capital). Where the component parts were considered separately, the data only covered a single year. This study extended previous studies by examining the component parts of VAIC as separate variables, in a longitudinal study, in order to understand better the value added from physical capital and intellectual capital.

Thirdly, a single theoretic framework has generally been used in the past to understand the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. This study used a multi-theoretic model integrating agency theory, stewardship theory, resource dependence theory and stakeholder theory to gain a better understanding of these relationships. The integration of theories was achieved by adopting ownership concentration as a contingent factor.

Lastly, this study contributes by examining the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources within industries.

Academics will benefit from this study. To the best of the researcher's knowledge, this is the first study using an integrated multi-theoretic framework for establishing the relationships of ownership concentration, the characteristics of the board of directors and the efficiency of value added by a company from its resources in the light of the multiple roles of the board of directors. The multi-theoretic contingency model recognises the various roles of the board of directors in an environment where intellectual capital has a place, and serves as a contribution to the corporate governance literature and theory.

This study will also be of value to policy setters. Agency theory traditionally forms the basis of corporate governance codes, such as the King Report on Corporate Governance for South Africa. The multi-theoretic contingency framework for this study aimed to demonstrate the need to consider a broader theoretic basis for corporate governance policy setting. In addition, corporate governance codes are often drafted using a one-size-fits-all approach. This study examined the relationships of ownership concentration, the characteristics of the board of directors and the efficiency of value added by a company from its resources for the four largest industries on the JSE to determine the need for a departure from this approach. The King IV Report on Corporate Governance for South Africa 2016 has dealt with certain nuances by adding sector supplements, which provide guidance and direction on the interpretation and application of the report for various categories and sectors of organisations. However, the supplements do not deal with specific industries.

Investors and financial analysts may benefit from this study, because it considers value added by both a company's physical and intellectual capital. The shift from an industrial product-based economy to a technological knowledge-based economy has resulted in greater significance being attributed to the value created by intellectual capital. Measures of corporate performance often merely consider financial performance or fail to capture the value added by intellectual capital. Therefore, measures of intellectual capital performance (such as VAIC) continue to gain interest.

1.7 STRUCTURE OF THE THESIS

The remainder of the thesis is structured in the following manner:

Chapter 2 identifies and describes the theoretic underpinnings relevant to the objectives of the research, which include agency theory, stewardship theory, resource dependence theory and stakeholder theory. It then identifies the various roles of the board of directors and provides a review of the body of literature dealing with intellectual capital, the measurement of intellectual capital, and corporate governance and intellectual capital performance.

Chapter 3 outlines the corporate governance landscape both in South Africa and globally, which served as a background to the study. The term *corporate governance* is first defined, an overview of the corporate governance models adopted in the United Kingdom (UK), the US and South Africa is then provided, and the specific corporate governance provisions concerning ownership concentration and the characteristics of the board of directors in the UK, the US and South Africa are reviewed and compared over time. Finally, the specific corporate governance provisions are linked to the underlying corporate governance theories.

Chapter 4 includes the hypotheses that were developed through the use of a multi-theoretic contingency lens. Agency theory, stewardship theory, resource dependence theory and stakeholder theory underpinned these hypotheses. Ownership concentration was introduced as a contingent factor with the potential to influence agency costs. These hypotheses posit relationships between ownership concentration, the characteristics of the board of directors and the efficiency of value added by a company from its resources, which are supported by the literature.

Chapter 5 provides a detailed description of the research methodology used in the study. This chapter begins by outlining the research orientation. It then describes the population and sample selection, the data sources and collection, and the specific variables. Lastly, the research method used to collect, analyse and interpret the data is outlined.

Chapters 6, 7 and 8 present the results of the data analysis, and Chapter 9 draws the study to its conclusion. In Chapter 9, the findings from the earlier chapters are summarised, the contributions and limitations of the research are explained, and recommendations are made for further research.

1.8 CHAPTER CONCLUSION

The main purpose of this study was to further the understanding of the relationships between ownership concentration, the characteristics of the board of directors and the efficiency of value added by a company from its resources, using a multi-theoretic contingency framework. Given the increasing importance of intellectual capital, this study contributes to the existing literature by considering these relationships to better understand the value added from physical and intellectual capital with regard to industries. In addition, this study makes an important contribution by using a multi-theoretic model integrating agency theory, stewardship theory, resource dependence theory and stakeholder theory to gain a better understanding of the relationships between ownership concentration, the characteristics of the board of directors and the efficiency of value added by a company from its resources.

CHAPTER 2

THEORY, ROLES OF THE BOARD OF DIRECTORS AND INTELLECTUAL CAPITAL

2.1 INTRODUCTION

The board of directors plays an important part in the corporate governance of the company and the management of intellectual capital. Consequently, the board of directors has the potential to create value for the company. This value emanates not only from the application of physical capital resources but also intellectual capital resources. This chapter examines relevant theory, discusses the roles of the board of directors, defines the term *intellectual capital*, identifies measures of intellectual capital, and reviews the literature on corporate governance and intellectual capital performance.

2.2 THEORETIC UNDERPINNINGS

Corporate governance studies considering the relationships between characteristics of the board of directors and performance have been approached from various theoretic perspectives. This study used a framework for integrating the viewpoints of agency theory, stewardship theory, resource dependence theory and stakeholder theory. An explanation of each of these theories follows.

2.2.1 Agency theory

Agency theory, which has its roots in economics, is the predominant theory used in corporate governance research (Davis, Schoorman & Donaldson, 1997). Berle and Means (1932) acknowledged the dispersion of ownership in the modern corporation, leading to the separation of ownership and management. Agency theory deals with the problems that arise owing to the separation of owners and managers in an organisation, and highlights the need for mechanisms to mitigate these problems. In a publicly listed company, shareholders (principals) own the company and appoint managers (agents) to run the business on their behalf (Jensen & Meckling, 1976; Solomon, 2020). The theory states that this principal-agent relationship leads to an agency problem because, given the opportunity, agents act in their own self-interest rather than in the best interests of the principals, and principals do not have the necessary information to accurately assess the actions of the agents (Eisenhardt, 1989; Jensen & Meckling, 1976; Ross, 1973; Solomon, 2020). Therefore, both principals and agents desire to maximise their individual utility regardless of the impact on the utility of the other party (Jensen & Meckling, 1976). Agency costs are incurred to alleviate this problem (Eisenhardt, 1989; Jensen & Meckling, 1976). For example, mechanisms are introduced by principals to control the actions of agents and to better align the interests of these two parties (Eisenhardt, 1989; Fama & Jensen, 1983b).

Agency costs consist of monitoring costs, bonding costs and residual losses (Jensen & Meckling, 1976). Monitoring costs relate to expenses incurred for the monitoring and assessment of the agent's performance. For example, shareholders appoint boards of directors to monitor management and there are costs associated with the appointment and development of the directors. Shareholders initially bear the monitoring costs, but these costs are eventually incurred by managers because they are compensated for covering these expenses (Fama & Jensen, 1983b). Bonding costs arise due to agents being required to work within the boundaries of the system established by the principals (Jensen & Meckling, 1976). These are implicit costs incurred by the agent to provide assurance that the principals' best interests are being served. Monitoring costs and bonding costs are inversely related. Therefore, managers avoid monitoring costs by incurring bonding costs. Residual losses are the result of the misalignment between the interests of principals and agents, which allows for inefficient management decisions that fail to maximise the wealth of the owners. Monitoring and bonding costs are incurred by owners to diminish residual losses (Jensen & Smith, 1985).

The monitoring of management by the board of directors is important because of the potential agency costs incurred when management pursues its own interests at the expense of the shareholders' interests. Monitoring can reduce overall agency costs and by doing so, improve corporate performance (Fama, 1980; Zahra & Pearce, 1989). A reduction in agency costs results in the availability of more funds and resources for the effective management of intellectual capital (Appuhami and Bhuyan, 2015), which drives corporate performance and has the potential to create value (Keenan & Aggestam, 2001).

While agency theory is valuable in situations where the use of corporate governance mechanisms can resolve conflicts of interest in relationships, further theory is required to understand alternative situations. In this light, a description of stewardship theory follows.

2.2.2 Stewardship theory

Stewardship theory represents a sociological and psychological approach to governance (Davis *et al.*, 1997). Similar to agency theory, stewardship theory deals with the owner (principal) who appoints the manager to act on his or her behalf (Davis *et al.*, 1997; Donaldson & Davis, 1991). However, the manager is referred to as the steward rather than the agent for the purposes of stewardship theory. Stewardship theory suggests that the objectives of stewards and principals are aligned (Davis *et al.*, 1997; Donaldson, 1990). Therefore, the steward will act in the best interests of the principal and place the principal's interests ahead of self-interest (Davis *et al.*, 1997). Stewardship theory contrasts with agency theory, in terms of which the agent is motivated by personal goals and acts with self-interest in mind, neglecting the interests of the principal. Stewardship theory argues that managers are inspired by a broad range of motives, rather than by self-interest. These motives include the desire for recognition of achievement and the satisfaction arising from success (Letza, Sun & Kirkbride, 2004).

Stewardship theory proposes that utility is maximised when principals and stewards co-operate with each other in a manner that favours the organisation (Davis *et al.*, 1997). According to the theory, stewards perceive their interests to be congruent with those of the principals and the organisation (Davis *et al.*, 1997; Donaldson & Davis, 1991). Therefore, stewards believe greater utility is achieved by acting in the interests of the organisation than can be realised through self-serving behaviour (Davis *et al.*, 1997; Donaldson & Davis, 1991). This implies that stewards are unlikely to behave opportunistically for personal benefit (Dalton, Daily, Ellstrand & Johnson, 1998). The steward appreciates that personal needs are satisfied by seeking to achieve collective organisational goals (Davis *et al.*, 1997). Thus the steward strives to achieve the goals of the organisation, such as favourable corporate performance (Davis *et al.*, 1997; Donaldson & Davis, 1991). Regardless of whether or not the interests of the principal and steward are aligned, the steward will co-operate with the principal. The principal will ultimately reap the benefits of this behaviour in the form of dividends or capital growth in his or her investment (Davis *et al.*, 1997).

Stewardship theory differs from agency theory, in that it concentrates on mechanisms that assist and empower rather than monitor and control managers (Davis *et al.*, 1997; Muth & Donaldson, 1998). Because the steward acts with organisational objectives in mind and can be trusted, the need to monitor and control the steward is minimised (Davis *et al.*, 1997). Accordingly, stewardship theory promotes providing authority and discretionary powers to stewards (Davis *et al.*, 1997; Donaldson, 1990; Donaldson & Davis, 1991). For example, chief executive officer (CEO) duality is encouraged, which allows the CEO to determine strategy without the threat of disapproval from the chairman of the board of directors (Boyd, 1995; Davis *et al.*, 1997; Donaldson, 1990; Donaldson & Davis, 1991). Thus, the CEO can set a strategy that enhances the management of intellectual capital, resulting in the opportunity for value creation.

Boards of directors serve not only as corporate governance mechanisms to monitor or motivate management, but also play a role in providing resources to organisations. Resource dependence theory deals with this role and is described next.

2.2.3 Resource dependence theory

Resource dependence theory arose from the seminal work by Pfeffer and Salancik (1978). This theory is recognised as one of the most influential theories in organisational and strategic management (Hillman, Withers & Collins, 2009). According to Pfeffer (1972), boards of directors facilitate companies to gain access to resources. Resource dependence theory concentrates on the role played by the board of directors in providing access to resources through connections to the company's external environment (Pfeffer, 1973). Therefore, the ability of the board of directors to provide relational capital is important to this theory. The external connections possessed by directors have the potential to contribute to the company's business development and long-term sustainability (Pfeffer & Salancik, 1978). Consequently, non-executive directors and directors who hold multiple directorships can add value to a company through their connections with the company's external environment.

Company directors can provide and secure access to resources for the company (Zahra & Pearce, 1989). The company is dependent on other organisations for certain resources. This dependence creates an element of uncertainty and the board of directors acts as a mechanism to minimise this uncertainty (Pfeffer, 1972) and manages dependence on external parties (Pfeffer & Salancik, 1978). By doing so, transaction costs arising from the interdependencies of organisations are reduced (Hillman, Cannella & Paetzold, 2000) and directors contribute to the survival of the organisation (Singh, House & Tucker, 1986).

According to resource dependence theory, environmental circumstances influence the characteristics of an effective board of directors (Boyd, 1995). Therefore, the most effective characteristics of the board of directors may differ from industry to industry and from one time period to another.

Resource dependence theory posits a direct relationship between the ability of the board of directors to provide access to resources and corporate performance (Hillman & Dalziel, 2003). Thus, the board of directors is viewed as a vital link between the company and the external resources required by the company to maximise performance (Pfeffer, 1972; Pfeffer & Salancik, 1978; Zald, 1969). Access to resources, such as knowledge, skills and capabilities can improve intellectual capital performance, resulting in improved corporate performance and value creation for a company.

One further theory is considered for the purposes of this study. The final theory contemplated is stakeholder theory. An outline of this theory follows.

2.2.4 Stakeholder theory

Stakeholder theory serves as an alternative to shareholder-based theories such as agency and stewardship theory. It differs from shareholder-based theories in that it maintains that the company's management should consider the interests of all the company's stakeholders rather than only those of the shareholders (Donaldson & Preston, 1995; Solomon, 2020). Freeman (1984, p. 46) defined the term *stakeholder* broadly as "any group or individual who can affect or is affected by the achievement of an organization's objectives". Therefore, company stakeholders are envisaged to include shareholders, employees, suppliers, customers, financiers, government and society. This broad definition recognises that practically any person or group of persons can affect or be affected by a company's actions. The board of directors acts as the company's link to its stakeholders (Hillman, Keim & Luce, 2001).

Some scholars acknowledge that it is not practical for company management to attend to the interests of all stakeholders (Mitchell, Agle & Wood, 1997). These scholars prefer a narrower definition, which limits the scope of the term *stakeholder*. For example, Hill and Jones (1992) believe that a stakeholder must have a claim on the company, while Clarkson (1995) argues that stakeholder status should be determined in terms of the necessity of the stakeholder's relationship with the company to the survival of the company.

Owing to the broad spectrum of stakeholders, multiple and sometimes conflicting goals arise (Harrison & Wicks, 2013). Therefore, management's role is to attempt to resolve these conflicts, taking into account the best interests of all stakeholders, in order to generate as much value as possible for the company. While financial performance is relevant to various company stakeholders, it is not the only measure of value relevant to stakeholders (Harrison & Wicks, 2013; Solomon, 2020). Therefore, value added, which represents the value created by the productive use of the company's resources, is considered a more appropriate measure of corporate performance from a stakeholder perspective (Meek & Gray, 1988). Since a company's resources include intellectual capital, more effective management of intellectual capital provides an opportunity for value creation.

The theories which are relevant to corporate governance can be linked to the roles of the board of directors. This is discussed further in the next section.

2.3 ROLES OF THE BOARD OF DIRECTORS

Value creation within companies is often attributed to good corporate governance practices (Charreaux & Desbrières, 2001) and the management of intellectual capital (Berezinets *et al.*, 2016; Scafarto, Ricci, Magnaghi & Ferri, 2020). Boards of directors play a central part in the corporate governance of companies and the management of intellectual capital (Berezinets *et al.*, 2016; Scafarto *et al.*, 2020). Therefore, understanding the roles of the board of directors is essential when considering what constitutes good governance and effective management of intellectual capital. Generally, there is consensus that boards of directors serve in three interrelated roles, namely monitoring and control, service and strategic (Brennan, 2006; Ingley & Van der Walt, 2001). A discussion of each of these roles follows.

2.3.1 Monitoring and control role

Boards of directors are responsible for protecting the interests of shareholders. Therefore, they are expected to monitor the actions of the company's management on behalf of the shareholders. The monitoring and control role of the board of directors includes oversight of internal controls and the appointment, performance evaluation and disciplining of management (Jensen & Meckling, 1976; Kang, Cheng & Gray, 2007). Agency theory, which is discussed in Section 2.2.1, supports the monitoring and control role of the board of directors.

The majority of governance recommendations promote the board of directors' monitoring and control role without considering the integration of this role with the service and strategic roles. For example, corporate governance regulations emphasise the need for independence with regard to the board of directors (Committee on the Financial Aspects of Corporate Governance, 1992; FRC, 2003; Higgs, 2003; IODSA, 2002, 2009, 2016). However, in many cases, the results of empirical research demonstrate either no relationship or a negative relationship between the independence of the board of directors and corporate performance (Agrawal & Knoeber, 1996; Barnhart & Rosenstein, 1998; Ho & Williams, 2003; Yermack, 1996). These relationships suggest that stewardship theory, which supports the strategic role of the board of directors, should be considered in addition to agency theory. Furthermore, independent directors who lack competence, experience and access to resources are unlikely to add value to a company (Nicholson & Kiel, 2004). Pfeffer and Salancik (1978) acknowledge that the external connections possessed by directors have the potential to contribute to the company's business development and long-term sustainability. As a result, resource dependence theory and stakeholder theory, which support the strategic and service roles of the board of directors, respectively, should be integrated with agency theory when considering the relationships between the characteristics of the board of directors and intellectual capital performance, which can drive value creation. Stewardship theory, resource dependence theory and stakeholder theory are discussed in more detail in Sections 2.2.2, 2.2.3 and 2.2.4, respectively.

2.3.2 Service role

The board of directors acts in a service role by providing the company with connections to the external environment and enhancing the legitimacy of the company (Hillman *et al.*, 2000; Pfeffer & Salancik, 1978). The ability of the board of directors to create value by acting in a service role depends on the level of human capital and relational capital contributed by the individual members of the board of directors. The service role of the board of directors is reinforced by stakeholder theory, which is contemplated in Section 2.2.4.

The King IV Report on Corporate Governance for South Africa 2016 identifies the need for stakeholder management, which includes ongoing communication by a company with its major stakeholders (IODSA, 2016). This approach narrows the expectation gap between stakeholders and the company by providing the board of directors and management with a better understanding of the true and reasonable needs, interests and expectations of the company's major stakeholders. By taking responsibility for the building of relationships with the company's major stakeholders, the board of directors plays a service role.

The service role, which relates to stakeholder theory, should not be viewed in isolation. From a corporate governance perspective, inclusivity of the broader stakeholder community rather than a shareholder focus is important to strategy and decision-making (IODSA, 2009). Additionally, understanding stakeholder expectations enhances the ability to improve strategy (IODSA, 2016) and highlights the need to integrate the service and strategic roles of the board of directors.

2.3.3 Strategic role

The strategic role of the board of directors is fulfilled through the provision of strategic direction to the company and reviewing the implementation of the strategy (Fama & Jensen, 1983b; Zahra & Pearce II, 1990). Stewardship theory and resource dependence theory, which are considered in Sections 2.2.2 and 2.2.3, respectively, favour the strategic role of the board of directors.

The King Report on Corporate Governance for South Africa 2009 recognised the importance of the board of directors' strategy for the achievement of sustainable businesses (IODSA, 2009). This recognition required a shift from short-term to long-term thinking because value creation must occur in a sustainable manner (IODSA, 2016). Diversity of the board of directors is believed to lead to better quality decision-making owing to the incorporation of a wider range of perspectives, which increases creativity and flexibility (Hillman, 2015; Milliken & Martins, 1996; Williams & Ho, 2001). This wider range of perspectives enhances strategic decision-making by providing a broader spectrum of problem-solving skills (Schweiger, Sandberg & Ragan, 1986).

As already mentioned in Sections 2.3.1 and 2.3.2, it is important not to consider the strategic role as a standalone function of the board of the directors. This role should be integrated with the monitoring and control role and the service role of the board of directors when considering the relationships between the characteristics of the board of directors and intellectual capital performance, which has the potential to create value for a company.

The board of directors creates value for the company by performing the monitoring and control, service and strategic roles in combination. The characteristics possessed by the board of directors, which are used in the performance of these roles, contribute to the management of a company's intellectual capital. The term *intellectual capital* is defined for this purpose.

2.4 DEFINITION OF INTELLECTUAL CAPITAL

There is no universal definition of the term *intellectual capital* (Dumay, 2016). Some researchers perceive intellectual capital and intangible assets to be the same, whereas others argue that intangible assets go beyond intellectual capital (Petty & Guthrie, 2000). In 1969, John Kenneth Galbraith, an economist, wrote a letter in which he used the term *intellectual capital* (Bontis, 2001; Feiwel, 1975), which he perceived to be a dynamic rather than static form of capital (Edvinsson & Sullivan, 1996). Consequently, Galbraith is recognised as the first to publish the term *intellectual capital* (Bontis, 2001; Feiwel, 1975; Serenko & Bontis, 2004). According to Edvinsson and Sullivan (1996), intellectual capital is knowledge that can be converted into value. Stewart (1997) expanded on this concept by proposing that intellectual capital is the knowledge, information, intellectual property rights and experience that can be used to create wealth. Therefore, intellectual capital must not be viewed simply as knowledge, but rather as the company's ability to generate value from that knowledge (Berezinets *et al.*, 2016). Dumay (2016, p. 169) refined the definition proposed by Stewart (1997) by replacing 'wealth' with 'value', stating that "intellectual capital is intellectual material, knowledge, experience, intellectual property, information … that can be put to use to create value". This study supported the views of Dumay (2016) that intellectual capital can be defined broadly and value extends beyond financial performance. Therefore, for the purposes of this study, Dumay's definition of intellectual capital was adopted. In this context, *intellectual capital* is the intellectual material, knowledge, experience, intellectual property and information that can be put to use by the board of directors to create value for the company.

Despite there being no universal definition of the term *intellectual capital*, there is general consensus that intellectual capital has three components: human capital; structural capital and relational capital (Appuhami & Bhuyan, 2015). These are discussed in the sections that follow.

2.4.1 Human capital

Human capital comprises the knowledge, qualifications, skills and experience that individual directors contribute to the decision-making processes of the board of directors (Johnson, Schnatterly & Hill, 2013; Roos, Edvinsson & Dragonetti, 1997). Theoretic knowledge may be gained through obtaining academic qualifications, while skills are a practical demonstration of knowledge, and experience is gained by using one's knowledge and skills over an extended period of time. Human capital influences the decision-making processes of the board of directors, because these processes are driven by the capabilities and experience of the individual members of the board of directors.

The knowledge, qualifications, skills and experience of the members of the board of directors are elements of the company's capital that the individual directors take home at night (Berezinets *et al.*, 2016; Roos *et al.*, 1997). Therefore, human capital consists of all the tacit knowledge entrenched in the company, which is not owned by the company. As a result, a portion of the company's capital, which potentially contributes to the value of the company, is not fully controlled by the company. Consequently, incentives may need to be offered to ensure the retention of directors who possess human capital and represent value for the company.

2.4.2 Structural capital

In contrast to human capital, structural capital can be owned by the company and is the knowledge that remains in a company after the employees go home at night (Roos *et al.*, 1997). Whereas human capital may be referred to as a 'thinking asset', structural capital may be considered a 'non-thinking' asset (Brennan & Connell, 2000). Edvinsson and Sullivan (1996) argue that structural capital is required to realise the value of human capital, since the realisation of thoughts and ideas requires supporting resources. Therefore, the structural capital of a company is the infrastructure that supports the human capital, and is capable of leveraging the human capital. Examples of structural capital are databases, organisational charts, process manuals, strategies and routines (Bontis, Chua Chong Keow & Richardson, 2000). This includes the share of a company's assets relating to the management (Edvinsson & Sullivan, 1996) and strategic direction of the company. Consequently, the strategic role of the board of directors forms part of the structural capital of a company.

2.4.3 Relational capital

Relational capital refers to the relationships that exist between members of the board of directors and external stakeholders of the company (Berezinets *et al.*, 2016). Better networking opportunities and improved access to critical resources for the company can arise from relational capital (Wincent, Anokhin & Örtqvist, 2010). Carpenter and Westphal (2001) suggest that relational capital serves as a channel for the flow of resources and information both to and from the company. Tian, Haleblian and Rajagopalan (2011) argue that boards of directors possessing more relational capital have access to better quality information, enabling improved decision-making. Therefore, the service role of the board of directors, which provides connections between the company and its external environment, has the potential to play an important part in the company's value creation process.

Intellectual capital is perceived to provide a company with a unique set of resources, which are not easily replicated by competitors and present the company with a competitive advantage that may be reflected in corporate performance (Stewart, 1997). However, the value of intellectual capital is difficult to determine from corporate reporting. Thus, numerous measures have arisen for this purpose. These measures are discussed next.

2.5 MEASUREMENT OF INTELLECTUAL CAPITAL AND INTELLECTUAL CAPITAL PERFORMANCE

The existing financial reporting framework relevant to companies listed on the Johannesburg Stock Exchange (JSE) emphasises financial measures and does not require the quantification or disclosure of most components of intellectual capital (Dumay & Guthrie, 2017; Van der Meer-Kooistra & Zijlstra, 2001). According to the literature, intellectual capital is commonly viewed as an off-balance sheet asset with substantial value that is responsible for the difference between market value and book value (Dumay, 2012; Stewart, 1997). However, this concept has been challenged owing to the inconsistencies in historical cost accounting for assets and the persistent fluctuation of share prices (Brennan & Connell, 2000; Dumay, 2012). A further weakness of this measure is the inability to decompose it to measure the individual components of intellectual capital (Brennan & Connell, 2000; Dumay, 2012).

Numerous measures of intellectual capital exist (Goebel, 2015; Sveiby, 2001; Sydler, Haefliger & Pruksa, 2014). In order to select an appropriate measure of intellectual capital, it is important to determine the purpose of the measure, since each measure carries advantages and disadvantages. Intellectual capital measures may be used for internal or external purposes (Cronje & Moolman, 2013; Sydler *et al.*, 2014). Internally, these measures could be used to enhance strategic decision-making and thereby manage the company's resources more effectively (Cronje & Moolman, 2013; Hunter, Webster & Wyatt, 2005; Sydler *et al.*, 2014). Externally, intellectual capital measures may improve external reporting. This may enhance the insights of users of the company's annual financial statements and other published information, such as existing and prospective shareholders, who use these measures to evaluate the company's historical performance and potential future growth (Cronje & Moolman, 2013; Hunter *et al.*, 2005; Sydler *et al.*, 2014). Therefore, intellectual capital measures reflect intellectual capital performance.

As previously mentioned, numerous methods exist for the measurement of intellectual capital. These methods can be grouped according to approach. Sveiby (2001) categorised these approaches in a two-by-two matrix; firstly, according to whether the approach operates at the organisational or components level, and secondly, according to whether the approach provides a monetary or non-monetary measure of intellectual capital. These approaches may be categorised as a scorecard approach, a market capitalisation approach, a direct intellectual capital approach and a return on assets approach (Forte, Tucker, Matonti & Nicolò, 2017; Sveiby, 2001). The scorecard approach operates at the components level and provides a non-monetary measure of intellectual capital. All three of the remaining approaches provide a monetary measure of intellectual capital. However, the direct intellectual capital approach operates at the components level, whereas the market capitalisation and return on assets approaches operate at the organisational level. Each of these approaches is discussed in the sections that follow.

2.5.1 Scorecard approach

The scorecard approach requires the identification of the different components of intellectual capital, which are then used to formulate non-financial indicators and financial ratios for the measurement of intellectual capital (Sveiby, 2001; Forte *et al.*, 2017). These indicators and ratios are reported by way of integrated scorecards and graphs (Forte *et al.*, 2017; Sveiby, 2001). Examples of the scorecard method are the balanced scorecard, Skandia Navigator and Intangible Assets Monitor (Sveiby, 2001; Sydler *et al.*, 2014). The qualitative nature of this approach may be advantageous because it provides a more comprehensive view of an entity's performance than purely financial indicators (Forte *et al.*, 2017; Sveiby, 2001). Non-financial indicators are also not limited to application at organisational level and may therefore be used at components level, which facilitates measurement closer to the time that an event occurs (Sveiby, 2001). Another advantage arising from the qualitative nature of this approach is that it may be useful for non-profit organisations, internal departments, public sector entities, and environmental and social purposes (Sveiby, 2001).

Nevertheless, this approach also has disadvantages. One disadvantage of this approach is its qualitative nature, which results in this measure often being subjective and company-specific (Sveiby, 2001; Sydler *et al.*, 2014). Transparency may also be compromised by this approach if there is no regulatory framework for rendering the disclosure of relevant non-financial indicators mandatory (Sydler *et al.*, 2014). Consequently, comparisons between companies within the same industry will be difficult if this approach is used unless the disclosure of certain non-financial indicators is mandatory and a consistent measurement method is established (Sveiby, 2001; Sydler *et al.*, 2014). The scorecard approach is less familiar to users than the financial approach and may generate extensive quantities of data, which are difficult to analyse and communicate (Sveiby, 2001).

2.5.2 Direct intellectual capital approach

The monetary value of intellectual capital may be estimated using the direct intellectual capital approach (Forte *et al.*, 2017; Sveiby, 2001). Examples of this approach are The Value Explorer and citation-weighted patents (Sveiby, 2001; Sydler *et al.*, 2014). The direct intellectual capital approach requires the identification of the separate components of intellectual capital, which are then evaluated directly, either individually or as an aggregate coefficient (Sveiby, 2001; Sydler *et al.*, 2014). The advantages and disadvantages of the direct intellectual capital approach are similar to those of the scorecard approach, as both of these approaches operate at components level rather than at organisational level. However, in contrast to the scorecard approach, the direct intellectual capital approach provides a monetary value for intellectual capital (Forte *et al.*, 2017; Sveiby, 2001). The determination of this monetary value relies on sophisticated valuation models, which complicates the computations (Sydler *et al.*, 2014). In addition, the monetary value only manages to encompass limited aspects of intellectual capital, as quantitative information is often incomplete or unreliable (Forte *et al.*, 2017; Sydler *et al.*, 2014). For example, the human capital component may neglect to account for the investment in the training and education of employees (Forte *et al.*, 2017; Pantzalis & Park, 2009). Mouritsen (2009) also notes that the direct intellectual capital approach fails to recognise the synergistic effects of the interaction between the intellectual capital components on total intellectual capital value.

2.5.3 Market capitalisation approach

The market capitalisation approach computes intellectual capital as the difference between the company's market capitalisation and the book value of shareholders' equity (Forte *et al.*, 2017; Sveiby, 2001). Examples of measures that are encompassed within this approach are Tobin's Q, market-to-book value (Sveiby, 2001; Sydler *et al.*, 2014) and enterprise value. This approach has certain advantages because it measures intellectual capital in monetary terms, which is useful for share market valuations and enables the performance of comparisons between companies in the same industry (Sveiby, 2001; Sydler *et al.*, 2014). It is also widely supported by the accounting community because it relies on information provided in the financial statements, which facilitates the communication of this measure (Sveiby, 2001; Sydler *et al.*, 2014; Goebel, 2015). Furthermore, the market capitalisation approach considers the interactions between the components of intellectual capital, which result in synergies that generate a total intellectual capital value greater than the sum of the parts (Forte *et al.*, 2017; Van der Meer-Kooistra & Zijlstra, 2001). However, disadvantages also arise and the value of intellectual capital determined using this approach is often useless to non-profit entities, internal departments and public sector entities (Sveiby, 2001). A further disadvantage is that this approach may result in a superficial value for intellectual capital because the measurement must be expressed according to monetary value (Sveiby, 2001; Sydler *et al.*, 2014). Lastly, the market capitalisation approach, which measures intellectual capital only at organisational level, has limited use for management purposes other than at board level (Sveiby, 2001).

2.5.4 Return on assets approach

The return on assets approach describes a company's intellectual capital as the excess return on its tangible assets (Demartini & Paoloni, 2013). The return on assets approach first calculates the return on assets for comparison with the industry average by dividing a company's average pre-tax earnings for a period of time by the company's average tangible assets during that period (Pew Tan, Plowman & Hancock, 2008; Sveiby, 2001). The difference between the company's return on assets and the industry average represents the company's excess return on assets and when multiplied by the average tangible assets, the result is the average annual earnings from intangible assets (Pew Tan *et al.*, 2008; Sveiby, 2001). The value of intangible assets or intellectual capital is then estimated by dividing the excess average annual earnings from intangible assets by the company's average cost of capital or an interest rate (Sveiby, 2001). Examples of the return on assets approach are economic value added (EVA) and knowledge capital earnings (Sveiby, 2001; Sydler *et al.*, 2014). The value added intellectual coefficient (VAIC) is also recognised as a measure of intellectual capital derived by following the return on assets approach. However, Sveiby (2001) states that VAIC does not precisely fit any of the four recognised approaches (see Sections 2.6 and 5.8.1 for a further discussion of VAIC). The advantages and disadvantages of the return on assets approach are similar to those of the market capitalisation approach (Sydler *et al.*, 2014). One disadvantage specific to the return on assets approach is sensitivity to interest rate and discount rate assumptions, which may have a significant impact on the calculated intellectual capital value (Sveiby, 2001).

2.5.5 Analysis of measures of intellectual capital and intellectual capital performance

Intellectual capital is a strategic resource, which serves as the driving force behind sustainable corporate performance and competitive advantage. Thus, an appropriate measure of intellectual capital should reflect the internal management perspective (Hunter *et al.*, 2005; Sydler *et al.*, 2014). Nevertheless, the measure should also be suitable for external purposes because it may be relied upon by existing and future investors as a measure of performance for decision-making purposes (Cronje & Moolman, 2013; Hunter *et al.*, 2005; Sydler *et al.*, 2014).

The scorecard approach and direct intellectual capital approach are usually more suitable for internal management purposes owing to the non-financial indicators incorporated into these methods (Forte *et al.*, 2017; Sveiby, 2001) and to the potential for the calculation of a superficial value for intellectual capital when purely monetary measures are used (Sveiby, 2001; Sydler *et al.*, 2014). However, there are no mandatory requirements in South Africa for the disclosure of most of the non-financial data required to measure intellectual capital (Dumay & Guthrie, 2017; Van der Meer-Kooistra & Zijlstra, 2001). This lack of transparency would hinder the collection of data required by existing and potential investors for measurement purposes. In addition, the use of qualitative indicators does not allow for comparison between companies (Sveiby, 2001; Sydler *et al.*, 2014). Therefore, the market capitalisation and return on assets approaches to intellectual capital measurement seem to be more appropriate for intellectual capital performance purposes.

The market capitalisation and return on assets approaches generate monetary values, which enable comparisons at company level (Sveiby, 2001; Sydler *et al.*, 2014). In addition, both of these approaches are accounting-based, which facilitates the collection of any financial data required for measurement purposes because the annual reports of listed companies are publicly available (Goebel, 2015; Sveiby, 2001; Sydler *et al.*, 2014). Furthermore, the market capitalisation and return on assets approaches are the more familiar approaches within the broad field of accounting owing to the less sophisticated calculations and ease of analysis of purely financial information (Sveiby, 2001). Although the market capitalisation and return on assets approaches only operate at organisational level and, therefore, have limited use for management purposes, these approaches may be useful for internal management purposes at board level (Sveiby, 2001). Methods associated with the market capitalisation approach, in particular, are of no use for internal departments despite their usefulness at board level and for external purposes.

Return on assets methods provide a monetary measure of intellectual capital and are not only relatively easy to calculate, but also provide a consistent basis of measurement, which enables comparison between companies (Forte *et al.*, 2017; Sveiby, 2001). Return on assets methods, such as EVA, adopt a shareholder perspective. However, intellectual capital is a strategic resource (Appuhami & Bhuyan, 2015), which requires a measure capable of dealing with the broader stakeholder perspective. The VAIC method provides a measure that satisfies this requirement (Iazzolino, Laise & Migliano, 2014). Although the VAIC method is associated with the return on assets approach, this method does not precisely fit this approach (Sveiby, 2001). For example, the VAIC method relies on financial data from the value-added income statement rather than data from the traditional income statement (Iazzolino *et al.*, 2014). As a result, the VAIC method looks beyond financial performance and determines a broader measure of value added. Since VAIC and EVA consider different aspects of value creation, Iazzolino and Laise (2013) and Berzkalne and Zelgalve (2014) argue that these measures are not true rivals and may co-exist because they are complementary. In contrast to the other return on assets methods, the VAIC method also explicitly refers to intellectual capital (Iazzolino & Laise, 2013). Although the methods associated with the return on assets approach are usually sensitive to interest rate and discount rate assumptions, this is not true for the VAIC method owing to the specific formulae used by this method. Therefore, the VAIC method, which adopts a return on assets approach, is considered to be a suitable measure of the value of intellectual capital. Because VAIC measures the monetary value created by each monetary unit invested in resources, it may be viewed as a measure of intellectual capital performance. The VAIC method is now discussed further.

2.6 VALUE ADDED INTELLECTUAL COEFFICIENT (VAIC)

The Skandia Navigator views human capital as a collection of characteristics possessed by employees, such as skills and experience (Iazzolino *et al.*, 2014). In contrast, VAIC envisages human capital as the amount of capital invested in employees by way of, for example, wages and training (Iazzolino *et al.*, 2014). The definition of the term *structural capital*, for the purposes of VAIC, is also not aligned with the meaning used in the Skandia Navigator. VAIC refers to structural capital as the difference between the value added from intellectual capital and the value added from human capital.

The VAIC method, developed by Pulic (1998), determines a measure of intellectual capital, which has increasingly been used in academic studies as a measure of intellectual capital performance (Firer & Williams, 2003). VAIC measures the extent of value creation for each monetary unit invested in resources (Berzkalne & Zelgalve, 2014). Therefore, this measure may be used to monitor and evaluate the efficiency of value added by the company from its resources (Ho & Williams, 2003; Ståhle, Ståhle & Aho, 2011). A higher VAIC value implies better efficiency of value added by the company from its total resources (Berzkalne & Zelgalve, 2014; Pulic, 1998). VAIC has three components and can be expressed as the sum of capital employed efficiency (CEE), human capital efficiency (HCE) and structural capital efficiency (SCE). CEE, HCE and SCE represent the extent of value created from the investment by a company of a single monetary unit in net assets, employees or structural capital, respectively (Gan & Saleh, 2008). Since structural capital corresponds to earnings before interest, tax, depreciation and amortisation (EBITDA), it measures the value added for all capital investors, including shareholders (Andriessen, 2004). To establish the value added for stakeholders, human capital must be added to structural capital.

The VAIC method has been criticised for its underlying assumptions. Firstly, the VAIC method is criticised for treating employee costs as assets rather than expenses owing to a large portion of these costs carrying no enduring benefit (Andriessen, 2004). Secondly, the VAIC method neglects to consider the causal relationships between CEE, HCE and SCE, which may create additional value (Andriessen, 2004). Thirdly, the VAIC method calculates CEE, HCE and SCE separately and sums these, but fails to take into account the synergies between the individual components in the value creation process (Andriessen, 2004), which may result in the understatement of value added. Fourthly, Ståhle *et al.* (2011) criticised the VAIC model for its omission of relational capital.

Despite the abovementioned criticisms, the use of VAIC is widely supported owing to its consistent and standardised form, which enables comparability for a large and diverse sample of companies (Chen *et al.*, 2005; Firer & Williams, 2003). VAIC also uses simple calculations and audited financial information to overcome some of the shortcomings of alternative intellectual capital measures, which are often criticised for their subjectivity (Firer & Williams, 2003). Studies examining the relationships between the characteristics of the board of directors and intellectual capital performance applying VAIC as the dependent variable include Appuhami and Bhuyan (2015), Ho and Williams (2003), Makki and Lodhi (2014) and Swartz and Firer (2005). CEE and intellectual capital efficiency (ICE) are also treated as dependent variables in the study by Ho and Williams (2003).

2.7 CORPORATE GOVERNANCE AND INTELLECTUAL CAPITAL PERFORMANCE

The relationship between corporate governance and corporate performance has been studied extensively, but no consensus has been reached on this nexus (Makki & Lodhi, 2014). Although the relationship between corporate governance and corporate performance has been examined in the literature, both conceptually (Jensen & Meckling, 1976) and empirically (Daily & Dalton, 1994), few studies pursue research on the relationship between corporate governance and intellectual capital performance, which has the potential to drive value creation (Berezinets *et al.*, 2016). This creates an opportunity for further research on this relationship. The link between corporate governance and intellectual capital was initially dealt with conceptually in the literature by Keenan and Aggestam (2001). Ho and Williams (2003) were the first to examine this relationship empirically.

Safieddine *et al.* (2009) examined the relationship between corporate governance and intellectual capital empirically, by conducting a survey to gather insights from full-time faculty members of a university in Beirut. The results of the study indicate that corporate governance and intellectual capital are positively related. However, these results are questionable owing to a limited response to the survey and the diverse views of the university faculty members regarding the university governance structure. Nevertheless, Makki and Lodhi (2014) provided support for the results presented by Safieddine *et al.* (2009) and argue that good corporate governance has no direct effect on financial performance; however, good corporate governance improves intellectual capital efficiency, which impacts positively on financial performance. According to Safieddine *et al.* (2009), corporate governance is perceived to play a significant role in the attraction and retention of intellectual capital and existing intellectual capital creates opportunities for the attraction of further intellectual capital.

Empirical studies examining the association between corporate governance and performance have traditionally used accounting or market-based measures (Ho & Williams, 2003; Swartz & Firer, 2005), which neglect to consider intellectual capital. However, some studies recognise that the importance of intellectual capital performance owing to the emergence of the knowledge-based economy. Many of these studies apply VAIC as a measure of intellectual capital performance. For example, Ho and Williams (2003) explored the relationship between the structure of the board of directors and intellectual capital performance using the efficiency of value added as the measure of performance. Other corporate governance studies using VAIC as a measure of intellectual capital performance include Al-Musali and Ku Ismail (2015), Appuhami and Bhuyan (2015), Buallay and Hamdan (2019), Shahzad, Baig, Rehman, Latif and Sergi (2019) and Swartz and Firer (2005).

Ho and Williams (2003) considered not only the efficiency of value added by the total resources of a company, but also the value added by capital employed (i.e. physical and financial capital) and intellectual capital (i.e. human and structural capital). VAIC was used as the proxy for the efficiency of value added by the total resources of a company, whereas CEE was the proxy for the efficiency of value added by a company’s capital employed and ICE was the proxy for efficiency of value added by a company’s intellectual capital. The study by Ho and Williams (2003) was not the only study that considered the components of VAIC. Appuhami and Bhuyan (2015) treated ICE as an independent variable and considered the relationships between the characteristics of the board of directors and ICE. In addition, Makki and Lodhi (2014) considered HCE, SCE and CEE in their study, which broadened the literature by drawing together research considering the corporate governance-intellectual capital efficiency nexus and the corporate governance-financial performance nexus.

Whereas Ho and Williams (2003) conducted an international comparative analysis using a sample of 84 South African, 94 Swedish and 108 United Kingdom (UK) publicly listed companies, Swartz and Firer (2005) empirically examined a sample of 117 South African publicly listed companies. The sample used in the study by Swartz and Firer (2005) excluded financial services and regulated utility companies owing to the regulatory environment in which these companies operate. In contrast, Al-Musali and Ku Ismail (2015) and Dalwai and Mohammadi (2020) only studied financial services companies in the Gulf Cooperation Council countries and Oman, respectively. Despite the different samples selected by Ho and Williams (2003) and Swartz and Firer (2005), all three of these studies were conducted using data for a single year. Swartz and Firer (2005) examined data relating to 2003, while Ho and Williams (2003) focused on 1998. In contrast to the single-year studies of Ho and Williams (2003) and Swartz and Firer (2005), the study by Al-Musali and Ku Ismail (2015) used a sample of 128 firm-year observations and covered three years from 2008 to 2010. Furthermore, this period coincided with the global financial crisis. Appuhami and Bhuyan (2015) also used a multi-period sample in their study, which used 300 firm-year observations for the period 2004 to 2013.

Most prior studies relating corporate governance mechanisms to the efficiency of value added by a company from its resources did not consider the component parts of VAIC separately (i.e. the efficiency of value added by a company from its physical capital and the efficiency of value added from its intellectual capital). Where the component parts were considered separately, the data only covered a single year. This presents an opportunity for further research into the component parts of VAIC as separate variables, in a longitudinal study, in order to improve the understanding of the value added from physical capital and intellectual capital.

The study by Makki and Lodhi (2014) used data from a randomly selected sample of companies listed on the Karachi Stock Exchange and developed a structural model to explore the impact of corporate governance practices on intellectual capital efficiency and financial performance. CEO duality, percentage of non-executive directors, directors' ownership, executive director's remuneration and number of shareholders were used as proxies for corporate governance in the study. Ho and Williams (2003) similarly used CEO duality, outside directors on the board of directors and inside directors' ownership to consider the relationships between the characteristics of the board of directors and intellectual capital performance and found that specific characteristics relating to the structure of the board of directors were associated with intellectual capital performance in particular circumstances; however, governance needs varied between companies even under different socio-political and economic conditions. Although the study by Ho and Williams (2003) excluded executive director's remuneration and number of shareholders, the characteristics of the board of directors examined were extended with the size of the board of directors. Therefore, Ho and Williams (2003) focused on the composition of the board of directors when determining the proxies for corporate governance.

Instead of simply considering the composition of the board of directors, Appuhami and Bhuyan (2015) examined the association between a broader array of internal corporate governance mechanisms and intellectual capital efficiency. The independent variables used by Appuhami and Bhuyan (2015) therefore differed from those in the research by Ho and Williams (2003) in that they excluded directors' ownership, but included audit committee composition and remuneration committee composition in addition to CEO duality, the size of the board of directors and percentage of independent directors on the board. The study by Swartz and Firer (2005), which considered the composition of the board of directors from a different angle, explored the relationships between the gender and ethnic composition of the board of directors and intellectual capital performance. Swartz and Firer (2005) suggested extending this research by conducting a similar longitudinal study or by considering alternative characteristics of the board of directors such as educational qualifications, occupational experience and length of service of directors. Al-Musali and Ku Ismail (2015) expanded the intellectual capital performance research by not only exploring the association between the diversity of the board of directors, rather than the structure of the board of directors, and intellectual capital performance, but also considering the moderating effect of the effectiveness of board meetings on this relationship from an agency theory perspective.

Whereas all of the abovementioned studies considered internal corporate governance mechanisms, the majority of these studies focused on the characteristics of the board of directors, including the composition of the board of directors. Limited studies incorporated a moderating variable when examining the relationships between internal corporate governance mechanisms and intellectual capital performance (Al-Musali & Ku Ismail, 2015; Buallay & Hamdan, 2019). Al-Musali and Ku Ismail (2015) used the effectiveness of meetings of the board of directors as a moderating variable, whereas Buallay and Hamdan (2019) adopted firm size for this purpose. Thus, the opportunity exists for further studies to explore the influence of alternative moderating variables on the relationships between corporate governance mechanisms and intellectual capital performance.

2.8 CHAPTER CONCLUSION

This chapter discussed the need for an integrated approach to consider the multiple roles of the board of directors, because all of these roles are undertaken simultaneously. The characteristics possessed by the board of directors contribute to the management of intellectual capital and have the potential to create value for a company. Therefore, this study examined the relationships between the characteristics of the board of directors and intellectual capital performance. After considering numerous measures relevant to intellectual capital, VAIC was identified as a suitable measure of intellectual capital performance.

As the board of directors plays a central role in the corporate governance of a company, a review of past studies examining corporate governance in combination with intellectual capital performance was conducted. These studies neglected to use an integrated multi-theoretic framework to deal with the multiple roles of directors. To overcome this shortcoming, a multi-theoretic framework will be adopted as a basis for the current study. The framework will integrate agency theory, stewardship theory, resource dependence theory and stakeholder theory.

Chapter 3 considers corporate governance and how this relates to the characteristics of the board of directors, which may create value for a company.

CHAPTER 3
CORPORATE GOVERNANCE AND THE BOARD OF DIRECTORS

3.1 INTRODUCTION

Various corporate governance models exist owing to the differences between countries, companies and changing needs over time. Good corporate governance practices formed the foundation of this study and this chapter outlines the corporate governance landscape both in South Africa and globally. Therefore, this chapter defines the term *corporate governance*, provides an overview of the corporate governance models adopted in the United Kingdom (UK), the United States of America (US) and South Africa, reviews the specific corporate governance provisions concerning the characteristics of the board of directors in the UK, the US and South Africa over time, considers ownership concentration as a corporate governance mechanism, and relates specific corporate governance provisions and ownership concentration, as a corporate governance mechanism, to the underlying theory.

3.2 DEFINITION OF CORPORATE GOVERNANCE

Various definitions exist for the term *corporate governance*. Shleifer and Vishny (1997, p. 737) define *corporate governance* as “the ways in which suppliers of finance to corporations assure themselves of getting a return on their investments”. In the UK Cadbury Report of 1992, the Cadbury Committee defined *corporate governance* relatively broadly as “the system by which companies are directed and controlled” (Committee on the Financial Aspects of Corporate Governance, 1992, p. 15). The first three versions of the King Report on Corporate Governance for South Africa neglected to define the term *corporate governance*. However, the fourth version (King IV), which was published in 2016, defines it to mean the exercise of ethical and effective leadership by the governing body towards the achievement of ethical culture, good performance, effective control and legitimacy. According to Brickley and Zimmerman

(2010, p. 236), “corporate governance is the system of laws, regulations, institutions, markets, contracts, and corporate policies and procedures (such as the internal control system, policy manuals and budgets) that direct and influence the actions of the top-level decision makers in the corporation (shareholders, boards and executives)”. In essence, *corporate governance* is defined as the manner in which companies are regulated and managed. Despite the abundance of definitions, it is evident that corporate governance mechanisms may be internal or external to the company. This research concerned itself with internal corporate governance mechanisms, with a specific focus on ownership concentration and the characteristics of the board of directors.

The G20/OECD Principles of Corporate Governance published by the Organisation for Economic Co-operation and Development (OECD, 2015, p. 9) provided a different perspective on corporate governance by stating not only that corporate governance “provides the structure through which the objectives of the company are set, and the means of obtaining those objectives and monitoring performance are determined”, but also that “corporate governance involves a set of relationships between a company’s management, its board, its shareholders and other stakeholders”. This insight recognises that corporate governance is concerned not only with shareholder interests, but also with the interests of other stakeholders. Despite the definition of corporate governance in King IV not specifically dealing with this aspect, corporate governance is dealt with from the stakeholder perspective in South Africa, which adopts a stakeholder-inclusive approach (IODSA, 2002, 2009, 2016), because the creation of value for a company depends on the company’s ability to create value for all its stakeholders (IIRC, 2013). This is significant for the research at hand, which considered the stakeholder perspective and was not limited to the shareholder viewpoint.

3.3 OVERVIEW OF CORPORATE GOVERNANCE GLOBALLY

Whereas good corporate governance practices were initially encouraged by individual countries, these were brought to the fore in the global arena by a report issued in 2000 by the World Bank, titled “Corporate governance: a framework for implementation” (Iskander & Chamlou, 2000). The corporate governance literature recognises not only that companies in different countries operate within different political, social and economic regimes (Davies & Schlitzer, 2008), but also that what is considered to be good corporate governance practice may differ within an individual country and over time (Iskander & Chamlou, 2000). Both the insufficiency of a single corporate governance model and the opportunity to grow from the experience of others are therefore acknowledged in the literature. Although South Africa is considered to be the leader on the African continent in corporate governance (Rwegasira, 2000; Vaughn & Ryan, 2006), the UK was the global pioneer in this arena and inspired the South African corporate governance model. The US approached corporate governance from a different angle from the UK and also informed the South African corporate governance model. Consequently, it is important to understand not only the South African corporate governance model, but also other predominant corporate governance models, such as those operating in the UK and the US. These models are outlined below.

3.3.1 Corporate governance in the United Kingdom

In 1992, the Cadbury Report was published in the UK in response to concerns about standards of financial reporting and accountability, particularly owing to the corporate scandals and collapse of large businesses, such as the Bank of Credit and Commerce International and Maxwell Communications Corporation (Boyd, 1996; Committee on the Financial Aspects of Corporate Governance, 1992). This report set out principles relating to financial aspects of good corporate governance, which were incorporated into the London Stock Exchange’s listing rules. While the Cadbury Report was directed at listed companies in the UK, it promoted the adoption of its principles by all companies (Committee on the Financial Aspects of Corporate Governance, 1992). The Cadbury Report is recognised for pioneering the ‘comply or explain’ approach to corporate governance (Keay, 2014), which was later adopted in the King Report on Corporate Governance for South Africa. This approach differs from statute in that it makes voluntary recommendations for best practice rather than instituting laws, which are mandatory. This enables flexibility in the application of corporate governance principles and encourages companies to adopt the spirit of the principles rather than simply performing a 'box-ticking' exercise.

In 1995, the Greenbury Committee issued a report in response to growing concern over the level of directors' remuneration in the UK (Study Group on Directors' Remuneration., 1995). The Hampel Committee was later established to review the extent to which the objectives of the Cadbury and Greenbury Reports had been achieved (Committee on Corporate Governance, 1998). This resulted in the publication of the Combined Code, which applied to all listed companies and drew together the principles set out in the Cadbury and Greenbury Reports (Committee on Corporate Governance, 2000). Parkinson and Kelly (1999) argued that the Combined Code neglected to properly consider the interests of all stakeholders by merely focusing on shareholder interests.

In order to improve best practice with regard to corporate governance, Sir Derek Higgs was appointed by the UK Government to review the role and effectiveness of non-executive directors (Higgs, 2003). In 2003, these recommendations, together with recommendations by Sir Robert Smith regarding the audit committee, were incorporated into the Combined Code on Corporate Governance, which replaced the Combined Code published by the Hampel Committee (FRC, 2003). The Combined Code on Corporate Governance came into effect for financial reporting periods beginning on or after 1 November 2003. It was later revised in 2006, 2008, 2010 and 2012. Despite the ongoing amendments to corporate governance principles in the UK, the foundational 'comply or explain' principle has been maintained.

The changes made in 2006 and 2008 related predominantly to the composition of the remuneration committee, audit committees and the statements concerning the application of the principles set out in the Combined Code on Corporate Governance (FRC, 2006; FRC, 2008). These modifications to the corporate governance principles in the UK were relatively minor and the primary emphasis of the revisions was to improve the relationship between the company's management and shareholders and the quality of information provided to shareholders through the explanations arising from the ‘comply or explain’ approach. Regardless of these efforts, companies continue to provide ‘boilerplate’ explanations (Keay, 2014), which fail to be company-specific and lack insight.

The 2008 financial crisis triggered a further re-evaluation of corporate governance systems in the UK (FRC, 2010a). This resulted in the UK Corporate Governance Code replacing the Combined Code on Corporate Governance in 2010. The UK Corporate Governance Code highlights the importance of the general principles that should guide the behaviour of the board of directors. In July 2010, the Financial Reporting Council also published the UK Stewardship Code, which should be seen as complementary to the UK Corporate Governance Code (FRC, 2010b).

The UK Stewardship Code sets out the principles that should be followed for effective stewardship by investors. The objective of the UK Stewardship Code is to enable institutional investors to better practise their stewardship responsibilities (FRC, 2010b; McNulty & Nordberg, 2016). These responsibilities include voting, monitoring and engaging with the board of directors of the company on issues such as strategy, performance and management of risk (FRC, 2010b). The 2008 financial crisis is partially attributed to poor institutional investor engagement, which facilitates the board of directors’ monitoring function (Roach, 2011). Although the board of directors of a company assumes the primary responsibility for stewardship by monitoring management, the investors play an important stewardship role by holding the board of directors accountable for carrying out its responsibilities (FRC, 2010b).

In September 2012, a revised version of the UK Corporate Governance Code was published by the Financial Reporting Council. This version was effective for financial years beginning on or after 1 October 2012 (FRC, 2012). The UK Corporate Governance Code was further revised in 2014 and the revised version was effective for financial years commencing on or after 1 October 2014 (FRC, 2014). The changes focused on the provision of information by the company relevant to the long-term sustainability of the company (FRC, 2014). This is important since intellectual capital plays a significant role in creating the value required for long-term sustainability in the corporate environment. Another revision to the UK Corporate Governance Code took place in 2016 and came into effect for financial years commencing on or after 17 June 2016 (FRC, 2016). This revision was a consequence of the implementation of the European Union’s Audit Regulation and Directive and changes were made, where required, to the recommendations concerning audit committees (FRC, 2016). The latest revision of the UK Corporate Governance Code took place in 2018 and came into effect for accounting periods beginning on or after 1 January 2019 (FRC, 2018). The focus of this revision is on the effective application of the principles in the UK Corporate Governance Code. However, it also highlights the significance of instituting a culture within the organisation that aligns with the company purpose and business strategy, encourages integrity and values diversity (FRC, 2003; Solomon, 2020). This is relevant because corporate governance should not be a ‘box-ticking’ exercise. For example, it is essential that the directors set the correct tone within the organisation to ensure an effective business strategy and the realisation of value from diversity. It is notable that the UK corporate governance regulations have been revised approximately every two years. This emphasises not only the dynamic nature of the corporate governance regulations, but also potential inadequacies of the earlier regulations.

3.3.2 Corporate governance in the United States of America

Whereas corporate governance regulation in the UK is presented in a code of best practice, which is voluntary, the US corporate governance regulations are legislated, which results in them being mandatory. It has been argued that the mandatory approach falls short, because it assumes a one-size-fits-all model for corporate governance and ignores the differences between businesses, such as size and industry (Arcot, Bruno & Faure-Grimaud, 2010; IODSA, 2009).

In the US, corporate governance is regulated in terms of state corporate legislation and federal securities legislation. The Delaware General Corporation Law (DGCL) plays a dominant role at state level owing to Delaware being the most common state for incorporation (Dyreng, Lindsey & Thornock, 2013). At federal level, the Sarbanes-Oxley Act of 2002, applies to all companies listed on stock exchanges in the US, irrespective of the location of the company (United States, 2002). The Sarbanes-Oxley Act was drafted in response to corporate scandals and the collapse of US companies such as Enron and WorldCom (Orin, 2008). The Sarbanes-Oxley Act focuses on the financial aspects of corporate governance and aims to improve financial reporting. In addition, the Sarbanes-Oxley Act brought an end to self-regulation of the auditing profession in the US by establishing the Public Company Accounting Oversight Board (United States, 2002). Following the 2008 financial crisis, further federal legislation in the form of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (hereafter referred to as 'the Dodd-Frank Act') was introduced. The Dodd-Frank Act was aimed at regulatory reform for the financial services industry, but also expanded the corporate governance regulations for all public companies (United States, 2010). The Sarbanes-Oxley Act and the Dodd-Frank Act are supported by the Securities and Exchange Commission, which has published certain rules to implement the provisions of these acts.

3.3.3 Corporate governance in South Africa

Owing to the growing interest in corporate governance globally, the Institute of Directors in South Africa formed the King Committee on Corporate Governance in 1992 to contemplate corporate governance in the South African context (IODSA, 2002). Corporate governance in South Africa was formalised in 1994 with the publication of the first King Report on Corporate Governance (King I) (IODSA, 2002), which was based on the UK Cadbury Report of 1992. With the passing of time, revised versions of the King Report were drafted and issued in 2002 (King II), 2009 (King III) and 2016 to replace any prior versions. All versions of the King Report aim to uphold the highest standards of corporate governance in South Africa (IODSA, 2002).

King II, which replaced King I, was drafted in response to local legislative and regulatory reform, which accompanied social and political transformation in South Africa (IODSA, 2002). For example, significant new legislation was introduced after

1994 including the Labour Relations Act No. 66 of 1995 (Republic of South Africa, 1995), Basic Conditions of Employment Act No. 75 of 1997 (Republic of South Africa, 1997) and the Employment Equity Act No. 55 of 1998 (Republic of South Africa, 1998). The Johannesburg Stock Exchange (JSE) listing requirements were also substantially revised in 1995 following international developments.

King III became necessary because of the corporate law reform in South Africa and changing trends in international governance (IODSA, 2009). The corporate law reform included the introduction of the new Companies Act (Republic of South Africa, 2008). While King I and II only applied to JSE listed companies, state-owned companies, banks, financial institutions and insurance entities, King III applied to all entities regardless of their size or structure. King III adopted an 'apply or explain' approach to corporate governance rather than the 'comply or explain' approach followed by King I and King II (IODSA, 2009; Ackers & Eccles, 2015). According to this approach, corporate governance practices were permitted to deviate from those prescribed by King III if the board of directors deemed this to be in the best interests of the company, and if it explained the reasons for any deviations (Ackers & Eccles, 2015; IODSA, 2009). The term *apply* was adopted since it can be argued that the term *comply* requires adherence and is uncompromising (Arcot *et al.*, 2010; IODSA, 2009). Consequently, it may be argued that the 'apply or explain' approach attributes greater significance to explanations than the 'comply or explain' approach does.

King IV was drafted in the light of recent fundamental changes worldwide in both business and society. Instead of using the 'apply or explain' approach, King IV introduced the 'apply and explain' approach (IODSA, 2016). The provision of explanations discourages companies from tackling corporate governance as a compliance exercise and motivates companies to approach corporate governance in a mindful manner. The required explanations also assist stakeholders to make informed decisions (IODSA, 2016). The shift from the industrial product-based economy to the technological knowledge-based economy highlighted the importance of the reporting of non-financial information (Dumay, 2016). Stakeholders of companies have greater expectations than in the past and millennials (i.e. those born since 1980) are driving global trends (IODSA, 2016). To develop improved strategy, executives need to understand stakeholder expectations (IODSA, 2016). While shareholders place a high level of significance on financial information and financial performance, other stakeholders of the company take a broader view of value and assign importance to non-financial information (Dumay, 2016). The Integrated Reporting <IR> Framework (IIRC, 2011) provides a means of reporting on non-financial information, including intellectual capital.

The Integrated Reporting <IR> Framework identifies six capitals: financial; manufactured; natural; human; social and relational; and intellectual (IIRC, 2011). Financial capital, manufactured capital and natural capital relate to physical capital, whereas the other three capitals are intangible in nature and may be identified in terms of the components of intellectual capital (De Villiers & Sharma, 2020; Dumay, 2016; Melloni, 2015). Human capital is recognised in both the integrated reporting framework and as a component of intellectual capital. Social and relational capital in the integrated reporting framework may be regarded as relational capital, while intellectual capital in the integrated reporting framework relates to structural capital (Melloni, 2015; De Villiers & Sharma, 2020; Dumay, 2016). According to King IV, millennials are attracted to companies with business models that integrate financial capital, manufactured capital, natural capital, human capital, social and relational capital, and intellectual capital (IODSA, 2016). This stakeholder perspective is notable because the principles included in the King Report on Corporate Governance for South Africa are predominantly driven by agency theory, which focuses on shareholder interests rather than broader stakeholder interests. Although the directors of a company have a fiduciary duty to that company, not only shareholder interests but broader stakeholder interests should be taken into account (Maroun & Cerbone, 2020).

Businesses exist to create value (IODSA, 2009) and are managed with this goal in mind (Aras & Crowther, 2008). The primary responsibility of the board of directors is to create value through positive corporate performance (IODSA, 2009). King I supported an integrated approach to corporate governance. King II, King III and King IV (IODSA 2002, 2009, 2016) adopted the inclusive approach to governance. This approach requires the board of directors to consider and promote the legitimate interests and expectations of not only the company's shareholders, but all of the company's stakeholders, when making decisions in the company's best interests (IODSA, 2009, 2016; Rossouw, Van der Watt & Rossouw, 2002; Rossouw, 2005). Consequently, the King Report on Corporate Governance for South Africa recognises the concept that value needs to take into account the interests of not only shareholders, but all stakeholders. The concept of *value* is viewed in terms of the triple bottom line, which recognises social and environmental performance in addition to economic performance (Ho & Taylor, 2007; IODSA, 2009; Maroun & Cerbone, 2020; Solomon 2020). According to King IV, "financial performance alone can no longer serve as a proxy for holistic value creation" (IODSA, 2016, p. 4). Concentrating on financial performance alone may be viewed as short-sighted owing to the focus on short-term objectives, which may lead to value creation in the short term, but at the cost of destroying value in the long term. Therefore, to create value in a sustainable manner, a shift from a short-term to long-term focus is required (Aras & Crowther, 2008; IODSA, 2016).

Corporate governance in South Africa was initially inspired by the UK Cadbury Report and is predominantly voluntary in nature. This is evident from the principle-based King Report on Corporate Governance for South Africa. However, in a similar manner to the US Sarbanes-Oxley Act and DGCL, certain good corporate governance practices are mandatory, owing to the implementation of these practices through South African legislation, such as the Companies Act No. 71 of 2008 (hereafter referred to as 'the Companies Act') and the Employment Equity Act No. 55 of 1998 (hereafter referred to as 'the Employment Equity Act').

Despite the recommended practices in the King Report on Corporate Governance for South Africa being voluntary, numerous corporate governance provisions were introduced into the Companies Act as part of the South African corporate law reform following the 2008 financial crisis. The introduction of these provisions into legislation transformed them from voluntary to mandatory practices. Additionally, Paragraph 3.84 of the JSE listing requirements incorporates certain of the recommended practices into the King Report on Corporate Governance for South Africa to ensure these practices are mandatory for JSE listed companies (JSE, 2017). The JSE listing requirements refer, among others, to the following specific practices: structure of the board of directors; chairman of the board of directors; capacity of directors; board committees; and diversity of the board of directors (JSE, 2017). Other practices regarding the directors of the company are also considered by the JSE listing requirements, such as the size of the board of directors; share ownership by the directors and rotation of the members of the board of directors. Furthermore, a JSE listed company must, in terms of the JSE listing requirements, make certain disclosures in its annual reports or annual financial statements. These include disclosures regarding the directors' interests in the share capital of the company and the application of the King Code.

In addition to the abovementioned disclosures, Paragraph 3.84 of the JSE listing requirements state that a JSE listed company must disclose adherence to these practices in the company's annual report (JSE, 2017). Furthermore, Paragraph 8.63(a) of the JSE listing requirements requires a narrative statement of how the company applied the principles in the King Code. Explanations are to be included to assist the shareholders with an evaluation of how the company applied these principles. Because the 2002 and 2009 versions of the King Report on Corporate Governance for South Africa were drafted on 'comply or explain' and 'apply or explain' bases, respectively, JSE listed companies benefited at the time of these reports from the flexibility offered by the ability to adopt an alternative practice to that recommended by the King Report on Corporate Governance for South Africa and to explain why the adoption of specific practices was not in the best interests of the company under consideration (IODSA, 2002, 2009). The introduction of King IV in 2016 resulted in Paragraph 8.63(a) of the JSE listing requirements being amended to cater for the adoption of the 'apply and explain' scheme (JSE, 2017). Therefore, the JSE listing requirements now require full application of the King Code principles and disclosure regime. This approach still offers flexibility because King IV is based on principles rather than laws and adopts an outcome-based approach.

3.4 CORPORATE GOVERNANCE PROVISIONS CONCERNING THE INDEPENDENCE, SIZE AND DIVERSITY OF THE BOARDS OF DIRECTORS

The board of directors plays a central role in corporate governance. In this role, the board of directors takes responsibility for controlling the company and establishing the company's strategic direction (IODSA, 2009). This includes monitoring the board of directors' relationship with management and the relationships of the company with stakeholders (IODSA, 2009). In addition, the strategy determined by the board of directors should be sufficiently flexible to respond to variations in market conditions and lead to long-term sustainable outcomes (IODSA, 2009). It is questionable whether the corporate governance regulations concerning boards of directors consider all responsibilities of directors, since the basis of these regulations is predominantly situated in agency theory. This results in the corporate governance regulations focusing on the monitoring and control role of directors, but neglecting their service and strategic roles.

This study extended from 2002 to 2018 and dealt with the specific provisions relating to the attributes of the board of directors in South Africa in terms of King II, King III and King IV. A discussion of these and UK and US provisions follows with a particular focus on the similarities and differences between the practices in the UK, the US and South Africa as well as King II, King III and King IV regarding the characteristics of the board of directors. These similarities and differences are presented in Tables 3.1 and 3.2.

The provisions for good corporate governance concerning the structure and independence of the board of directors, and the size and diversity of the board of directors are outlined in the next section.

Table 3.1: The evolution of the King Report provisions relating to attributes of the board of directors from 2002 to 2018

	2002 King Report (King II)	*2009 King Report (King III)*	*2016 King Report (King IV)*
Independence of the board of directors			
Chief executive officer (CEO) duality	No	No	No
Non-executive directors	Majority	Majority	Majority
Independent non-executive directors	Sufficient non-executive directors should be independent to protect shareholder interests	Majority of non-executive directors should be independent	Majority of non-executive directors should be independent
Size and diversity of the board of directors	Not specified, determined based on combined knowledge, skills, experience and resources for effective functioning of the board of directors	Not specified, determined based on combined knowledge, skills, experience and resources for effective functioning of the board of directors	Not specified, determined based on combined knowledge, skills, experience and resources for effective functioning of the board of directors Should set race and gender targets for membership of board of directors

Source: Compiled from the 2002, 2009 and 2016 King reports (IODSA 2002, 2009, 2016)

Table 3.2: Corporate governance regulations regarding board characteristics in South Africa, the United Kingdom and the United States of America for 2018

	South Africa	*United Kingdom*	*United States of America*
Independence of the board of directors			
Chief executive officer (CEO) duality	No, a lead independent director should be appointed if the same person serves as both CEO and chairman of the board of directors	No	Permitted, but disclosure of whether or not these roles are separated.
Non-executive directors	Majority of board of directors	Majority of board of directors	Majority of board of directors
Independent non-executive directors	Majority of non-executives should be independent	A minimum of half of the members of the board of directors (excluding the chairman) should be independent non-executive directors	Majority of board of directors must be independent
Size and diversity of the board of directors	Minimum of three directors for public companies that are not listed on the Johannesburg Stock Exchange (JSE) and a minimum of four directors for JSE listed companies	Report on the board of directors' policy on diversity and progress made towards implementation of the policy.	At least one director; however, sufficient directors will be required to discharge the directors' duties effectively
	Should set race and gender targets for membership of board of directors		
	JSE listed companies to have a policy for the promotion of gender diversity at board level and to report on the implementation of the policy.		Disclosure of how diversity is taken into consideration when nominating directors, the implementation of any diversity policy and how this policy is assessed

Source: Compiled from the 2016 King Report (IODSA, 2016), the Companies Act (Republic of South Africa, 2008), JSE listing requirements (JSE, 2017), the UK Corporate Governance Code 2018 (FRC, 2018), Delaware General Corporation Law (Delaware General Assembly, 2021), NYSE listing rules (Kim & Klein, 2017; Vetter & Evans, 2014), NASDAQ listing rules (Kim & Klein, 2017; NASDAQ, 1999; Vetter and Evans, 2014), Securities and Exchange Commission proxy disclosure enhancements (SEC, 2009)

3.4.1 Structure and independence of the board of directors

3.4.1.1 Structure of the board of directors

In the UK, the Cadbury Report recommended that the company should have a unitary board of directors with a combination of executive and non-executive directors (Committee on the Financial Aspects of Corporate Governance, 1992). This practice was also adopted in South Africa by King II, King III, King IV and Section 66 of the Companies Act owing to the benefits of interaction between directors with various skills, experience and backgrounds (IODSA, 2002, 2009, 2016; Republic of South Africa, 2008). Furthermore, since the DGCL plays a dominant role in US state law and Section 141 of the DGCL requires a single-tier board of directors (Delaware General Assembly, 2021), this is the predominant structure of the board of directors adopted in the US. The board of directors either manages the business or provides direction to the management team. By adopting a single-tier structure, the board of directors is able to delegate day-to-day managerial duties to members of the company's senior management without affording them board status.

3.4.1.2 Chief executive officer (CEO) duality

According to the UK Cadbury Report and the reports that followed, the same person should not serve as both chairman of the board of directors and CEO of the company (Committee on the Financial Aspects of Corporate Governance, 1992; FRC, 2016). This practice was also recommended by King II, King III and King IV in South Africa (IODSA, 2002, 2009, 2016). In contrast, there is no requirement in the US regulation for the separation of these roles. However, since 2010, the Securities and Exchange Commission has required companies to disclose, with reasons, whether or not they separate these roles (SEC, 2009). Because separate persons are not required to serve as chairman of the board of directors and CEO in the US, the chairman of the board of directors is not required to be an independent non-executive director. This contradicts recommendations in the UK and South Africa. The UK Corporate Governance Code and King II, King III and King IV in South Africa also recommend that the chairman of the board of directors should be an independent non-executive director (FRC, 2003; IODSA, 2002, 2009, 2016).

The Cadbury Report recommended that when the same person serves as both chairman of the board of directors and CEO of the company, it is vital that the board of directors includes a strong and independent non-executive component, with a recognised senior member (Committee on the Financial Aspects of Corporate Governance, 1992). In South Africa, a similar but slightly different approach is adopted. In addition to recommending that there should be a strong independent non-executive director element to the board of directors, King II recommended that an independent non-executive director should serve as deputy chairman of the board of directors in the case of a company where there is no separation between the CEO and the chairman of the board of directors (IODSA, 2002). King III built on this by introducing the concept of the lead independent non-executive director, who should be appointed when the independence of the chairman of the board of directors is compromised in order to resolve any conflicts of interest (IODSA, 2009). This concept is carried forward by King IV (IODSA, 2016). For companies listed on the Johannesburg Stock Exchange in South Africa, this is not simply a recommendation, but a requirement in terms of the JSE listing requirements (JSE, 2017). King III and King IV further enhanced the independence of the board of directors by establishing the requirement that a retired CEO should not chair the board of directors until three years have elapsed (IODSA, 2009, 2016). These recommendations stem from the agency theory perspective, which suggests that given the opportunity, the company's management will act in its own best interests rather than those of the shareholders. These recommendations ignore the possibility of good stewardship, where managers align their interests with those of the company and shareholders. In contrast, US legislation has no specific requirement for an independent element on the board of directors or a lead independent director. Therefore, US companies need only disclose, with reasons, whether or not the company has a lead independent director and the specific leadership role played by the lead director (SEC, 2009).

3.4.1.3 Non-executive directors

In terms of Paragraph 3.84(f) of the JSE listing requirements, directors must be classified according to capacity as executive, non-executive or independent (JSE, 2017). The Companies Act in South Africa generally does not distinguish between executive and non-executive directors. Therefore, all provisions in the Companies Act relating to directors apply equally to executive and non-executive directors, unless explicitly noted otherwise (Republic of South Africa, 2008). For the purposes of King III, the term *executive directors* is defined as directors who are involved in the management of the company and/or in full-time salaried employment of the company and/or any of its subsidiaries (IODSA, 2009). In contrast, non-executive directors are considered to be directors who are not involved in the day-to-day management of the company's business or full-time salaried employees of the company and/or its subsidiaries. King IV distinguishes between executive and non-executive directors, despite not defining these roles.

In South Africa, despite the Companies Act not specifically distinguishing between executive and non-executive directors, Companies Regulation 43(4) requires one member of the social and ethics committee not to be involved in the day-to-day management of the company's business and not to have been involved in this capacity within the previous three financial years (Republic of South Africa, 2011). In addition, the audit committees of South African companies, which are required to consist of only directors, must each consist of at least three directors who are not involved in the day-to-day management of the company's business and have not been involved in this capacity during the previous financial year (Republic of South Africa, 2008). This implies that certain directors are required to be non-executive.

According to the JSE listing requirements, companies listed in South Africa must establish a policy to achieve a balance of power and authority with regard to the board of directors (JSE, 2017). The purpose of this practice is to ensure that no individual director has autonomous decision-making power. Whereas King II recommended a balance of executive and non-executive directors, preferably with a majority of non-executive directors, King III recommended a balance of power with a majority of non-executive directors (IODSA, 2009). The recommendations of the UK Combined Code on Corporate Governance were more lenient in this regard proposing that a minimum of one-third of the board of directors should consist of non-executive members (FRC, 2003).

3.4.1.4 Independent non-executive directors

The UK Cadbury Report also recommended that the majority of the non-executive directors should be independent (Committee on the Financial Aspects of Corporate Governance, 1992). This practice was also followed by King III and King IV in South Africa, which are more specific than King II in this regard (IODSA, 2009, 2016). King IV not only acknowledges the significance of the board of directors being independent in appearance, but also emphasises the importance of independence of mind, irrespective of the director's executive, non-executive or independent non-executive status (IODSA, 2016). Furthermore, the recommendations of Sir Derek Higgs, which were incorporated into the Combined Code on Corporate Governance, proposed that a minimum of half of the members of the board of directors (excluding the chairman) should be independent non-executive directors (FRC, 2003; Higgs, 2003).

With regard to independence, King III noted that non-executive directors were independent of management on all matters including strategy, performance, sustainability, resources, transformation, diversity, employment equity, standards of conduct and evaluation of performance (IODSA, 2009). The JSE listing requirements also specifically note that participation by a director in a share incentive or share option scheme compromises that director's independence (JSE, 2017). In all other circumstances, the JSE listing requirements draw on the definition in the King Report on Corporate Governance for South Africa to determine whether or not directors are independent. The JSE listing requirements were updated in this regard owing to the introduction of King IV and now require the independence of directors to be decided upon holistically, considering substance over form, in terms of the determining factors set out in the King Code and Section 94(4)(a) and (b) of the Companies Act (IODSA, 2016; JSE, 2017; Republic of South Africa, 2008).

In general, the majority of the board of directors of US listed companies must consist of independent directors, according to both the New York Stock Exchange (NYSE) and National Association of Securities Dealers Automated Quotations (NASDAQ) listing rules (Vetter & Evans, 2014). In contrast, in the UK, at least half of the board of directors should consist of independent directors (FRC, 2003), and in South Africa, the majority of the non-executive directors on the board of directors should be independent (IODSA, 2009). According to the NYSE, the board of directors of a company must satisfy itself that a director has no material relationship with the company in order to classify the director as independent. Both the NYSE and NASDAQ listing rules provide guidance on determining whether or not a director of a US listed company is classified as independent (Vetter & Evans, 2014). King III also set out criteria for determining whether or not a non-executive director is independent. The criteria for an independent non-executive director in South Africa are as follows (IODSA, 2009):

- he or she does not represent a shareholder who has the ability to control or significantly influence management or the board of directors;
- he or she does not have a direct or indirect interest in the company, its holding company or subsidiary company that exceeds 5% of the group's total number of shares in issue;
- he or she does not have a direct or indirect interest in the company of less than 5% of the group's total number of shares in issue that is material to the director's personal wealth;
- he or she was not employed in an executive capacity by the company or group in the preceding three financial years;
- he or she was not appointed as the designated auditor or partner in the group's external audit firm, or senior legal advisor for the preceding three financial years;
- he or she is not an immediate family member of a person who is, or has been employed in an executive capacity by the company or group in the three preceding financial years;

- he or she is not a professional advisor to the company or group, except as a director;
- he or she has no business or other relationship that could be perceived by an objective outsider to interfere materially with the director's capacity to act in an independent manner; and
- he or she does not receive remuneration contingent upon the company's performance.

In contrast, King IV adopts a holistic approach, considering substance over form, and classifies a director as independent if it can be concluded that "there is no interest, position, association or relationship which, when judged from the perspective of a reasonable and informed third party, is likely to influence unduly or cause bias in decision-making in the best interests of the organisation" (IODSA, 2016, p. 51). According to King IV, the following factors, among others, indicate that the independence of an organisation's director is compromised:

- the director is a significant source of financial capital, or ongoing funding to the organisation, or is an employee or representative of such a source;
- the director participates in a share incentive scheme of the company;
- the director owns securities in the company, which are material to the director's personal wealth;
- the director has been employed by the organisation in an executive management position during the preceding three financial years, or is a related party to a person who has held such a position;
- the director has been the designated external auditor responsible for performing the statutory audit for the organisation, or a key member of the audit team during the three preceding years;
- the director is a significant or ongoing professional advisor to the organisation, other than as a member of the board of directors;
- the director is a member of the board of directors, or the executive management of a significant customer of, or supplier to, the organisation;

- the director is a member of the board of directors or the executive management of another organisation, which is a related party to the organisation under consideration; or
- the director is entitled to remuneration that is contingent upon the organisation's performance.

Whereas King III referred to the independence of directors, the Companies Act in South Africa does not specifically refer to the independence of directors. Section 94(4) of the Companies Act identifies certain criteria that audit committee members must satisfy to qualify for appointment in this capacity (Republic of South Africa, 2008). For example, a member of the audit committee should not be a material supplier or customer of the company, whose integrity or objectivity may be perceived to be compromised owing to this relationship with the company. Although the Companies Act does not specifically identify the intention of these criteria, it is evident that the purpose is to ensure the independence of audit committee members. Since audit committee members are required to be directors of the company, this implies that the Companies Act establishes independence requirements for certain company directors.

3.4.2 Size and diversity of the board of directors

The corporate governance regulations deal with both the size and diversity of the board of directors.

3.4.2.1 Size of the board of directors

Although no minimum or maximum size is specified for the board of directors in the UK, the Cadbury Report recommended that the board of directors should include at least three non-executive directors (Committee on the Financial Aspects of Corporate Governance, 1992). Similar to the UK, no maximum number of members is stipulated for the board of directors in South Africa. In addition, King II was silent with regard to a minimum size for the board of directors. In contrast, King III and King IV recommend that a minimum of two executive directors be appointed to the board of directors (IODSA, 2009, 2016). While King III specified that the two executive directors should be the CEO and the financial director, King IV identifies the two executives more broadly as the CEO and one other executive director (IODSA, 2009, 2016). Nevertheless, JSE listed companies have been required to appoint a financial director with effect from June 2009 (IODSA, 2009). The inclusion of two executive directors on the board of directors ensures that the board of directors has more than one point of contact with the management of the company.

Taking into account the recommendation that the majority of the board of directors should consist of non-executive directors in South Africa, the recommendation for two executive directors implies that a minimum of three non-executive directors should be appointed to the board of directors. In addition, both the Companies Act in South Africa and the JSE listing requirements specifically stipulate a minimum number of members for the board of directors for South African companies. In terms of Section 66 of the Companies Act, a private company is required to have at least one director and a public company to have a minimum of three directors (Republic of South Africa, 2008). This minimum is increased to four for JSE listed companies (JSE, 2017). The company's memorandum of incorporation may stipulate a larger number of directors for this purpose.

Additional directors may be required to satisfy the requirements of the Companies Act and the company's memorandum of incorporation to appoint an audit committee or social and ethics committee, each of which must consist of three members (Republic of South Africa, 2008). Although directors are permitted to serve on more than one board committee, each director should only be counted once when determining whether the requirement regarding the minimum number of directors has been satisfied. At least one member of the social and ethics committee must be a director who is not involved in the day-to-day management of the company's business and must not have been involved in that capacity in the previous three financial years (Republic of South Africa, 2011). Consequently, this director must be a non-executive director. The provisions of the Companies Act also enhance the independence of the audit committee of a public company by requiring such a committee to consist of members who (Republic of South Africa, 2008)

- are not involved in the day-to-day management of the company's business, and have not been involved in this capacity during the previous financial year;
- are not prescribed officers, or full-time salaried employees of the company or another company within the same group, and have not served in this capacity during the previous three financial years;
- are not material suppliers or customers of the company, such that a reasonable and informed party would perceive the integrity, impartiality or objectivity of the director in question to be compromised; and
- are not related to any of the abovementioned persons.

In the US, the only specific requirement with regard to size of the board of directors appears in Section 141(b) of the DGCL, which requires a company to have at least one director (Delaware General Assembly, 2021). Nevertheless, more than one director may be necessary to satisfy the board committee requirements. For example, the audit committee must consist of no less than three members, according to the NYSE and NASDAQ listing rules (Kim & Klein, 2017). Furthermore, the NASDAQ listing rules require the compensation committee to consist of a minimum of two members (NASDAQ, 1999). However, there is nothing restricting an audit committee member from also serving as a member of the compensation committee or any other board committee. Irrespective of the regulatory requirements, the board of directors should consist of sufficient members to discharge its duties effectively. Consequently, a sufficient number of members of the board of directors are required in order to ensure adequate independence, diversity, skills and experience.

3.4.2.2 Diversity of the board of directors

The Employment Equity Act was introduced in South Africa to achieve employment equity (Republic of South Africa, 1998). This Act has since been amended by the Employment Equity Amendment Act No. 47 of 2013 (Republic of South Africa, 2013b). Both of these acts take steps towards acknowledging diversity of employees, including executive directors. The preamble to the Employment Equity Act acknowledges the disparities in employment, occupation and income in the South African labour market owing to past discriminatory statute and practices, including a history of apartheid (Republic of South Africa, 1998). These disparities were particularly to the detriment of certain groups of individuals, such as black people, women and people with disabilities. Therefore, Section 2 of the Employment Equity Act recognises the purpose of the Act as twofold (Republic of South Africa, 1998). Firstly, it aims to achieve equity in the workplace by promoting equal opportunity and fair treatment in employment by way of the eradication of unfair discrimination. Secondly, it intends to achieve equity in the workplace for all workforce categories and levels through the implementation of affirmative action mechanisms to redress the past disadvantages in employment experienced by black people, women and people with disabilities.

Specific requirements with regard to diversity were first introduced by the US in 2009. In the US, Securities and Exchange Commission rules require disclosure in a proxy statement of how the nomination committee takes into consideration diversity when identifying members for the board of directors. Should the company have a policy in this regard, disclosure must be made of how the policy is implemented and how the effectiveness of the policy is evaluated (SEC, 2009). The 2012 version of the UK Corporate Governance Code introduced similar provisions for the UK in the form of recommendations rather than requirements (FRC, 2012). However, the UK Corporate Governance Code referred specifically to gender diversity in addition to making general reference to diversity. South Africa only followed in the footsteps of the US and UK in 2015 when the JSE listing requirements introduced requirements for JSE listed companies to have a policy for the promotion of gender diversity at board level. According to Maroun and Cerbone (2020), from 2012 to 2017, approximately 81% of directors of JSE listed companies were male. However, the policy requirements appear to have had an impact as there was an increase in female representation on the boards of directors of these companies in 2017 (Maroun & Cerbone, 2020). Each company listed in South Africa is also required, in its annual report, to disclose how the policy is considered and applied to the nomination and appointment of directors. In the case where the company has agreed to voluntary targets for gender diversity, the company is also required to report on its performance relative to these targets. These requirements took effect in January 2017 and were limited to gender diversity. Similar requirements were introduced by the JSE in 2017, with regard to race diversity at board level (JSE, 2017). These requirements came into effect on 1 June 2018. Therefore, all annual reports of JSE listed companies issued on or after this date must include the necessary race diversity disclosure. King IV, which came into effect on 1 April 2017 and applies to all entities rather than only JSE listed companies, also recommends that the board of directors sets targets for race and gender diversity with regard to the composition of the board of directors (IODSA, 2016). Signs of improvement in race diversity exist and as members of the board of directors of a company resign, new board members are more likely to be appointed with race and gender diversity in mind (Maroun & Cerbone, 2020).

South Africa's first democratic government was elected in 1994 and was mandated to redress the inequalities of the past arising from the apartheid legacy in South Africa. This mandate was embodied in the Constitution of the Republic of South Africa (Republic of South Africa, 1993), which took effect on 27 April 1994, the same date that South Africa's first democratic government was elected. This Constitution, also known as the 'Interim Constitution', facilitated the continued governance of South Africa during this period of transition and introduced a bill of rights to protect the rights of all people in South Africa. As a result, legislation was introduced in South Africa to enable broad-based black economic empowerment (BBBEE). The purpose of this legislation was to advance economic transformation and enhance the participation of previously disadvantaged black individuals in the South African economy by creating opportunities for such individuals. In addition to the JSE requirements and King IV recommendations, the Broad-Based Black Economic Empowerment Amendment Act

No. 46 of 2013 requires each South African company to prepare an annual compliance report indicating the company's compliance with BBBEE requirements (Republic of South Africa, 2013a). The JSE listing requirements obligate each JSE listed company to publish this report on the company's website and to make an announcement on the stock exchange news service of the publication (JSE, 2017). Despite the South African reporting requirements being restricted to gender and race diversity, King III acknowledged that diversity relates to academic qualifications, technical expertise, relevant industry knowledge, experience, nationality, age, race and gender (IODSA, 2009). In contrast, King IV makes no reference to academic qualifications, technical expertise, industry knowledge or nationality, but encourages diversity with regard to knowledge, skills, experience and culture (IODSA, 2016).

King III stated that relevant knowledge, skills and experience enabled directors to bring judgement to bear on the business of the company (IODSA, 2009). Although the Companies Act does not stipulate qualification and experience requirements for members of the board of directors, Section 69(6) of the Companies Act states that minimum qualifications for directors may be set out in the company's memorandum of incorporation (Republic of South Africa, 2008). Specific requirements also exist for audit committee members, who must collectively have adequate knowledge and experience to discharge the functions of the committee. Section 94(5) of the Companies Act, read together with Companies Regulation 42 (Republic of South Africa, 2008, 2011), states that a minimum of one-third of the members of a company's audit committee at any point in time must possess academic qualifications, or experience, in economics, law, corporate governance, finance, accounting, commerce, industry, public affairs or human resource management.

3.5 OWNERSHIP CONCENTRATION AS A CORPORATE GOVERNANCE MECHANISM

Despite the corporate governance regulations not specifically dealing with ownership concentration, this is considered to be a corporate governance mechanism. Early studies regarding the modern corporation assumed dispersion of company ownership (Berle & Means, 1932; Jensen & Meckling, 1976). This assumption implied a lack of shareholder power and control (Berle & Means, 1932), which could lead to a company's management not acting in the best interests of the shareholders in a large organisation in which there is separation of ownership and control. A study by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) found that dispersed company ownership was more prevalent in countries with good shareholder protection.

The assumption of dispersed company ownership was refuted in further studies that provided evidence of ownership concentration in the US (Demsetz, 1983; Demsetz & Lehn, 1985; Morck, Shleifer & Vishny, 1988) and developing economies (La Porta *et al.*, 1998). Hu and Izumida (2008) explain that ownership concentration empowers large shareholders and provides them with the motivation to monitor management. As a result, the interests of a company's management may be more closely aligned with the interests of the shareholders (Jensen & Meckling, 1976). This reduces the possibility of principal-agent agency problems, which arise when managers act in their own best interests rather than in the best interests of the shareholders for whom they act. A reduction in principal-agent agency problems, diminishes agency costs and makes more resources available for the strategic role of the directors and better management of intellectual capital (Appuhami & Bhuyan, 2015). Nevertheless, Edmans and Holderness (2017) argue that higher levels of ownership concentration may result in excessive monitoring, which may aggravate the principal-agent agency problem and hinder the management function, reducing the potential for effective management of intellectual capital and value creation. Higher levels of ownership concentration may also worsen the agency problem if management is pressurised by large shareholders to focus on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010).

Despite ownership concentration having the potential to mitigate or aggravate the principal-agent agency problem, it may also give rise to the principal-principal agency problem (Gaur *et al.*, 2015). In contrast to principal-agent agency problems, which arise owing to conflicts between shareholders and managers of companies, the principal-principal agency problem arises owing to conflicts between majority and minority shareholders (Auh & Menguc, 2005; Gaur *et al.*, 2015; Young, Peng, Ahlstrom, Bruton & Jiang, 2008). These conflicts arise in the presence of ownership concentration when majority shareholders use their power to expropriate company resources to the detriment of minority shareholders (Gaur *et al.*, 2015; ElKelish, 2018). Self-interested majority shareholders may also expropriate company resources at the expense of other stakeholders (Maher & Andersson, 1999).

Young *et al.* (2008) identify the principal-principal agency problem as a significant corporate governance concern in emerging economies. This is a consequence of the combined effect of ownership concentration and the absence of effective corporate governance mechanisms to protect minority shareholders (La Porta, Lopez-de-Silanes, Shleifer & Vishny, 1997; Morck, Wolfenzon & Yeung, 2005). In spite of the emerging economy in South Africa, it has been acclaimed as the largest and most developed economy in Africa (Vaughn & Ryan, 2006). South Africa has also served as a leader in corporate governance and has a well-established corporate governance system with mechanisms to protect minority shareholders (Vaughn & Ryan, 2006). King II acknowledged that the empowerment of dominant shareholders should not be to the detriment of other stakeholders and minority shareholders (IODSA, 2002). King III and King IV further developed this idea by recognising the need for equitable treatment of all shareholders. The expectation is that minority shareholders should be protected from harmful actions that favour the interests of controlling shareholders. Notwithstanding possible ownership concentration, the board of directors should balance the interests of all stakeholders (including minority shareholders) in the best interests of the company, taking into account the economy, society, the environment and good corporate citizenship (IODSA, 2009, 2016). The Companies Act also provides protection for minority shareholders, who may apply to the court in South

Africa for relief should they believe that they have been oppressed, unfairly prejudiced or disregarded (South Africa, 2008). The shareholders agreement may be used as tool to protect the rights of minority shareholders in South Africa (South Africa, 2008). Owing to the protection provided for minority shareholders by the corporate governance and legal frameworks in South Africa, ownership concentration should not give rise to principal-principal agency problems in South Africa.

3.6 THEORETIC UNDERPINNINGS OF CORPORATE GOVERNANCE MECHANISMS IN SOUTH AFRICA RELATING TO THE CHARACTERISTICS OF THE BOARD OF DIRECTORS AND OWNERSHIP CONCENTRATION

Table 3.3 relates the South African corporate governance provisions concerning the characteristics of the board of directors to agency theory, stewardship theory, stakeholder theory and resource dependence theory and the roles of the board of directors. The table is limited to the board characteristics forming the subject of this study and is drafted with regard to the approach of the corporate governance regulations in South Africa. In addition to the characteristics of the board of directors, Table 3.3 also includes ownership concentration as a corporate governance mechanism. Because ownership concentration is not specifically dealt with in the corporate governance regulations in South Africa, the literature is used to relate this aspect to the theory and the roles of the board of directors. A discussion of this follows the table.

Table 3.3: Corporate governance mechanisms in South Africa concerning the characteristics of the board of directors and ownership concentration, related theories and the roles of the board of directors

	South African corporate governance provisions	*Related theories*	*Associated role of the board of directors*
Independence of the board of directors Chief executive officer (CEO) duality Non-executive directors Independent non-executive directors	 No Majority Majority	 Agency	 Monitoring and control
Size of the board of directors	Not specified, determined based on combined knowledge, skills, experience and resources for effective functioning of the board of directors. No clarity is provided as to what constitutes the effective functioning of the board of directors.	Agency Stakeholder Resource dependence	Monitoring and control Service Strategic
Diversity among members of the board of directors	Should set race and gender targets for membership of the board of directors.	Agency Stakeholder Resource dependence	Monitoring and control Service Strategic
Ownership concentration	A higher level of ownership concentration may more closely align the interests of the company's management and shareholders, thus reducing the need for the monitoring and control role and providing an opportunity for increased focus on the service and strategic roles. This change in focus may improve the management of intellectual capital. In contrast, a higher level of ownership concentration may hinder the management function or result in management focusing on short-term performance, making the monitoring and control role more important and reducing the effort and resources directed towards the strategic role and intellectual capital management. In addition, a higher level of ownership concentration suggests that majority shareholders have increased power to influence management decisions and act in their own interests rather than in the interests of all stakeholders. This may enhance the agency theory perspective owing to the interests of a company's management and shareholders being more closely aligned, but could be to the detriment of the directors' service and strategic roles.		

Source: Compiled based on the 2016 King Report (IODSA, 2016), the Companies Act (Republic of South Africa, 2008), JSE listing requirements (JSE, 2017) and the ownership concentration literature (Edmans & Holderness, 2017; Guthrie and Sokolowsky, 2010; Hu & Izumida, 2008)

3.6.1 Independence of the board of directors

As mentioned in Section 3.4.1.2, the same person should not serve as both chairman of the board of directors and CEO for a listed company in South Africa (IODSA, 2002, 2009, 2016). It is further recommended that the board of directors should consist of a majority of non-executive directors and that the majority of these directors should be independent (IODSA, 2009, 2016). These provisions are aimed at maintaining the board of directors' independent judgement (IODSA, 2016).

This approach to the composition of the board assumes that managers do not act in the best interests of the shareholders. In these circumstances, independence plays an important role in the ability of a company's directors to effectively monitor and control the company's managers (Hambrick, Misangyi & Park, 2015), which promotes the concepts of agency theory (Jensen & Meckling, 1976). It is notable that the corporate governance regulations in South Africa do not give credence to stewardship theory and the possibility that the managers may act in the interests of shareholders.

3.6.2 Size and diversity of the board of directors

Relevant knowledge, skills and experience enable directors to bring judgement to bear on the business of the company (IODSA, 2009). In addition, the board of directors should set targets for race and gender diversity with regard to the composition of the board of directors (IODSA, 2016). As explained in Section 3.4.2.1, the board of directors should consist of sufficient members in order to ensure adequate independence, diversity, skills and experience to objectively and effectively discharge its governance role and responsibilities (IODSA, 2016). According to the King Report on Corporate Governance for South Africa, these responsibilities include monitoring and controlling management, setting the company's strategic direction and ensuring accountability to stakeholders for corporate performance (IODSA, 2016).

The responsibilities of the board of directors, as outlined in the King Report on Corporate Governance for South Africa, may be linked to the monitoring and control, strategic and service roles of the board of directors. As discussed in Section 2.3, these roles of the board of directors correspond to agency theory, resource dependence theory and stakeholder theory, respectively. The regulations in South Africa regarding the size and diversity of the board of directors refer to adequacy in order to discharge the governance role and responsibilities (IODSA, 2016). This description is vague and may result in the board of directors focusing on the monitoring and control role at the expense of the strategic and service roles.

3.6.3 Ownership concentration

Agency problems and agency costs arise when managers act in their own best interests rather than in the best interests of the shareholders on behalf of whom they act (Berle & Means, 1932; Jensen & Meckling, 1976). As previously mentioned in Section 3.5, ownership concentration may reduce the agency problem by aligning the interests of the company's management more closely with those of the shareholders because large shareholders have greater incentives to monitor the company's management (Hu & Izumida, 2008). However, large shareholders may also aggravate the agency problem through excessive monitoring, which may impede the management function (Edmans & Holderness, 2017) or pressurise management into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010). In addition, a higher level of ownership concentration suggests that shareholders have increased power to influence management decisions and serve their own interests rather than the interests of all stakeholders. This could be to the detriment of the directors' service (stakeholder theory) and strategic roles (stewardship and resource dependence theories).

Therefore, the current study proposes that a higher level of ownership concentration has the potential to diminish or aggravate the agency problem. In this light, ownership concentration is treated as a corporate governance mechanism to reduce or increase agency costs. When agency costs are reduced through a high level of ownership concentration more closely aligning the interests of a company's management and shareholders, there is an opportunity for the board of directors to concentrate less on the monitoring and control role (agency theory) and to strengthen the importance of the strategic role (stewardship theory) by allocating more effort and resources to this. Consequently, more resources are made available for the effective management of intellectual capital, which may result in value creation. In contrast, when agency costs are increased owing to a higher level of ownership concentration hindering the management function or leading to management focusing on short-term performance, the monitoring and control role becomes more important and less effort and resources can be directed towards the strategic role (stewardship theory), weakening the importance of this role of the directors and the management of intellectual capital. Additionally, this study suggests that shareholders have increased power to influence management decisions and serve their own interests rather than the interests of all stakeholders at a higher level of ownership concentration. This may enhance the agency theory perspective owing to the interests of a company's management and shareholders being more closely aligned, but could be to the detriment of the directors' service (stakeholder theory) and strategic roles (stewardship and resource dependence theories), which include the management of intellectual capital.

3.7 CHAPTER CONCLUSION

The crux of this chapter was to obtain an understanding of the South African corporate governance model, how it compares with global corporate governance models and how it links to corporate governance theories and the roles of the board of directors. While the South African corporate governance model is predominantly principle-based and voluntary, several aspects of corporate governance have also been made mandatory by way of legislation. The UK corporate governance model, by which South Africa was largely inspired, also follows a principle-based approach, whereas the US follows the legislative approach.

Good corporate governance practice is considered important for a company to add value and remain sustainable. The principles of corporate governance in South Africa are predominantly drafted with agency theory in mind. Agency theory focuses narrowly on the monitoring and control role of the board of directors and neglects to consider the strategic and service roles, which relate to stewardship theory, resource dependence theory and stakeholder theory. Although the strategic and service roles of the board of directors are not totally neglected in the corporate governance regulations with regard to resource dependence theory and stakeholder theory, the concept of stewardship theory is ignored. In addition, the emphasis on agency theory may be at the expense of alternative theories. This study challenges the use of a single theoretic basis for corporate governance and suggests the need for a multi-theoretic framework to deal with the multiple roles of directors. It endeavours to determine whether companies with boards of directors possessing certain characteristics have a tendency to be associated with better efficiency of value added from resources than those that do not. Using a multi-theoretic model, this study adopted ownership concentration as a contingent factor in the multi-theoretic model to examine the potential moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. Chapter 4 establishes the multi-theoretic contingency model for this purpose and develops the hypotheses stemming from this model.

CHAPTER 4
DEVELOPMENT OF HYPOTHESES

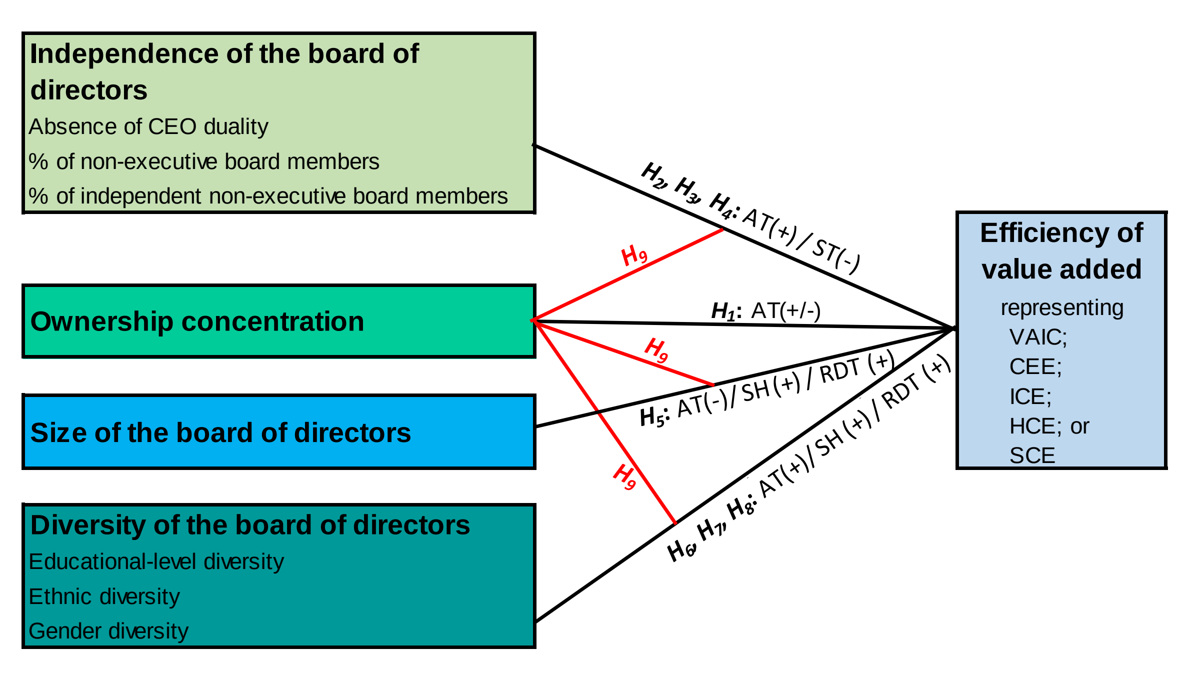
4.1 INTRODUCTION

This chapter presents hypotheses and a multi-theoretic contingency model to deal with the research problem identified in Chapter 1. The hypotheses and the model were derived from the theoretic underpinnings of the study (see Chapter 2) and a review of the academic literature dealing with the empirical evidence relevant to the relationships of ownership concentration and the characteristics of the board of directors with performance.

4.2 DEVELOPMENT OF HYPOTHESES

This section presents the development of the hypotheses by drawing together the literature and the theoretic underpinnings relevant to the study. In doing so, the relationships between ownership concentration, several characteristics of the board of directors and the efficiency of value added by a company from its resources were taken into consideration. The characteristics of the board of directors considered were the absence of chief executive officer (CEO) duality, the percentage of non-executive members of the board of directors, the percentage of the non-executive members of the board of directors who were independent, the size of the board of directors, educational-level diversity, ethnic diversity and gender diversity. A multi-theoretic contingency framework, as illustrated in Figure 4.1, was used for examining these relationships. Ownership concentration was the contingent factor in this framework and efficiency of value added represents the value added intellectual coefficient (VAIC) and its sub-components, capital employed efficiency (CEE) and intellectual capital efficiency (ICE), which is further divided into human capital efficiency (HCE) and structural capital efficiency (SCE).

Figure 4.1: Multi-theoretic contingency framework



AT = agency theory, ST = stewardship theory, SH = stakeholder theory, RDT = resource dependence theory, VAIC = value added intellectual coefficient, CEE = capital employed efficiency, ICE = intellectual capital efficiency, HCE = human capital efficiency, SCE = structural capital efficiency

Source: Gaur et al. (2015) (Amended)

4.2.1 Ownership concentration and performance

According to agency theory, conflicts of interest may arise owing to managers acting out of self-interest rather than in the best interests of the shareholders (Jensen & Meckling, 1976). Ownership structure serves as an important corporate governance mechanism to resolve the agency problem and enhance the performance of the company (Brown, Beekes & Verhoeven, 2011). Unlike small shareholders, large shareholders have the power and the motivation to allocate resources to monitor and discipline managers (Grossman & Hart, 1980; Hu & Izumida, 2008; Shleifer & Vishny, 1997). Furthermore, a company's controlling shareholders, their representatives or relatives, who commonly serve as directors of the company, have the ability to directly impact management decisions in their capacity as directors (Wang & Shailer, 2015). Therefore, ownership concentration reduces conflicts of interest by more closely aligning the interests of company management and shareholders. This has the potential to reduce agency costs attributable to monitoring, thereby enhancing corporate value (Shleifer & Vishny, 1997). As a result, a higher degree of ownership concentration may lead to improved efficiency of value added by a company from its resources because a reduction in agency costs results in increased availability of funds for intellectual capital management (Appuhami and Bhuyan, 2015). Nevertheless, a higher level of ownership concentration may also aggravate the agency problem through excessive monitoring, which may hinder the management function (Edmans & Holderness, 2017), and by pressurising management into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010). Therefore, excessive monitoring may result in less effective management of intellectual capital. Additionally, ownership concentration may lead to the expropriation of resources by large shareholders and less availability of funds for intellectual capital management, which is to the detriment of other stakeholders (including minority shareholders) (Maher & Andersson, 1999). Young *et al.* (2008) specifically identify the potential conflict between majority and minority shareholders as a problem in emerging markets. According to La Porta *et al.* (1997) and Morck *et al.* (2005), this is generally a consequence of the combined effect of ownership concentration and the absence of effective corporate governance mechanisms to protect minority shareholders. South Africa, which is an emerging market, has served as a leader in corporate governance and possesses a well-established corporate governance system, including mechanisms to protect minority shareholders (Vaughn & Ryan, 2006). The Companies Act also provides legal protection for minority shareholders, who may apply to the court in South Africa for relief should they believe that they have been oppressed, unfairly prejudiced or disregarded (Republic of South Africa, 2008). Additionally, the shareholders agreement may be used as a tool to protect the rights of minority shareholders in South Africa (Republic of South Africa, 2008). Owing to the protection provided for minority shareholders by the corporate governance and legal frameworks in South Africa, ownership concentration should not give rise to conflicts between minority and majority shareholders in South Africa.

Past empirical studies examining the relationship between ownership concentration and company performance presented conflicting results. Using linear regression, Demsetz and Lehn (1985) found no evidence of a relationship between ownership concentration and corporate performance. Morck *et al.* (1988) argue that this may be due to the linear specification when the relationship may be non-linear. A number of studies found a positive relationship between ownership concentration and corporate performance, which supports the notion that a higher level of ownership concentration leads to improved monitoring and disciplining of management. For example, in an Asian setting, Nguyen, Locke and Reddy (2015) found a positive relationship and determined that the quality of a country's corporate governance system was important when explaining the relationship between ownership concentration and corporate performance. They drew this conclusion by using a dynamic modelling approach and comparing the well-established corporate governance system in Singapore with the less-developed corporate governance system in Vietnam. A positive relationship between ownership concentration and corporate performance was also found in European studies set in Greece (Kapopoulos & Lazaretou, 2007) and Italy (Perrini, Rossi & Rovetta, 2008) for a sample of publicly traded companies. Claessens, Djankov, Fan and Lang (2002) found a positive relationship between a higher level of cash flow ownership by the largest shareholder and increased company value. This finding supports the assertion that positive incentive effects exist in the presence of ownership concentration. However, the study by Claessens *et al.* (2002) also found a negative association between increased control rights of the largest shareholder and improved company value, which was attributed to a negative entrenchment effect of large controlling shareholders. The entrenchment effect arises owing to the control provided to management through insider ownership. Wang and Shailer (2015) also found a negative relationship between ownership concentration and corporate performance across countries, irrespective of institutional settings.

In contrast to findings of a linear relationship between ownership concentration and corporate performance, De Miguel, Pindado and De la Torre (2004) found a quadratic relationship in this regard for a sample of Spanish companies. Their research justifies both the notion that a higher level of ownership concentration leads to improved monitoring of management and the idea that a higher level of ownership concentration leads to entrenchment of large controlling shareholders. Some studies reported an 'up-down-up' relationship between ownership concentration and corporate performance (Cho, 1998; Gugler, Mueller & Yurtoglu, 2004). This relationship depicts an alignment of shareholder and manager interests in the first and third stages and an entrenchment effect in the second stage. Other studies only demonstrated an 'up-down' relationship in the form of an inverted U-shape (Arosa, Iturralde & Maseda, 2010; McConnell & Servaes, 1990; Thomsen & Pedersen, 2000).

Taking into account the mixed results of previous studies and the potential for ownership concentration to enhance or aggravate the agency theory perspective and the monitoring and control role of the board of directors, the first hypothesis is as follows:

H_1: There is a relationship between ownership concentration and the efficiency of value added by a company from its resources.

4.2.2 Absence of CEO duality and performance

CEO duality refers to the situation where a company's CEO is also the chair of the board of directors (Finkelstein & D'aveni, 1994). Therefore, the absence of CEO duality implies that the company separates the roles of CEO and chairman of the board of directors. Whether or not CEO duality improves or compromises performance remains an unresolved issue in both business and academia (Duru, Iyengar & Zampelli, 2016). The two opposing theories that are central to this discussion are agency theory and stewardship theory.

From an agency theory perspective, CEO duality compromises the ability of the board of directors to monitor and discipline the CEO (Finkelstein & D'aveni, 1994). This may be attributed to the empowerment of the CEO, which compromises the independence of the board of directors and reduces oversight by the board of directors (Appuhami & Bhuyan, 2015; Finkelstein, 1992). As a result, Appuhami and Bhuyan (2015) note that

CEO duality may impede the efficient creation and use of intellectual capital owing to CEOs acting opportunistically out of self-interest rather than in the best interests of the shareholders. Therefore, agency theory promotes the independence of the board of directors from management in order to avoid management entrenchment and opportunism (Eisenhardt, 1989; Fama & Jensen, 1983a). Since agency theory does not support the notion of CEO duality, this theory suggests a negative relationship between CEO duality and performance (Jensen, 1993). King II, King III and King IV follow agency theory by recommending the separation of the positions of the CEO and the chair of the board of directors (IODSA, 2009). In the absence of this separation, King II recommended that an independent non-executive director should serve as chairman or the board of directors should include a strong independent non-executive director element (IODSA, 2002), and both King III and King IV recommend the appointment of a lead independent director (IODSA, 2009).

In contrast to agency theory, stewardship theory suggests that CEO duality encourages unity of leadership, contributing to company effectiveness and ultimately improved performance (Donaldson & Davis, 1991). According to stewardship theory, the concentration of power and authority in a single individual will enhance the leadership of the company by developing consistent expectations for both members of management and the board of directors.

The results of empirical studies examining the relationship between CEO duality and performance are inconclusive. The meta-analysis by Dalton *et al.* (1998), which reviewed 31 studies, indicated no evidence of a systematic relationship between CEO duality and corporate performance. Using a sample of 192 companies in 12 industries, Boyd (1995) integrated agency and stewardship theory and showed that the direction and extent of the relationship between CEO duality and corporate performance varied systematically depending on the level of environmental uncertainty, which was determined in terms of munificence, dynamism and complexity.

Rechner and Dalton (1991) examined 141 companies over a six-year period and reported that boards of directors of companies that had an independent chairperson significantly outperformed companies with CEO duality in terms of return on equity, return on investment and profit margin. Ho and Williams (2003) also found a significant negative relationship between CEO duality and both the value added intellectual coefficient (VAIC) and intellectual capital efficiency (ICE) for South African, Swedish and United Kingdom (UK) companies. Duru *et al.* (2016) expanded on these results by finding a significant negative relationship between CEO duality and corporate performance, which was positively moderated by increased independence of the board of directors. Furthermore, Tang (2017) found a negative relationship between CEO duality and corporate performance when the CEO was more empowered than the other executives and when a blockholding outside director formed part of the board of directors.

In contrast to the above findings, the study by Appuhami and Bhuyan (2015) found a significant positive relationship between CEO duality and VAIC for a sample of Australian service companies, which suggests that not separating the roles of CEO and the chair of the board of directors leads to the more efficient use of the company's resources, including intellectual capital. Donaldson and Davis (1991) used a sample of 321 US companies of various sizes from several industries and found a significantly higher mean shareholder return, as represented by average return on equity, for companies with CEO duality. Brickley, Coles and Jarrell (1997) report that separating the roles of CEO and the chair of the board of directors in large companies may lead to agency costs that outweigh the benefits of the absence of CEO duality.

Studies have also been conducted that found no relationship between CEO duality and corporate performance. One such study is by Rechner and Dalton (1989), who compared the shareholder returns (from 1978 to 1973) of 141 companies adopting CEO duality with the returns of companies that separated the roles of the CEO and chairman of the board of directors. The study by Vafeas and Theodorou (1998), which analysed data from 250 UK public companies, also indicated no significant relationship between CEO duality and corporate performance. Further support is provided for these findings by Ho and Williams (2003), who found no significant relationship between CEO duality and ICE in South Africa, Sweden and the UK and no significant relationship between CEO duality and VAIC in Malaysia, respectively. Despite these findings, a strong theoretic argument exists for such a relationship (Krause, Semadeni & Cannella Jr, 2014).

Generally, consensus is lacking regarding the relationship between CEO duality and performance. This is often attributed to the endogeneity problem, which makes it difficult to determine a causal relationship between the two variables (Duru *et al.*, 2016). Duru *et al.* (2016) attempted to partially resolve this issue by using a dynamic model rather than a static model to enhance statistical inference. This approach deals with the problem identified by Wintoki, Linck and Netter (2012), namely that research studies often disregard the possibility that current corporate governance variables are not exogenous and may be a function of past performance.

For the purposes of this study, based on the lack of consensus regarding the absence of CEO duality and the opposing views of agency theory and stewardship theory, the second hypothesis to be tested is as follows:

H_2: There is a relationship between the absence of CEO duality and the efficiency of value added by a company from its resources.

4.2.3 Independent non-executive directors and performance

According to agency theory, given the opportunity, managers tend to act in their own personal interests at the expense of shareholder interests (Jensen & Meckling, 1976; Solomon, 2020). For example, managers may engage in earnings management practices to reflect more favourable corporate performance and gain higher remuneration. Independent non-executive directors are non-executive directors who are "independent in character and judgement and there should be no relationships or circumstances which are likely to affect, or could appear to affect this independence" (IODSA, 2009, p. 38). Consequently, independent non-executive directors may serve as a mechanism to mitigate such opportunistic behaviour and align the interests of managers and shareholders by more objectively monitoring and controlling the behaviour of management (Zahra & Pearce, 1989). Therefore, agency theory suggests that a higher percentage of independent non-executive directors on the board of directors will be associated with better performance (Agrawal & Knoeber, 1996). Despite each new version of the King Report on Corporate Governance for South Africa replacing its predecessor, the current and all prior King Reports support the agency theory perspective by recommending that the majority of the board of directors should consist of non-executive directors (IODSA, 2002, 2009, 2016). Even though a comparison of the proposals of King II with the recommendations of King III and King IV identifies differences with regard to the extent of the independence of non-executive directors, the agency theory viewpoint is evident in all three versions of the King Report on Corporate Governance for South Africa.

Stewardship theory takes a diametrically opposite view to agency theory. According to stewardship theory, decision-making is enhanced when the board of directors is constituted of a larger proportion of inside directors (Kiel & Nicholson, 2003). Therefore, superior performance is achieved when the board of directors consists of a majority of inside directors, because the depth of knowledge, expertise and commitment of insiders facilitate the strategic role of the board of directors (Muth & Donaldson, 1998).

Empirical studies have presented mixed results for the association between independent non-executive directors and performance. Consistent with agency theory, Ho and Williams (2003) found a significant positive correlation between the proportion of outside directors on the board of directors and both VAIC and capital employed efficiency (CEE) for a sample of 84 South African companies. Appuhami and Bhuyan (2015) provided support for this finding with regard to VAIC for a sample of top service companies in Australia. In contrast, no significant relationship was found between the proportion of outside directors on the board of directors and both VAIC and CEE for a sample of 94 Swedish and 108 UK companies (Ho & Williams, 2003). Using a sample of 122 Belgian companies, Dehaene, De Vuyst and Ooghe (2001) reported a significant positive relationship between the number of outside directors and return on equity. Terjesen, Couto and Francisco (2016) suggested that the positive relationship between independent non-executive directors and corporate performance only existed in the presence of gender diversity with regard to the board of directors. Rosenstein and Wyatt (1990) found positive excess returns in response to announcements of the appointment of non-executive directors to the board of directors. Consistent with this finding, the research by Dahya and McConnell (2007) showed a rise in share prices and improved operating performance around the time of announcements by UK companies regarding an increase in the number of outside directors. The number of outside directors generally increased in response to the need for adherence with the Cadbury Report recommendations.

Using ordinary least squares (OLS) regression, Yermack (1996) found a significant negative relationship between the proportion of independent directors and Tobin's Q. Studies by Agrawal and Knoeber (1996) and Barnhart and Rosenstein (1998) supported this finding, which is in line with stewardship theory. Agrawal and Knoeber (1996) used not only OLS regression, but also simultaneous equations to arrive at their conclusions. Kiel and Nicholson (2003) found a positive relationship between the proportion of inside directors and Tobin's Q. Nevertheless, Yermack (1996) reported no significant relationship between the proportion of independent non-executive directors and various other measures of corporate performance. Furthermore, no significant relationship between the proportion of independent non-executive directors and corporate performance was evident when Yermack (1996) applied a fixed effects regression rather than OLS regression.

Some studies found a curvilinear relationship between the proportion of independent directors on the board of directors and performance. For example, Wagner III, Stimpert and Fubara (1998) provided evidence that boards of directors with a particularly high or low proportion of insiders performed better than those where the number of insiders and outsiders were more balanced. These findings support the results of an earlier study by Morck *et al.* (1988). In contrast, Barnhart and Rosenstein (1998) found a curvilinear relationship between the proportion of independent directors on the board of directors and Tobin's Q, which indicated weaker performance for companies with boards of directors that had a particularly high or low percentage of independent directors.

Hermalin and Weisbach (1991) and Vafeas and Theodorou (1998) conducted large cross-sectional studies, using US and UK data respectively, and reported no significant relationship between the proportion of outside directors and corporate performance. The study by Agrawal and Knoeber (1996) similarly used a large sample of cross-sectional data from the US. This approach for the selection of data is relevant because the sample for the majority of studies that found evidence of a positive relationship between non-executive directors and performance is narrowed by the selection criteria, which concentrate on the decision control role of non-executive directors and ignore the decision management role of executive directors (Vafeas & Theodorou, 1998).

In the first stage of a South African study, Maroun and Cerbone (2020) examined the relationship between the proportion of non-executive directors and the level of corporate governance. The second stage of the study investigated the association between the level of corporate governance and financial performance. Maroun and Cerbone (2020) found that a higher level of corporate governance was practiced by boards of directors with a greater proportion of non-executive directors. In addition, improved corporate governance practices were found to be associated with better financial performance at the 1% level of significance when financial performance was measured using Tobin’s Q, but not when ROA and ROE were used to measure financial performance.

Endogeneity issues attributable to possible spurious relationships between variables were purposefully dealt with by Hermalin and Weisbach (1991) through the use of panel data and instrumental variables. This methodology was similarly applied by Yermack (1996) and Vafeas and Theodorou (1998).

The following hypotheses take into account the diametrically opposite perspectives of agency theory and stewardship theory, which support the monitoring and control role and the strategic role of the board of directors, respectively:

H_3: There is a relationship between the percentage of members of the board of directors who are non-executive and the efficiency of value added by a company from its resources.

H_4: There is a relationship between the percentage of non-executive members of the board of directors who are independent and the efficiency of value added by a company from its resources.

4.2.4 Size of the board of directors and performance

The size of the board of directors refers to the number of members serving on the board of directors. Many studies argue against large boards of directors. For example, Yermack (1996) argues that large boards of directors lead to communication, co-ordination and decision-making problems, resulting in reduced performance. In the case where a decision must be made by a large number of members of the board of directors, free-riding may occur due to a reduction in effort by some members of the board of directors and this may result in the board of directors relinquishing control to the CEO (Jensen, 1993). Jensen (1993) maintains that companies with oversized boards of directors are less likely to operate effectively and advises that boards of directors should not have more than seven or eight members in order to function effectively. Similarly, a study by Lipton and Lorsch (1992) recommended restricting the number of members of the board of directors to ten, but preferably to eight or nine. Guest (2009) confirms that the optimal size of the board of directors is less than ten members, but adds that the performance measure under consideration impacts on the precise optimal size of the board of directors. Jensen (1993) and Lipton and Lorsch (1992) argue that as the board of directors becomes oversized, the marginal benefits of monitoring management are outweighed by the additional costs of ineffective decision-making. In line with these sentiments, some studies found that smaller boards of directors were associated with higher corporate value (Eisenberg, Sundgren & Wells, 1998; Yermack, 1996).

The disadvantages of having large boards of directors can largely be attributed to the ineffectiveness of the board of directors owing to the impairment of the control and monitoring functions of the board of directors (Ntim, Opong & Danbolt, 2015). In terms of agency theory, this implies a negative relationship between the size of the board of directors and performance. Stakeholder theory and resource dependence theory both suggest a positive association between the size of the board of directors and performance. Consistent with stakeholder theory, companies that are able to meet the needs of all stakeholders generate more value not only for shareholders, but for all stakeholders (Freeman, Wicks & Parmar, 2004). According to resource dependence theory, larger boards of directors provide more extensive linkages to the environment and are likely to be more effective than smaller boards of directors in establishing external links to critical resources (Pfeffer & Salancik, 1978). Consequently, companies benefit from larger boards of directors owing to wider representation of stakeholders and enhanced access to critical resources.

Prior studies presented mixed results with regard to the relationship between the size of the board of directors and performance. Empirical studies examining the relationship between these two variables were predominantly based on US and Western European samples (Conyon & Peck, 1998; Guest, 2009; Yermack, 1996). The US empirical studies generally reported a negative relationship between the size of the board of directors and corporate performance (Guest, 2009). Yermack (1996) provided evidence of a negative relationship between the size of the board of directors and performance measures, such as Tobin's Q and return on assets, for a large sample of US industrial companies with an average of 12.3 members on the board of directors. Similar results emanated from other US studies (Cheng, 2008; Cheng, Evans & Nagarajan, 2008). In contrast to the sample used in the study by Yermack (1996), Eisenberg *et al.* (1998) used a large sample of small Finnish companies with an average of 3.7 members on the board of directors. Despite the difference in the samples selected by Eisenberg *et al.* (1998) and Yermack (1996), the Finnish study confirmed the results presented in the US study. Other Western European studies that reported a negative relationship between the size of the board of directors and performance include Beiner, Drobetz, Schmid and Zimmermann (2004) and Conyon and Peck (1998).

In a South African study, Maroun and Cerbone (2020) first examined the relationship between the size of the board of directors and a composite corporate governance score before examining the relationship between the level of corporate governance and financial performance. A higher corporate governance score represented better corporate governance practices. The size of the board of directors was found to have very little impact on the corporate governance score. Improved corporate governance practices were found to be associated with better financial performance at the 1% level of significance when financial performance was measured using Tobin's Q, but not when ROA and ROE were used to measure financial performance.

Using panel data and applying econometric models that control for endogeneity, the UK study by Guest (2009) found that the size of the board of directors had a significant negative effect on profitability, Tobin's Q and share returns. In the UK, the impact of large boards of directors on corporate performance is more likely to be attributed to impairment of the advisory role of the board of directors than the monitoring role of the board of directors since a much weaker monitoring role is played by UK boards of directors than US boards of directors (Guest, 2008, 2009). Ntim *et al.* (2015) argue that South African companies perform a weaker agency role and a stronger resource dependence role than companies based in both the US and Western Europe. Consequently, the monitoring and control role of the board of directors is compromised to some degree in South Africa. This has been ascribed to broad-based black economic empowerment (BBBEE) that should reflect in appointments to the board of directors, a scarcity of directors with appropriate skills and experience, concentration of ownership, more government ownership and poor enforcement of corporate regulations (Ntim *et al.*, 2015). BBBEE was introduced to redress the inequalities arising from the apartheid legacy in South Africa. The purpose of BBBEE is to advance economic transformation and enhance the participation of black individuals, who were previously disadvantaged, in the South African economy. Using a sample of 169 South African companies from 2002 to 2011, Ntim *et al.* (2015) found a positive association between the size of the board of directors and performance measured in terms of Tobin's Q, return on assets and shareholder returns, and reported that this could more likely be attributed to the board of directors' resource dependence role than its agency role. This finding contradicts the previously mentioned findings of US and Western European studies.

Inconsistent with most US and Western European studies, Beiner, Drobetz, Schmid and Zimmermann (2006) found a positive association between the size of the board of directors and Tobin's Q for a sample of Swiss listed companies. Ho and Williams (2003) conducted an international comparative analysis and regressed the size of directors against VAIC, CEE and ICE for a sample of 286 listed companies in South Africa, Sweden and the UK. Their study found a moderately significant positive relationship between the size of the board of directors and CEE in the UK, but no significant relationship between these variables in South Africa or Sweden. Furthermore, Ho and Williams (2003) found that the size of the board of directors was not significantly associated with VAIC and ICE. Appuhami and Bhuyan (2015) also found no significant relationship between the size of the board of directors and VAIC. In contrast, Buallay and Hamdan (2019) and Shahzad *et al.* (2019) found that board size was positively associated with VAIC. The results of studies finding a positive relationship between the size of the board of directors and performance support the resource dependence and stakeholder theory perspectives.

King III and King IV do not specify the number of directors that should serve on the board of directors, but recognise the need for sufficient members to provide the combined knowledge, skills, experience and resources necessary for the effective functioning of the board of directors (IODSA, 2009, 2016). Based on agency theory, which is concerned with the monitoring and control role of the directors, and stakeholder and resource dependence theories, which deal with the strategic and service roles of the directors, the following hypothesis is proposed:

H$_5$: There is a relationship between the size of the board of directors and the efficiency of value added by a company from its resources.

4.2.5 Diversity of the board of directors and performance

Diversity of the board of directors refers to the recognised variety of attributes and expertise that the members of the board of directors possess. The members of the board of directors apply these attributes and their expertise when performing board processes and making decisions (Van der Walt & Ingley, 2003). The attributes of the members of the board of directors serve as elements of human capital.

In terms of agency theory, directors are expected to monitor the actions of managers, who serve as agents of shareholders, to ensure that they act in accordance with shareholders' interests (Berle & Means, 1932; Jensen & Meckling, 1976). Agency theorists suggest that diversity with regard to the composition of the board of directors enhances the independence of the board of directors, which leads to an improvement in the board of directors' monitoring function (Triana, Miller & Trzebiatowski, 2013; Van der Walt & Ingley, 2003). This, in turn, results in better performance. Although shareholders form a major stakeholder group of the company, there are many other stakeholder groups. Stakeholder theory suggests the need to consider the interests of not only shareholders, but all stakeholder groups (Donaldson & Preston, 1995; Solomon, 2020). The board of directors acts as the company's link to its stakeholders (Hillman *et al.*, 2001). Therefore, stakeholders' interests can be served more effectively when all stakeholders are represented on the board of directors. However, it is important to strike a balance between broad representation of stakeholders on the board of directors and the size of the board of directors to ensure the effectiveness of the board of directors. The board of directors also provides the company with access to resources (Pfeffer, 1972). Diversity of the board of directors is a useful mechanism to achieve representation of stakeholders on the board of directors and provide access to resources.

The literature proposes various benefits associated with diversity of the board of directors. One of these benefits is better quality decisions (Hillman, 2015; Milliken & Martins, 1996). Williams and Ho (2001) argue that the management of intellectual capital requires broader perceptions and more creativity and flexibility in the decision-making process. Hillman (2015) and Miller and Del Carmen Triana (2009) note that diversity may enhance group decision-making owing to an increase in creativity and the consideration of a broader set of alternatives. These arguments support the view that diverse perspectives lead to a broader range of potential solutions and thereby enhance strategic decision-making (Schweiger *et al.*, 1986). Other benefits of diversity of the board of directors are improved performance of the monitoring function by the board of directors (Adams & Ferreira, 2009) and facilitation of access to critical resources for the company (Pfeffer, 1972; Pfeffer & Salancik, 1978).

Despite the benefits of more diverse boards of directors, the costs of diversity are also notable (Adams, Haan, Terjesen & Ees, 2015). Excessively diverse boards of directors may lack unity and harmony. Auh and Menguc (2005) note that a high level of diversity may come at the cost of effective communication and collaboration, cohesiveness and co-ordination. Therefore, conflict may arise between members of the board of directors and compromise the quality and timeliness of decision-making (Adams *et al.*, 2015).

Previous studies examining the relationship between diversity of the board of directors and performance have predominantly focused on developed countries (Adams & Ferreira, 2009; Adams & Kirchmaier, 2016; Hillman, 2015; Kang *et al.*, 2007; Post & Byron, 2015; Rose, 2007). Mixed results emanate from these studies, which may be attributed to variations between studies in methodologies, performance measures, time horizons, omitted variables and contextual matters (Adams *et al.*, 2015; Campbell & Vera, 2010). Contextual issues include variations in cultural backgrounds and differences in regulatory and economic settings (Kang *et al.*, 2007). The endogeneity of corporate governance and, more specifically, diversity of the board of directors could also explain these mixed results (Adams *et al.*, 2015).

This study considered three aspects of diversity of the board of directors, namely educational-level, ethnic and gender. The impact of educational-level diversity, ethnic diversity and gender diversity on performance may differ because these variables relate to different human capital attributes and linkages to the external environment (Carter *et al.*, 2010).

Educational-level diversity

There is considerably less research on the relationship between educational-level diversity and corporate performance than on the relationship between other areas of diversity of the board of directors and corporate performance (Mahadeo, Soobaroyen & Hanuman, 2012). Educational-level diversity is cognitive or non-observable in comparison with ethnic and gender diversity, which are highly visible and may provide signals to the public (Milliken & Martins, 1996; Simons & Pelled, 1999; Tsui, Egan & O'Reilly III, 1992). The educational-level diversity of the board of directors refers to the variety of skills and knowledge held by the members of the board of directors owing to some members having more advanced education than others. Skills and knowledge may influence the board of directors' ability to be creative and make strategic decisions (Forbes & Milliken, 1999). Using data from a sample of US retail banks, Bantel (1993) found that banks with a clear strategy were associated with top management teams that had diverse educational backgrounds. Similarly, educational-level diversity of executives has been reported to be positively related to corporate performance (Simons & Pelled, 1999). Furthermore, after controlling for financial ratios, the size of the board of directors and industry, Kim and Lim (2010) reported consistently positive relationships between corporate performance and the educational levels of independent non-executive directors.

Rose (2007) found that the board of directors did not need any specific education to function effectively and Mahadeo *et al.* (2012) provided evidence that boards of directors with more educational-level diversity demonstrated worse performance. Nevertheless, Al-Musali and Ku Ismail (2015) also found no significant relationship between the board of directors' educational-level diversity and intellectual capital performance. Additionally, Al-Musali and Ku Ismail (2015) reported that the effectiveness of meetings of the board of directors had no significant moderating effect on this relationship. This may be attributed to a lack of participation at meetings of the board of directors, because many members of the board of directors in the Gulf Cooperation Council countries claimed that they did not receive sufficient and appropriate information to prepare in advance for meetings of the board of directors, which resulted in problems related to information asymmetry (GCC Board Directors Institute, 2011).

Ethnic diversity and gender diversity will now be contemplated. First, ethnic diversity and gender diversity of the board of directors will be considered individually. Thereafter, the joint literature on these two aspects of diversity will be reviewed.

Ethnic diversity

Ethnic diversity of the board of directors refers to the assortment of ethnic backgrounds of the members of the board of directors. In contrast to gender diversity, there is a scarcity of studies on the relationship between ethnic diversity and corporate performance (Hillman, 2015). Nevertheless, the existing studies presented mixed results. For example, the study by Carter *et al.* (2003) found a significant positive relationship between the proportion of ethnic minority directors on the board of directors and performance, as measured by Tobin's Q. In contrast, Carter *et al.* (2010) found no significant relationship between ethnic diversity and performance (as measured by return on assets and Tobin's Q) for a sample of major US companies. Similarly, Taljaard, Ward and Muller (2015) found that racial diversity within boards of directors was not associated with financial performance.
Gender diversity is the final aspect of diversity that was considered in this study. A review of the empirical literature dealing with the relationship between gender diversity of the board of directors and performance is set out below.

Gender diversity

The board of directors' gender diversity refers to the extent of representation of males and females by members of the board of directors. There is a large body of academic literature examining the relationship between gender diversity and corporate performance (Hillman, 2015; Post & Byron, 2015). The results of these studies are mixed. Some studies found a positive relationship between the board of directors' gender diversity and corporate performance (Carter *et al.*, 2003; Terjesen *et al.*, 2016; Shahzad *et al.*, 2019), whereas the results of other studies presented a negative association between these variables (Adams & Ferreira, 2009; Ahern & Dittmar, 2012). Nadeem, Farooq and Ahmed (2019) found a significant positive relationship between female representation on the board of directors and intellectual capital efficiency, including human capital efficiency and structural capital efficiency. A number of studies also found no relationship between the proportion of female members of the board of directors and corporate performance (Miller & Del Carmen Triana, 2009; Rose, 2007). However, the literature dealing with the relationship between female representation on boards of directors and performance tends to concentrate on financial performance and the creation of value through the use of tangible rather than intangible assets (Nadeem *et al.*, 2019). Studies finding no relationship or a negative relationship between gender diversity and performance may have arrived at these results owing to an extremely low or high number of females on the board of directors. Joecks, Pull and Vetter (2013) argue that this will invalidate the results because diversity will be compromised owing to the dominance of a single gender.

Using a sample of Spanish companies, Campbell and Mínguez-Vera (2008) found a positive relationship between the board of directors' gender diversity and Tobin's Q. Similar results arose from the study done by Carter *et al.* (2003), using US data. Terjesen *et al.* (2016) used data from 3 876 public companies from 47 countries and found that companies with more female directors demonstrated better performance in terms of both Tobin's Q and return on assets. Consistent with Carter *et al.* (2003), Adams and Ferreira (2009) also used US data, but the results of their study showed a negative relationship between the female representation on the board of directors and

Tobin's Q. Miller and Del Carmen Triana (2009) also found a negative relationship between the board of directors' gender diversity and corporate performance, despite showing evidence of a positive relationship between the board of directors' gender diversity and innovation. Ahern and Dittmar (2012) set their study in Norway where quotas were introduced to increase female representation on boards of directors. According to Ahern and Dittmar (2012), both at the time of the announcement of the introduction of the quota and in the succeeding years, companies affected by the quota experienced a decline in share price. The implementation of the quota also resulted in a deterioration in operating performance together with younger and more inexperienced boards of directors.

Using a sample of 2 500 Danish companies, Smith, Smith and Verner (2006) found that the relationship between the board of directors' gender diversity and accounting-based measures of performance depended on the measure of performance and the measure of the proportion of women on the board of directors. Furthermore, Smith *et al.* (2006) provided evidence that the positive performance effect was stronger when female members of the board of directors possessed a university degree. Rose (2007) also examined data relating to Danish companies and reported no significant relationship between female representation on the board of directors and Tobin's Q. Post and Byron (2015) provided some support for the findings of Rose (2007) and Smith *et al.* (2006). In a meta-analysis of 140 studies examining the relationship between females on the board of directors and financial performance, Post and Byron (2015) found a positive relationship when an accounting-based measure was used to measure performance and practically no relationship when a market-based measure was used to measure performance. Despite this, Post and Byron (2015) found a positive relationship between female representation on the board of directors and market-based performance in countries with more gender equality and a negative relationship between these variables in countries with less gender equality. The association between female representation on the board of directors and accounting-based measures is also strengthened in the presence of increased shareholder protection (Post & Byron, 2015). In addition to using traditional measures of performance such as return on assets, Nadeem, De Silva, Gan and Zaman (2017) used an adjusted measure of VAIC to empirically examine the relationship between the board of directors' gender diversity and performance for a sample of 906 Chinese listed companies from 2010 to 2014. Using static OLS estimation, Nadeem *et al.* (2017) found a significant positive relationship between the board of directors' gender diversity and intellectual capital efficiency. However, no significant relationship was evident when endogeneity was taken into account using a generalised method of moments approach to examine this relationship (Nadeem *et al.*, 2017). Similarly, Nadeem *et al.* (2017) found no significant relationship between gender diversity and return on assets. These findings were ascribed to the male-dominated economy, gender-related stereotypical attitudes and the lack of gender-related regulation in China (Nadeem *et al.*, 2017).

Nielsen and Huse (2010) argue that the unique contribution by women may enable them to have an impact on the strategic role of the board of directors. Female members of the board of directors are capable of contributing favourably to the strategic role of the board of directors because they are more likely than men to have advanced qualifications (Singh, Terjesen & Vinnicombe, 2008), bring international diversity to the board of directors (Singh *et al.*, 2008), actively serve on the board of directors (Virtanen, 2012), prepare properly for meetings (Pathan & Faff, 2013), attend meetings of the board of directors (Adams & Ferreira, 2009) and debate matters (Ingley & Van Der Walt, 2005). The greater the number of female members of the board of directors, the more chance that they will be able to influence decisions of the board of directors. Some studies suggested that the presence of more than one female on the board of directors could influence decisions made by the board of directors, whereas other studies concluded that at least three females would be required (Konrad, Kramer & Erkut, 2008; Torchia, Calabrò & Huse, 2011). Adams and Ferreira (2009) also suggest that more gender diverse boards of directors devote more time to the board of directors' monitoring role.

A small number of past research studies examined the relationships of ethnic and gender diversity with performance in a single study. An outline of this literature follows.

Ethnic and gender diversity

Carter *et al.* (2010) suggested an endogenous relationship between ethnic minority diversity and gender diversity of the board of directors and corporate financial performance. Using a sample of 291 South African listed companies representing eight non-financial industries and taking into consideration issues of endogeneity, Ntim (2015) reported that the board of directors' ethnic diversity and gender diversity were positively associated with performance, as measured by Tobin's Q, return on assets and shareholder returns. The study by Swartz and Firer (2005) measured performance in terms of intellectual capital performance rather than adopting the measures used by Ntim (2015) and similarly found a significant positive relationship between ethnic diversity and performance. These findings support the stakeholder theory and resource dependence viewpoints. The percentage of female members on the board of directors was also examined as an aspect of diversity by Swartz and Firer (2005), who found no distinct relationship between the percentage of female members of the board of directors and intellectual capital performance. This could possibly be explained by the fact that the study did not consider the specific positions held by female directors on the board of directors (Swartz & Firer, 2005; Zald, 1969).

Despite Roberson and Park (2007) identifying a U-shaped curvilinear association between leadership diversity in companies and company value, Ntim (2015) specifically identified no such association of ethnic and gender diversity of the board of directors with Tobin's Q, return on assets and shareholder returns. In addition, Ntim (2015) presented evidence that the stock market ascribed more value to ethnic diversity than to gender diversity. Despite this, Hillman, Cannella Jr and Harris (2002) found similarities between females and ethnic minorities, because both were more likely to have non-business backgrounds, hold advanced educational degrees and take on multiple directorships at a more rapid rate than their white male counterparts.

In the South African context, Ntim (2013a) investigated the relationship between stakeholder corporate governance provisions, including affirmative action, and financial performance. Affirmative action mechanisms are adopted in South Africa to redress the past disadvantages in employment experienced by black people and women. According to Ntim (2013a), stakeholder corporate governance provisions improve access to resources in South Africa, resulting in better long-term financial performance. Maroun and Cerbone (2020) also considered the South African context and found that an increase in racial diversity was associated with improved corporate governance. In the smallest companies listed on the JSE, Maroun and Cerbone (2020) found a statistically significant relationship between increased gender diversity and a higher level of corporate governance. However, increased gender diversity in larger companies listed on the JSE was not necessarily associated with improved levels of corporate governance. Additionally, better corporate governance practices were found to be associated with better financial performance at the 1% level of statistical significance when financial performance was measured using Tobin's Q, but not when ROA and ROE were used to measure financial performance.

Knowledge, race and gender are all aspects of diversity recognised by King III and King IV (IODSA, 2009, 2016) as essential for the effective functioning of the board of directors. In order to function effectively, the board of directors must serve not only in a monitoring and control role, but also in strategic and service roles. The presence of diversity on the board of directors may benefit both the strategic and service roles, which could potentially result in improved performance. Based on the monitoring and control, strategic and service roles of the board of directors as represented by agency theory, resource dependence theory and stakeholder theory, respectively, the following hypotheses are proposed:

H_6: There is a positive relationship between the board of directors' educational-level diversity and the efficiency of value added by a company from its resources.

H_7: There is a positive relationship between the board of directors' ethnic diversity and the efficiency of value added by a company from its resources.

H_8: There is a positive relationship between the board of directors' gender diversity and the efficiency of value added by a company from its resources.

4.2.6 Moderating effect of ownership concentration

A higher level of agency problems leads to an increased importance of the monitoring and control role of directors (Fama & Jensen, 1983b). Agency problems may be minimised by an increased level of ownership concentration in the company (Jensen & Meckling, 1976). The greater the extent of ownership concentration, the more likely management is to serve in the interests of shareholders, owing to the alignment of management and shareholder interests. Therefore, minimising agency problems reduces agency costs and the need for the board of directors' monitoring and control role. A reduction in agency costs results in the availability of more resources for the board of directors' strategic role and intellectual capital management (Appuhami & Bhuyan, 2015). Therefore, directors are more likely to take a strategic role and to drive management to focus on the long-term sustainability of the company than on short-term returns when there is a higher level of ownership concentration. This may be attributed to the increased monitoring of management by large shareholders (Grossman & Hart, 1980). It may also be due to the potential large equity interest held in the company by controlling shareholders or their relatives, who are often directors of the company with the ability to directly influence management (Shleifer & Vishny, 1997). This is the case because directors are incentivised to take a strategic role when they possess a greater equity interest in the company (Hansen & Hill, 1991).

A study by Hu and Izumida (2008) suggest that higher levels of ownership concentration empower large shareholders and provide them with the motivation to monitor management. This provides an opportunity for the board of directors to concentrate less on the monitoring and control role (agency theory) and to allocate more effort and resources to the strategic role (stewardship theory), while maintaining the goal of value creation. However, Edmans and Holderness (2017) argue that higher levels of ownership concentration may result in excessive monitoring, which may aggravate the agency problem and hinder the management function, reducing the potential for value creation. Higher levels of ownership concentration may also worsen the agency problem if management is pressurised by large shareholders to focus on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010). When the agency problem is aggravated, agency costs increase and the monitoring and control role of the directors becomes more important and less effort and resources can be directed towards the strategic role and the management of intellectual capital (Appuhami & Bhuyan, 2015). Therefore, the current study treated ownership concentration as a corporate governance mechanism to influence agency costs. Since agency problems may be reduced or aggravated by an increased level of ownership concentration, the relationship between the independence of the board of directors and the efficiency of value added by a company from its resources should be moderated by a greater level of ownership concentration (Gaur *et al.*, 2015).

Shareholders with a significant equity stake in the company are more likely to ensure the efficient use of company resources to enhance their personal benefits. Consequently, a higher level of ownership concentration in a company would incentivise the large shareholders to manage the directors to employ resources and act in the interests of the shareholders as opposed to the interests of all stakeholders (Gaur *et al.*, 2015). In the case of large shareholders who are self-interested, the incentive may be to expropriate resources to the detriment of other stakeholders (Maher & Andersson, 1999), which would result in the availability of less resources for the improvement intellectual capital management and value creation. This may enhance the perceptions of agency theory, whereas it may inhibit the propositions of the resource dependence and stakeholder theories. Therefore, the relationships of the size and diversity of the board of directors with the efficiency of value added by a company from its resources may be moderated by greater ownership concentration.

Accordingly, the hypothesis to be tested is as follows:

H_9: The relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources are moderated by a higher level of ownership concentration.

4.3 CHAPTER CONCLUSION

After considering the mixed results of empirical studies that examined the relationships of ownership concentration and several characteristics of the board of directors with performance, this chapter presented a multi-theoretic contingency model incorporating agency theory, stewardship theory, resource dependence theory and stakeholder theory. In this model, intellectual capital performance was represented by the efficiency of value added from the company's resources. The model was based on nine hypotheses, which are summarised in Table 4.1 together with the potential underlying theories. Chapter 5, which follows, discusses the methodology used to test the hypotheses.

Table 4.1:Summarised research hypotheses for the relationships of ownership concentration and the characteristics of the board of directors with efficiency of value added by a company from its resources

Hypotheses	***Independent variables and moderating variable^ to be tested for a relationship with the efficiency of value added by a company from its resources***	***Expected relationship***	***Underlying theory***
H_1	Ownership concentration	Positive/Negative	Agency
H_2 H_3 H_4	Absence of chief executive officer (CEO) duality Percentage of members of the board of directors who are non-executive directors Percentage of non-executive members of the board of directors who are independent	Positive Negative	Agency Stewardship
H_5	Size of the board of directors	Negative Positive	Agency Resource dependence and stakeholder
H_6 H_7 H_8	Educational-level diversity Ethnic diversity Gender diversity	Positive	Agency, resource dependence and stakeholder

^ Ownership concentration is the moderating variable used to test Hypothesis H_9.

Source: Self-compiled

CHAPTER 5
RESEARCH METHODOLOGY

5.1 INTRODUCTION

This chapter explains the research methodology applied to this study to achieve the research objectives presented in Section 1.4. The term *research methodology* means the broad approach the researcher adopts to conduct the research study (Leedy & Ormrod, 2015). Therefore, the specific research methods used for the study form part of the research methodology.

As previously determined in Section 1.3, the main purpose of this study was to further the understanding of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources, using a multi-theoretic contingency framework. Relevant characteristics of the board of directors were identified and a multi-theoretic contingency framework was established in Chapters 2 to 4 of this study. In order to deal with the main purpose of the study, keeping in mind the relevant characteristics of the board of directors and the multi-theoretic contingency framework, this chapter describes the research methodology adopted. In addition, this chapter provides grounds for the research methodology.

This chapter begins by outlining the research approach, it then discusses the research paradigm and explains the research strategy, research design and research method adopted for the study. Details are then provided with regard to the population and sample selection, the data sources and collection, the specific variables, and the validity and reliability of the data that formed the subject of this study. A discussion of the approach to the data analysis then follows. Lastly, ethical matters relating to the study are considered.

5.2 RESEARCH APPROACH

A quantitative research approach was used in the study. This approach tests objective theories by examining the relationships between variables (Creswell, 2014). Researchers who adopt a quantitative approach typically follow a deductive form of reasoning. Deductive reasoning begins with one or more assumptions, which the researcher accepts to be correct. Logical reasoning is then used to draw conclusions that must be correct, if the original assumptions are correct (Leedy & Ormrod, 2015). For the purposes of the quantitative approach, statistical techniques can usually be applied to analyse data, which is measured numerically (Creswell, 2014).

The quantitative approach used in this study was justified by the main purpose of the study set out in Section 1.3, namely to further the understanding of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources, using a multi-theoretic contingency framework. Deductive reasoning, which also supports the quantitative approach, was used to derive hypotheses based on the existing theory evident from the literature. The quantitative approach was also suitable for this study because the variables used in these hypotheses were measured numerically and statistical analysis was used to investigate the research problem.

The factors that differentiate the quantitative research approach from the qualitative and mixed methods research approaches are the philosophical assumptions of the researcher (the research paradigm), the research strategy and research design employed, and the specific methods used to carry out the research strategy (Creswell, 2014). Each of these factors is now discussed in Sections 5.3, 5.4 and 5.5, respectively.

5.3 RESEARCH PARADIGM

As mentioned in Section 5.2, philosophical assumptions are a distinguishing factor of the research approach. The philosophical assumptions are the worldview that the researcher brings to the research study (Creswell, 2014). This worldview may be referred to as the research paradigm. Three important factors that characterise the research paradigm are ontology, epistemology and methodology (Creswell, 2014; Guba & Lincoln, 1994)

Ontology is concerned with the nature of reality and has two aspects: objectivism and subjectivism (Saunders, Lewis & Thornhill, 2009). Objectivism suggests that social entities exist in reality, external to and independent of social actors. For the purposes of this study, objectivism was applicable because the researcher remained independent of the research matter.

Epistemology refers to what is considered to be acceptable knowledge in a field of study (Bryman & Bell, 2011; Saunders *et al.*, 2009). One of the core issues in epistemology is whether or not the principles relevant to the natural sciences also apply to the social sciences (Bryman & Bell, 2011). The current study undertook accounting research and is positioned within the social sciences. Accounting research generally follows either a positivist or an interpretivist paradigm.

The positivist paradigm applies a natural science lens to social science (Bryman & Bell, 2011; Saunders *et al.*, 2009). In doing so, it views social reality in an objective sense and maintains that the researcher is independent of what is being researched (Bryman & Bell, 2011). Positivist research works with an observable social reality to establish law-like generalisations and can be approached by applying existing theories to develop hypotheses for testing using deductive reasoning (Bryman & Bell, 2011; Saunders *et al.*, 2009). The positivist research paradigm can also be related to the objectivism aspect of ontology. Therefore, the positivist research paradigm is better suited to quantitative research than to qualitative research.

Methodology deals with how the researcher goes about finding out what he or she believes can be known (Antwi & Hamza, 2015; Guba & Lincoln, 1994). The research methodology selected must not be reduced to the methods used to do the research. Rather, the methods must be tailored to a predetermined methodology (Guba &

Lincoln, 1994). The selection of methodology is limited by the ontology and epistemology. Because both the ontology and epistemology appropriate to this study support the stance that the researcher remains objective and independent of the research matter, the verification of hypotheses using quantitative methods and deductive reasoning was appropriate for the current study (Antwi & Hamza, 2015; Yilmaz, 2013).

The research objectives, identified in Section 1.4, were as follows:

- to empirically establish the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources;
- to empirically determine the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources for each of the top industries represented on the Johannesburg Stock Exchange (JSE);
- to empirically establish whether a higher level of ownership concentration has a moderating effect on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources; and
- to draw conclusions based on the findings of the study and make recommendations for further research.

The hypotheses, which postulate relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources, are presented in Section 4.2. These hypotheses provide testable propositions to achieve the first three objectives. The empirical approach to the research objectives, as demonstrated by the hypotheses, indicates that the current research is quantitative in nature. Each of these research objectives concerns the characteristics of a company's board of directors, which are underpinned by regulations. Additionally, in Chapter 4, deductive reasoning was used to derive hypotheses based on existing theory to achieve the research objectives. Because this research is quantitative in nature, the characteristics of the board of directors are a social reality established by regulations and deductive reasoning was used to derive research hypotheses, a positivist paradigm was adopted in the current study. The positivist paradigm, which is based on established theory and considers the world to be external and objective, also supports the objectivism aspect of the research ontology.

The research strategy and research design adopted for this study, which is closely linked to the research approach, is deliberated in the following section.

5.4 RESEARCH STRATEGY AND RESEARCH DESIGN

Numerous research strategies exist. These include experiments, surveys, case studies, action research, grounded theory studies, phenomenological, ethnographical, and archival research (Creswell, 2014; Saunders *et al.*, 2009). It is worth noting that these strategies are not mutually exclusive; however, some of these strategies are specifically appropriate for deductive reasoning, while others are particularly suitable for inductive reasoning (Saunders *et al.*, 2009). Since the research approach used deductive reasoning and hypotheses, the research strategy was designed to test these hypotheses. Therefore, a quantitative research strategy was selected for the current study. Quantitative research strategies applicable to deductive reasoning include experiments, surveys and archival research (Creswell, 2014; Saunders *et al.*, 2009).

Archival research collects data, which is part of the reality being studied, from existing records and documents (Bryman & Bell, 2011; Saunders *et al.*, 2009). This strategy responds to questions about the past and variations over time (Saunders *et al.*, 2009). Care must be taken to ensure the availability and accessibility of data before selecting this strategy owing to the limitations of archival data, which arise due to matters such as confidentiality, regulations and missing data (Saunders *et al.*, 2009).

The research strategy forms part of the research design, which may be exploratory, descriptive or explanatory (Saunders *et al.*, 2009). Descriptive research aims to enable “researchers to draw conclusions about the current state of affairs regarding a situation or issue but not about cause-and-effect relationships” (Leedy & Ormrod, 2015, p. 386).

Descriptive research does not necessarily merely provide an accurate description of data, but may also include a deeper analysis of the data and explanations that are meaningful (Robson & McCartan, 2016; Saunders *et al.*, 2009).

The archival research strategy was adopted for the current study. This strategy was considered appropriate, because it answers questions about the past and variations over time. It also creates expectations with regard to the stated relationships in the future. As a result, this research strategy used a multi-theoretic contingency framework to deal with the main purpose of the study, stated in Section 1.3, which was to further the understanding of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources.

A descriptive research design was applied to deal with the main purpose of the study. This research design provided the researcher with the opportunity to draw conclusions about a set of circumstances, but not about causal relationships. The researcher identified specific companies listed on the JSE main board as units of analysis for the study to further the understanding of the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources, using a multi-theoretic contingency framework. The data is described and analysed in more depth, and conclusions are then drawn.

The significance of the research objectives, identified in Section 1.4, must not be understated because these objectives are the driving force behind the research strategy (Saunders *et al.*, 2009). Despite the existence of numerous research strategies, the choice of strategies is constrained by the research approach and research design adopted.

The research methods used to carry out the research strategy are discussed in the next section.

5.5 RESEARCH METHOD

Research methods are the procedures used to collect, analyse and interpret data used in a research study (Creswell, 2014; Leedy & Ormrod, 2015). These methods may be quantitative, qualitative or mixed (Creswell, 2014). The appropriate method for a study depends on whether the researcher intends to predetermine the information to be collected or accepts that information will emerge from study participants as the research progresses (Creswell, 2014; Robson & McCartan, 2016). Predetermined information is suitable for quantitative studies (Creswell, 2014). The information collected in the current study was predetermined using hypotheses. This supports the quantitative research method.

Data collected for quantitative research is typically numerical (Robson & McCartan, 2016). Data may be collected based on an instrument or test when quantitative research methods are used (Antwi & Hamza, 2015; Creswell, 2014). This form of data collection is appropriate when the data to be collected is predetermined (Antwi & Hamza, 2015; Creswell, 2014). In the current study, data was numerical and predetermined based on hypotheses, which resulted in the application of statistical tests. Therefore, the collection of data can be associated with quantitative research methods.

Data analysis may be in the form of statistical analysis or text and image analysis (Robson & McCartan, 2016). Statistical analysis is applicable to quantitative data, when the information to be collected is predetermined. The current research study used statistical analysis, which supports the quantitative research method.

The interpretation of results from data analysis is contingent on the nature of the data collected and the analysis conducted. When quantitative research methods are used for the collection and analysis of data, interpretation of statistical results is required (Creswell, 2014). The findings of research using quantitative methods can typically be generalised to a wider population, represented by the sample of entities included in the study (Antwi & Hamza, 2015; Robson & McCartan, 2016). In the current study, the data was analysed statistically and the interpretation of statistical results was required. This allowed for the findings of the study, which were generated based on a sample of JSE listed companies, to be generalised to a broader population of JSE listed companies. This aligns with the quantitative research method.

5.6 POPULATION AND SAMPLE

According to Cohen, Manion and Morrison (2011), research quality relies not only on the suitability of the selected research approach, research strategy and research method, but also on the appropriateness of the sampling strategy applied. Therefore, the selection of the population and sample that serve as the subject of the study must be carefully considered.

5.6.1 Population

Zikmund, Babin, Carr and Griffin (2009) define the term *population* to mean any complete group of entities that share a common set of characteristics. Therefore, for the purpose of research, the population is the entire group of entities that the researcher intends to study.

As previously mentioned, the main purpose of this study was to further the understanding of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources, using a multi-theoretic contingency framework. Therefore, corporate governance regulations, which are often the driving force behind the characteristics of the board of directors, were taken into account in determining the population of this study.

The JSE listing requirements state that all companies with a primary listing on the JSE main board must comply with certain principles encompassed in the King Report on Corporate Governance for South Africa, while the remaining principles must be implemented according to the relevant application regime (JSE, 2017). Whereas the

King Report on Corporate Governance for South Africa 2002 (King II) required compliance with all its recommendations (IODSA, 2002), the King Report on Corporate Governance for South Africa 2009 (King III) recognised that not all companies were the same and adopted the 'apply or explain' regime for the King III provisions not specifically requiring compliance in terms of the JSE listing requirements (IODSA, 2009; JSE, 2017). Similarly, the King Report on Governance for South Africa 2016 (King IV) acknowledges that corporate governance is not 'one size fits all' and the 'apply and explain' regime is implemented for JSE listed companies with regard to the principles of King IV that are not mandatory in terms of the JSE listing requirements (IODSA, 2016; JSE, 2017). Because King II came into effect on 1 March 2002, the population of this study consisted of all companies listed on the main board of the JSE at 1 March 2002. Data was collected for these companies for the 2002 to 2018 financial years, to the extent that this data was available. King II, King III and King IV were effective at different times during this period. In order to reduce survivorship bias, the sample included companies that delisted or were suspended from the main board of the JSE for no more than one year during the study period. As discussed in Section 5.12.2.1, this did not result in an unbalanced panel because missing values were replaced. Companies listed on the alternative exchange of the JSE (AltX) were excluded from the population and sample of this study owing to the JSE listing requirements being less stringent for companies listed on the AltX than for companies listed on the JSE's main board (JSE, 2017).

Some studies on the relationship between corporate governance and performance specifically excluded companies in the financial services and utilities industries from the population owing to the application of more stringent regulations to these companies (Swartz & Firer, 2005). This will not be the case for this study because many of the corporate governance principles contained in the King Report on Corporate Governance for South Africa are based on agency theory and neglect to give proper consideration to alternative theories such as stewardship theory, resource dependence theory and stakeholder theory. Because this study adopted a multi-theoretic approach, alternative practices to those recommended in the King Report on Corporate Governance for South Africa were relevant. In addition, bearing in mind that this study concerned itself with corporate governance practices rather than compliance with specific corporate governance regulations, it was appropriate to include companies with more stringent corporate governance requirements than those implemented in terms of the King Report on Corporate Governance for South Africa, the JSE listing requirements and the Companies Act No. 71 of 2008. This study also paid attention to the efficiency of value added from intellectual capital, which is particularly prevalent in service industries such as the financial services industry. Furthermore, corporate governance failures were blamed for the 2008 financial crisis, which placed the financial services industry in the spotlight.

5.6.2 Sample

Leedy and Ormrod (2015) define the term *sample* to mean a subset of a population of entities that share common characteristics. Consequently, the sample that forms the subject of the study was drawn from the population selected. This sample was selected on 4 July 2019.

For the purpose of this study, a company was only included in the final sample if it satisfied the following criteria:

- the company was listed before and continued to be listed at 1 March 2002;
- the company had a primary listing on the main board of the JSE;
- the financial data required was available on the *Iress* database or in the company’s annual reports; and
- the company had no more than one year of missing data that was replaced (as discussed in Section 5.12.2.1) owing to a change in financial year-end, voluntary liquidation, suspension, or delisting.

As a result, the sample selected for the current study is presented in Table 5.1. In this study, not only the full sample was analysed, but also the top four industries. These industries were identified in terms of the number of companies in each industry. Therefore, the top four industries were the basic materials, consumer services, financials and industrials industries. The remaining industries were not included in the industry analysis owing to the number of periods exceeding the number of cross-sections, which led to results being unobtainable for some of the empirical work performed.

Table 5.1: Sample composition

Panel A: Sample selection: 2002 to 2018		
	Companies (N)	***Company-year observations (N)***
JSE listed companies as at 4 July 2019	355	6 035
Add: Delisted on or after 1 March 2002	48	816
Less: Listed on or after 1 March 2002	(134)	(2 278)
Less: AltX companies	(47)	(799)
Less: Secondary listings on JSE	(41)	(697)
Less: Insufficient data	(64)	(1 088)
Final sample	117	1 989

Panel B: Johannesburg Stock Exchange industry classification			
	Unique companies (N)	***Company-year observations***	
		(N)	***(%)***
Basic materials	18	306	15
Consumer goods	10	170	9
Consumer services	26	442	22
Financials	23	391	20
Health care	2	34	2
Industrials	31	527	26
Technology	6	102	5
Telecommunications	1	17	1
	117	1 989	100

5.7 DATA SOURCES AND COLLECTION

This study used secondary data (i.e. archival data) drawn from electronic databases, annual or integrated reports of companies and company websites. Secondary data is data that was collected previously for other purposes (Johnston, 2017; Zikmund *et al.*, 2009). Johnston (2017) affirms that secondary data analysis is a valid approach to research, provided it is carried out systematically.

Data relating to the characteristics of the board of directors was primarily obtained from the *Iress* database and the annual or integrated reports of the relevant companies. The *Iress* database is a reputable source of South African company and financial data, considered to provide valid and reliable data. In cases where the data relating to the characteristics of the board of directors was not available on the *Iress* database or in a company's annual reports, reference was made to the company's website to obtain further data. Ownership concentration data was drawn from the well-established and dependable *Refinitiv Eikon* database, which provides company fundamental and financial data for numerous years and several countries, including South Africa. Lastly, financial data required to calculate the measures of efficiency of value added by a company from its total resources (i.e. value added intellectual coefficient (VAIC)), physical capital resources (i.e. capital employed (CEE)) and intellectual capital resources (i.e. intellectual capital efficiency (ICE), consisting of human capital efficiency (HCE) and structural capital efficiency (SCE)), was obtained from the *Iress* database.

5.8 DATA AND VARIABLES

The data collected for this study relates to the dependent, independent and control variables. A description of these variables follows.

5.8.1 Dependent variables (measures of the efficiency of value added by a company from its resources)

The dependent variables of the study are measures of the value created by intellectual capital performance. Intellectual capital is often referred to as the difference between the market and book value of a company (Brennan & Connell, 2000; Dumay, 2012) However, this concept has been challenged owing to the inconsistencies in historical cost accounting for assets and the persistent fluctuation of share prices (Brennan &

Connell, 2000; Dumay, 2012). A further weakness of this measure is the inability to decompose it to measure the individual components of intellectual capital (Brennan & Connell, 2000; Dumay, 2012).

For the purposes of the study, the dependent variable was measured from a stakeholder perspective in terms of the efficiency of value added by the company from its resources. Five measures were used for this purpose: VAIC; CEE; ICE; HCE and SCE. VAIC measures the efficiency of value added by a company from its total resources, whereas CEE, ICE, HCE and SCE are subcomponents of VAIC and represent the value added by a company from its physical capital resources (i.e. capital employed) and intellectual capital resources (i.e. human capital and structural capital).

VAIC, which was developed by Pulic (1998), is a measure of intellectual capital, which is increasingly being used in academic studies as a measure of intellectual capital performance (Firer & Williams, 2003). This measure may be used to monitor and evaluate the efficiency of value added by the company from its total resources (Ho & Williams, 2003). A higher VAIC value implies better efficiency of value added by the company from its total resources (Pulic, 1998). VAIC has three components and can be expressed as the sum of CEE, HCE and SCE. This can be expressed algebraically for company *i* at time *t* as follows:

$$VAIC_{it} = CEE_{it} + HCE_{it} + SCE_{it}$$

where

$CEE_{it} = VA_{it} / CE_{it}$

$HCE_{it} = VA_{it} / HC_{it}$

$SCE_{it} = SC_{it} / VA_{it}$

CE_{it} = capital employed by company *i* at time *t*

= book value of net assets for company *i* at time *t*

HC_{it} = human capital of company *i* at time *t*

= total salaries and wages for company *i* at time *t*

SC_{it} = structural capital of company *i* at time *t*

$= VA_{it} – HC_{it}$

VA_{it} = value added by company *i* at time *t*

ICE is the sum of HCE and SCE and can be expressed mathematically for company *i* at time *t* as follows (Pulic, 2004):

$$ICE_{it} = HCE_{it} + SCE_{it}$$

These calculations were based on the company's value added, which can be expressed algebraically for company *i* at time *t* as the sum of structural capital and human capital (Iazzolino *et al.*, 2014; Pulic, 2008):

$$VA_{it} = SC_{it} + HC_{it}$$

or

$$VA_{it} = P_{it} + D_{it} + A_{it} + HC_{it}$$

where, for company *i* at time *t*:

P_{it} = operating profit

D_{it} = depreciation

A_{it} = amortisation

HC_{it} = total salaries and wages

This means that:

$$SC_{it} = P_{it} + D_{it} + A_{it}$$

$$= EBITDA_{it}$$

where, for company *i* at year *t*:

$EBITDA_{it}$ = earnings before interest, tax, depreciation and amortisation

Companies traditionally sell products or services to customers and receive cash in return. In contrast, the products and services provided by companies in the banking sector of the financials industry are in cash format. For example, banks receive deposits from customers and incur an interest expense on the funds received. These deposits are reflected in the statement of financial position as liabilities owing to creditors and the interest expense is treated as part of operating expenses in the income statement. Banks also extend loans to customers by providing cash to the customers and earn interest from customers as a result of the loans. These loans are treated as debtors in the statement of financial position and the interest earned forms part of operating income.

For the purpose of the calculation of VAIC, structural capital is traditionally equivalent to earnings before interest, tax, depreciation and amortisation (EBITDA). Earnings before interest and tax are equal to operating profit. The *Iress* database does not consider the nature of the business when calculating EBITDA and treats interest in the same way for banks and other businesses. Therefore, the calculation of EBITDA done by *Iress* adjusts earnings to exclude the net interest income or net interest expense irrespective of whether this is for financing or operating purposes. However, the adjustment should only be for non-operating income and expenses. For companies in the banking sector of the financials industry, interest forms part of the net operating profit rather than being a financing income or cost. Because the EBITDA calculated by the *Iress* database excludes the net operating profit attributable to interest for companies in the banking sector, this study adjusted the EBITDA values provided by the *Iress* database for companies in the banking sector to ensure that all operating profit was included as part of structural capital. This was done by adding the net interest income or deducting the net interest expense, which is of an operating nature rather than a financing nature, to the values provided by the *Iress* database for EBITDA.

Dividends are also usually not treated as part of operating profit. However, dividend revenue may form part of operating profit when the core business of a company is investment in equities. In such circumstances, dividend revenue was included as part of the operating profit for the purposes of measuring structural capital (IASB, 1992).

Ståhle *et al.* (2011) criticise the VAIC model owing to the omission of relational capital. Despite these criticisms, the use of VAIC is widely supported for measuring the value of intellectual capital owing to its consistent and standardised form, which enables comparability for a large and diverse sample of companies (Chen *et al.*, 2005; Firer & Williams, 2003). VAIC also overcomes some of the shortcomings of alternative intellectual capital measures, which are often criticised for their subjectivity, by using simple calculations and audited financial information (Firer & Williams, 2003). Examples of studies examining the relationships between the characteristics of the board of directors and intellectual capital performance that apply VAIC as the independent variable are Appuhami and Bhuyan (2015), Ho and Williams (2003), Makki and Lodhi (2014) and Swartz and Firer (2005). CEE (Ho & Williams, 2003) and ICE (Appuhami & Bhuyan, 2015; Ho & Williams, 2003) are also treated as independent variables in a limited number of studies. However, these studies do not consider the relationships between the characteristics of the board of directors and the efficiency of value added by the company from its resources within industries, nor do they investigate the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by the company from its resources.

For the purposes of the current study, the independent variables, which were studied in relation to these dependent variables are now discussed.

5.8.2 Independent variables (characteristics of the board of directors)

As mentioned in Section 1.3, the main purpose of this study was to further the understanding of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources, using a multi-theoretic contingency framework.

The independent variables initially included in this study were based on the existing literature and represent the following specific characteristics of the board of directors:

- absence of chief executive officer (CEO) duality;
- presence of independent non-executive directors;
- size of the board of directors;
- educational-level diversity;
- ethnic diversity; and
- gender diversity.

The characteristics of the board of directors were selected as independent variables in the current study because these attributes contribute to the ability of the board of directors to manage intellectual capital, which has the potential to create value for a company. The specific characteristics selected relate to the independence, size and diversity of the board of directors. All of these characteristics are taken into account in the King IV Report on Corporate Governance for South Africa 2016 (King IV), which acknowledges the importance of effective and efficient intellectual capital management for value creation in South Africa (IODSA, 2016). To add value in a sustainable manner, the focus must be on business strategy and long-term performance rather than disciplinary actions and short-term performance (Aras & Crowther, 2008). Therefore, the strategic role and service role of the directors, which concentrate on long-term performance, are important to value creation. Nevertheless, there is a tendency in King IV to highlight the monitoring and control role of the board of directors and agency theory, which focus on short-term performance, when making recommendations for matters such as independence of the board of directors. This divergence between the understanding of the drivers of sustainable value creation and the recommendations for best practice with regard to corporate governance in South Africa provide a basis for the selected independent variables.

Consideration was given to the inclusion of the best set of independent variables that explained the largest percentage of variation of the dependent variable in the regression models. Backward elimination, which is also known as stepwise backward regression, was used for this purpose. This process begins with the full set of independent variables, as determined based on the literature review. The least statistically significant independent variables are then removed from the model, one at a time, until the adjusted R^2 decreases (Gujarati, 2004; Hair, Black, Babin & Anderson, 2010). R^2 represents the coefficient of determination which ranges between 0 and 1 (Greene, 2012; Hair *et al.*, 2010). The coefficient of determination measures the proportion of the total variance in the dependent variable that is explained by the predictor variables (Greene, 2012). The adjusted R^2 reduces the R^2 value by taking into account the number of predictor variables and the sample size (Hair *et al.*, 2010; Urdan, 2010). When backward elimination is applied, increases in the adjusted R^2 from the removal of an independent variable indicate that the variable does not contribute to the explanatory power of the model.

The full set of independent variables initially included in this study are now discussed further. These variables were measured in accordance with prior studies. Individual characteristics of the board of directors were measured at the end of the relevant financial years for each company included in the sample of this study.

5.8.2.1 Absence of CEO duality

The *absence of CEO duality* is a dummy variable of 1 if the same person serves as CEO and the chair of the board of directors, otherwise 0 (Gaur *et al.*, 2015; Ho & Williams, 2003; Jermias & Gani, 2014).

5.8.2.2 Presence of independent non-executive directors

A director of a company may be classified as executive or non-executive. Non-executive directors may be further categorised as either independent or not independent. The *presence of independent non-executive directors* has two components. Each of these components is considered as a separate variable in the current study. The first component is the percentage of members of the board directors who are non-executive (Ho & Williams, 2003; Pamburai *et al.*, 2015), whereas the second component is the percentage of non-executive members of the board of directors who are independent (Pamburai *et al.*, 2015).

5.8.2.3 Size of the board of directors

Size of the board of directors represents the total number of members on the board of directors (Gaur *et al.*, 2015; Ho & Williams, 2003; Pamburai *et al.*, 2015). This includes executive and non-executive directors. It also includes all non-executive directors, irrespective of whether or not they are independent.

5.8.2.4 Educational-level diversity

The South African Qualifications Authority devised a National Qualifications Framework, which provides a hierarchy of higher education qualifications. The upper levels of this hierarchy include the following categories of higher education qualifications in descending order:

- doctoral degree;
- master's degree;
- honours degree and postgraduate diploma; and
- bachelor's degree.

In the current study, these categories of higher education qualification were supplemented with an additional category indicating 'no qualification'. In the current study, only the highest level of qualification was taken into account for each member of the board of directors of a company for each financial year. The total number of qualifications in each category were then calculated per financial year. Teachman's index was then calculated using this data to reflect the diversity in the levels of higher education qualifications. A higher index value represents greater diversity in educational level. The index value was calculated as follows (Solanas, Selvam, Navarro & Leiva, 2012):

$$T = -\sum_{i=1}^{k} f_i \times \ln f_i$$

where

T	= Teachman's index
k	= number of categories
f_i	= relative frequency of the i^{th} category

The maximum value of Teachman's index was calculated as follows:

$$T = -\ln\left(\frac{1}{k}\right)$$

Since there are five categories of educational level in the current study, the maximum possible value for the Teachman's index for educational-level diversity was 1.609.

5.8.2.5 Ethnic diversity

For the purposes of this study, *ethnic diversity* means Blau's index calculated based on the classification of the members of the board of directors as either black or non-black. In line with the Broad-Based Black Economic Empowerment Amendment Act No. 46 of 2013, the term *black people* means Africans, Coloureds and Indians (Republic of South Africa, 2013a). This classification was used to identify the black and non-black members of the board of directors in the current study. Therefore, ethnic diversity was measured as follows (Solanas *et al.*, 2012):

$$B = 1 - \sum_{i=1}^{k} f_i^2$$

where

B	= Blau's index
k	= number of classifications
f_i	= relative frequency of the i^{th} classification

The minimum value for Blau's index is zero and this occurs when all members of the board of directors fit into the same classification, which results in there being no diversity. Therefore, a higher index value indicates more diversity. The maximum value for Blau's index was calculated as follows:

$$B = \frac{k-1}{k}$$

This value tends towards 1 as the number of classifications increases. In the current study, the maximum possible value of Blau's index for ethnic diversity was 0.5 because there were only two possible classifications.

5.8.2.6 Gender diversity

With regard to gender, members of the board of directors were classified as either male or female. For the purposes of this study, *gender diversity* is measured as Blau's index calculated based on the classification of the members of the board of directors as either male or female. Consequently, Blau's index for gender diversity was calculated as follows (Solanas *et al.*, 2012):

$$B = 1 - \sum_{i=1}^{k} f_i^2$$

where

B	= Blau's index
k	= number of classifications
f_i	= relative frequency of the i^{th} classification

The minimum value for Blau's index is zero and this occurs when all members of the board of directors fit into the same classification, which results in there being no diversity. Therefore, a higher index value indicates more diversity. The maximum value for Blau's index was calculated as follows:

$$B = \frac{k-1}{k}$$

This value tends towards 1 as the number of classifications increases. In the current study, the maximum value of Blau's index for gender diversity was 0.5 because there were only two possible classifications.

5.8.3 Potential moderating variables (ownership concentration measures)

Ownership concentration is first considered as an independent variable and then as a potential moderator in the current study. As discussed in Section 4.2.6, a higher level of ownership concentration is considered as a potential moderator because it is considered to be a corporate governance mechanism that can reduce or aggravate agency problems, which impacts on the resources available for the effective management of intellectual capital by the board of directors. As a result, a higher level of ownership concentration has the potential to impact the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. The ownership concentration variables were measured in accordance with prior studies at the end of the relevant financial years for each company included in the sample of this study.

Various measures were used for *ownership concentration*. The first measure adopted in the current study is the Herfindahl index, calculated based on the percentage ownership of ordinary shares by each shareholder of a company. The other measures used in the preliminary model, specified in Section 5.10.1, are the percentage ownership of ordinary shares by the top shareholder, the top three shareholders and the top five shareholders. These measures are supported by the studies of Gaur *et al.* (2015) and Waheed and Malik (2019), which used the percentage ownership of ordinary shares by the top shareholder and top five shareholders, respectively. Hu and Izumida (2008) used more than one measure of ownership concentration by including both the combined common equity owned by the ten largest and five largest shareholders. There is no consensus on the most suitable measure of ownership concentration and even though Mavruk, Overland and Sjögren (2020) identify 20 different measures of ownership concentration, including the Herfindahl index, the voting rights of the largest shareholder and the voting rights of the largest five shareholders, these measures are not exhaustive.

Studies on performance that used top shareholdings as a measure of ownership concentration include Demsetz and Lehn (1985), Demsetz and Villalonga (2001) and McConnell and Servaes (1990). According to Yasser and Al Mamun (2015), shareholdings by the largest shareholder, two largest shareholders, three largest shareholders and five largest shareholders are common measures of ownership concentration. Using principal component analysis, Mavruk *et al.* (2020) identified the shareholdings by the largest and five largest shareholders to be associated with incentives for improved monitoring by a company's management. Ownership concentration measures based on large shareholdings do not consider the magnitude and dispersion of the remaining shareholdings, which play an important role in determining control. This differs from the Herfindahl index, which accounts for the number of shareholders and the size of each shareholding (Rhoades, 1993). However, it was unclear from the principal component analysis conducted by Mavruk *et al.* (2020) whether the Herfindahl index was better suited to the principal-agent agency problem, which deals with the misalignment of the interests of a company's management and shareholders, or the principal-principal agency problem, which deals with the misalignment of the interests of the majority and minority shareholders.

The use of more than one measure of ownership concentration is also supported by some studies relating ownership concentration to performance (Demsetz & Lehn, 1985; Earle, Kucsera & Telegdy, 2005; Yasser & Al Mamun, 2015). Mavruk *et al.* (2020) used the Herfindahl index in conjunction with top shareholding measures. In the current study, the Herfindahl index was used in conjunction with the shareholdings of the largest shareholder, the largest three shareholders and the largest five shareholders. These four measures of ownership concentration were all included in the preliminary model, presented in Section 5.10.1, and a revised model was specified after conducting a correlation analysis of these variables.

The Herfindahl index is a statistical measure of concentration, which can be used to measure concentration in a variety of contexts (Rhoades, 1993). In accordance with Céspedes, González and Molina (2010), the Herfindahl index was calculated as the sum of the squares of the percentage shareholding held by each individual shareholder in a company and can be represented as follows:

$$HI = \sum_{i=1}^{n}(SH_i)^2$$

where

HI	= Herfindahl index
n	= number of ordinary shareholders of the company
SH_i	= percentage shareholding of ordinary shares in the company

For each company, the Herfindahl index accounts for the number of ordinary shareholders and the relative size of each shareholding (Rhoades, 1993). This can be illustrated with an example. A company (Company X) with only two shareholders who have equivalent shareholdings has a Herfindahl index of 5 000 (= $50^2 + 50^2$). Another company (Company Y) with four shareholders holding 50%, 30%, 15% and 5%, respectively, has a Herfindahl index of 3 650 (= $50^2 + 30^2 + 15^2 + 5^2$). Therefore, Company X, which has only two shareholders with a shareholding of 50% each, has a larger Herfindahl index than that of Company Y, which has 50% of its shares owned by a single shareholder and the remaining 50% dispersed between three shareholders. This indicates that a larger Herfindahl index is associated with a higher level of ownership concentration. The maximum possible value for the Herfindahl index is 10 000 (= 100^2) and this occurs when a company has a single shareholder owning 100% of its ordinary shares. The lowest possible value for the Herfindahl index approaches zero and arises when there are numerous shareholders, each with a very small shareholding percentage of the ordinary shares of a company (Rhoades, 1993).

5.8.4 Control variables

This study initially adopted the following control variables, which are widely used in the literature dealing with the relationships between the characteristics of the board of directors and intellectual capital performance (Appuhami & Bhuyan, 2015; Ho & Williams, 2003; Swartz & Firer, 2005):

- company size;
- dividend yield;
- return on assets; and
- leverage.

In addition to these control variables, studies specifically examining the relationships of ownership concentration, the characteristics of the board of directors and performance also considered managerial ownership or institutional ownership as a control variable. Gaur *et al.* (2015) included managerial ownership as a control variable owing to a higher level of ownership by top management leading to a reduction in agency problems, whereas Waheed and Malik (2019) used institutional ownership as a control variable owing to increased institutional ownership reducing agency problems. In both cases, the reason given for inclusion was the alignment of the interests of managers and shareholders owing to the reduction in agency costs (Gaur *et al.*, 2015; Waheed & Malik, 2019). In the current study, director ownership was initially adopted as a control variable for the same reason. Using a sample of 169 companies listed on the JSE in South Africa from 2002 to 2007, Ntim (2013b) found that companies with a higher level of total ownership by all members of the board of directors (executive and non-executive) also had a higher level of performance. In contrast, companies with a higher level of ownership by executive directors had a lower level of performance. Ntim (2013b) used Tobin's Q as the primary measure of performance and tested the robustness of the results with return on assets and total shareholder return as alternative measures of performance. This suggests that an increased level of share ownership by the entire board of directors is positively related to improved performance for companies listed on the JSE in South Africa.

The initial selection of control variables was drawn from the literature and these were all included in the preliminary model for the current study, as specified in Section 5.10.1. According to Spector and Brannick (2011), researchers should not blindly include control variables in a study. Therefore, the control variables were subsequently narrowed down based on Pearson correlation analysis, which was conducted between the dependent variables and the control variables, as well as between the different control variables. The Pearson correlation coefficient is one of the most widely used statistics (Ratner, 2009). It assumes a linear relationship between the two variables under consideration, both of which must be continuous variables (Urdan, 2010). The correlation coefficient indicates whether, on average, there is an association between two variables. In the case of a weak correlation between the control variable and the dependent variable, the association between the variation in the values on the control variable and the variations in the values on the dependent variable is poor (Urdan, 2010). Therefore, the control variables included in the preliminary model in the current study were subsequently reduced to exclude those with the weakest association with the dependent variables. Correlation coefficient values between -0.3 and 0.3 indicated a weak linear relationship (Ratner, 2009). In addition, very strong correlations (less than -0.8 or more than 0.8) between two different control variables indicated that these variables potentially served as proxies for each other. The control variables that had the lowest correlations with the dependent variable were consequently removed from the preliminary model to derive the revised model.

5.8.4.1 Company size

In the current study, c*ompany size* was measured using the natural log of total assets at year-end (Al-Musali & Ku Ismail, 2015; Jermias & Gani, 2014; Pamburai *et al.*, 2015). This controls for variations in company size (Jermias & Gani, 2014; Pamburai *et al.*, 2015).

5.8.4.2 Dividend yield

Dividend yield signified the ordinary dividends per share as a percentage of the share price at year-end (Ho & Williams, 2003; Vafeas & Theodorou, 1998). This represents dividend policy.

5.8.4.3 Return on assets

For the purposes of this study, the term *return on assets* represents the company's profitability and is the ratio of operating profit to total assets at year-end (Ho & Williams, 2003; Ntim, 2013a). This is a measure of financial performance.

5.8.4.4 Leverage

Leverage was measured as the total debt divided by total shareholders' equity at year-end (Ho & Williams, 2003). This controls for differences in capital structure and capital management, which forms an important part of a company's strategic direction (Tarus & Aime, 2014). Because providers of debt can control management actions (Jensen & Meckling, 1976), leverage may impact on the roles adopted by the board of directors and the potential for value creation.

5.8.4.5 Director ownership

For the purposes of this study, *director ownership* was represented by the percentage of a company's total number of ordinary shares held by the members of the board of that company (Gul & Tsui, 2001; Ho & Williams, 2003). Direct and indirect interests of both the executive and non-executive members of a company's board of directors were used to measure director ownership. The inclusion of both direct and indirect shareholdings to measure ownership interests is supported by La Porta, Lopez-de-Silanes, Shleifer and Vishny (2002).

Not only is the measurement of the independent variables, dependent variables and control variables important, but also the validity and reliability of these measures. This is discussed further in the sections that follow.

5.9 DATA VALIDITY AND RELIABILITY

The validity and reliability of the data collected are imperative because these factors determine the extent to which the researcher can draw meaningful conclusions from the data analysis (Leedy & Ormrod, 2015). The term *validity* refers to the extent to which a variable measures what it is intended to measure (Leedy & Ormrod, 2015; Robson & McCartan, 2016; Saunders *et al.*, 2009). The validity of a variable is dependent on the particular context (Leedy & Ormrod, 2015). The term *reliability* means the consistency with which a variable produces a result when the entity being measured has remained unchanged (Leedy & Ormrod, 2015; Saunders *et al.*, 2009).

The literature review identified suitable measures for the variables in this study. This enhances the validity of the data because other studies have given credibility to these measures. In addition, secondary data of a quantitative nature was used in this study. Therefore, the researcher was able to apply an objective state of mind when collecting the data. No manipulation nor interpretation of the data took place during collection. This further increases the validity of the data, owing to the avoidance of bias. Furthermore, the extent to which the dataset covers the target population, time frame and variables under consideration is important for validity (Saunders *et al.*, 2009). In the current study, coverage was achieved because secondary data was obtained from databases and publically available annual reports that include data for the variables under consideration for companies listed on the main board of the JSE for the period 2002 to 2018.

The reliability of data may be enhanced by standardising the measure of a variable for all entities (Leedy & Ormrod, 2015). In the current study, secondary financial data was drawn from the *Iress* database and *Refinitiv Eikon* database, which standardise the measurement of data. For example, all data quoted in a currency other than South

African rands is converted to South African rands on the *Iress* database. In addition, any data quoted for a period shorter or longer than a full financial year is annualised on the database. Furthermore, standardised formulae are used to calculate financial data such as ratios. With regard to the characteristics of the board of directors, criteria were established for the collection of data from company annual reports. These criteria are described in Section 5.8, which details the variables used in this study. The data presented in the annual reports of JSE listed companies is also standardised owing to regulations included in the JSE listing requirements, International Financial Reporting Standards, South African Companies Act and the King Report on Corporate Governance for South Africa. Where data was not available in the annual reports, further data was obtained from the *Iress* database and the company's website.

The source of secondary data is important for its reliability and validity, and is determined based on the reputation and authority of the source (Saunders *et al.*, 2009). Secondary data from large, well-known organisations is likely to be reliable and valid because the sustainability of these organisations depends on their credibility. The *Iress* database and the *Refinitiv Eikon* database are both reputable databases including company and financial data for JSE listed companies and are widely used for research purposes.

Efforts were made to ensure the accuracy and completeness of the secondary data collected. For example, a sample of data collected from the *Iress* database was agreed to the annual reports to ensure accuracy. Where no value was available for a variable for a company, this was confirmed by reviewing the annual reports. In addition, reasonability checks were performed when collecting data on the characteristics of the board of directors from the annual reports by comparing data from year-to-year, as data was collected for multiple periods.

5.10 PRELIMINARY RESEARCH MODEL

The preliminary research model was derived based on the hypotheses set out in Chapter 4 and the variables described in Section 5.8. The variables used in the model specifications are summarised in Table 5.2. α_0 is the constant term, each β is a coefficient in the regression model and ε is the error term. A revised version of Model 1 is derived in the data analysis in Chapter 6.

Table 5.2: Summary of variables used in preliminary model specifications

Variable	***Description***	***Definition/ Calculation***
Dependent variables		
VAIC	Value added intellectual coefficient	CEE + ICE
CEE	Capital employed efficiency	(Salaries and wages + Earnings before interest, taxation, depreciation and amortisation) / Book value of net assets
ICE	Intellectual capital efficiency	HCE + SCE
HCE	Human capital efficiency	(Salaries and wages + Earnings before interest, taxation, depreciation and amortisation) / Salaries and wages
SCE	Structural capital efficiency	Earnings before interest, taxation, depreciation and amortisation / (Salaries and wages + Earnings before interest, taxation, depreciation and amortisation)
		VAIC, CEE, ICE, HCE and SCE measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively.
Potential moderating variables (Ownership concentration)		
HERF	Herfindahl index based on percentage shareholdings	Sum of the squares of the percentage shareholding held by each shareholder
TOP1	Percentage shareholding of top shareholder	% shareholdings of the top shareholder
TOP3	Percentage shareholding of top three shareholders	Sum of the % shareholdings of the top three shareholders
TOP5	Percentage shareholding of top five shareholders	Sum of the % shareholdings of the top five shareholders
Independent variables (Characteristics of the board of directors)		
NONDUAL	Absence of CEO duality	Dummy variable of 1 if the same person serves as CEO and chair of the board of directors, otherwise 0
NONEXEC	Percentage of board members who are non-executive	Number of non-executive board members / Number of board members
IND	Percentage of non-executive board members who are independent	Number of independent board members / Number of non-executive board members
BSIZE	Board size	Number of board members
EDUDIV	Educational-level diversity	Teachman's index based on the number of board members with a doctoral degree, master's degree, honours degree/postgraduate diploma, bachelor's degree or no qualification as their highest level of qualification
EDIV	Ethnic diversity	Blau's index based on number of black and non-black board members
GDIV	Gender diversity	Blau's index based on number of male and female board members
Control variables		
CSIZE	Company size	Natural log of total assets at year-end
DY	Dividend yield	Ordinary dividends per share as a percentage of the share price at year-end
ROA	Return on assets	Operating profit / Total assets (at year-end)
LEV	Leverage	Total debt / Total shareholders' equity (at year-end)
DIROWN	Director ownership	Percentage of total number of ordinary shares held by the board members

5.10.1 Model 1 (excluding interaction terms)

Model 1 in the current study deals with Hypotheses H_1 to H_8, which posit relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources. It contains no interaction terms and is specified separately for each of the five dependent variables. This study used the following model specifications for Model 1 for company *i* at period *t*:

Model 1a

$$VAIC_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP1_{it} + \beta_3 TOP3_{it} + \beta_4 TOP5_{it} + \beta_5 NONDUAL_{it} + \beta_6 NONEXEC_{it} + \beta_7 IND_{it} + \beta_8 BSIZE_{it} + \beta_9 EDUDIV_{it} + \beta_{10} EDIV_{it} + \beta_{11} GDIV_{it} + \beta_{12} CSIZE_{it} + \beta_{13} DY_{it} + \beta_{14} ROA_{it} + \beta_{15} LEV_{it} + \beta_{16} DIROWN_{it} + \varepsilon_{it}$$

Model 1b

$$CEE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP1_{it} + \beta_3 TOP3_{it} + \beta_4 TOP5_{it} + \beta_5 NONDUAL_{it} + \beta_6 NONEXEC_{it} + \beta_7 IND_{it} + \beta_8 BSIZE_{it} + \beta_9 EDUDIV_{it} + \beta_{10} EDIV_{it} + \beta_{11} GDIV_{it} + \beta_{12} CSIZE_{it} + \beta_{13} DY_{it} + \beta_{14} ROA_{it} + \beta_{15} LEV_{it} + \beta_{16} DIROWN_{it} + \varepsilon_{it}$$

Model 1c

$$ICE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP1_{it} + \beta_3 TOP3_{it} + \beta_4 TOP5_{it} + \beta_5 NONDUAL_{it} + \beta_6 NONEXEC_{it} + \beta_7 IND_{it} + \beta_8 BSIZE_{it} + \beta_9 EDUDIV_{it} + \beta_{10} EDIV_{it} + \beta_{11} GDIV_{it} + \beta_{12} CSIZE_{it} + \beta_{13} DY_{it} + \beta_{14} ROA_{it} + \beta_{15} LEV_{it} + \beta_{16} DIROWN_{it} + \varepsilon_{it}$$

Model 1d

$$HCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP1_{it} + \beta_3 TOP3_{it} + \beta_4 TOP5_{it} + \beta_5 NONDUAL_{it} + \beta_6 NONEXEC_{it} + \beta_7 IND_{it} + \beta_8 BSIZE_{it} + \beta_9 EDUDIV_{it} + \beta_{10} EDIV_{it} + \beta_{11} GDIV_{it} + \beta_{12} CSIZE_{it} + \beta_{13} DY_{it} + \beta_{14} ROA_{it} + \beta_{15} LEV_{it} + \beta_{16} DIROWN_{it} + \varepsilon_{it}$$

Model 1e

$$SCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP1_{it} + \beta_3 TOP3_{it} + \beta_4 TOP5_{it} + \beta_5 NONDUAL_{it} + \beta_6 NONEXEC_{it} + \beta_7 IND_{it} + \beta_8 BSIZE_{it} + \beta_9 EDUDIV_{it} + \beta_{10} EDIV_{it} + \beta_{11} GDIV_{it} + \beta_{12} CSIZE_{it} + \beta_{13} DY_{it} + \beta_{14} ROA_{it} + \beta_{15} LEV_{it} + \beta_{16} DIROWN_{it} + \varepsilon_{it}$$

Table 5.3 summarises how the research model specifications for Models 1a to 1e relate to the hypotheses stated in Section 4.3. Hypotheses H_1[1] to H_8 posit the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources.

Table 5.3: Summary associating the preliminary research model for Model 1 with the hypotheses for the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources

Coefficient	*Variable notation*	*Hypothesis*	*Expected sign of coefficient*	*Variables to be tested for a relationship with the efficiency of value added by a company from its resources*
β_1	HERF	$H_{1.1}$	+/-	Ownership concentration
β_2	TOP1	$H_{1.2}$	+/-	Ownership concentration
β_3	TOP3	$H_{1.3}$	+/-	Ownership concentration
β_4	TOP5	$H_{1.4}$	+/-	Ownership concentration
β_5	NONDUAL	H_2	+/-	Absence of CEO duality
β_6	NONEXEC	H_3	+/-	Percentage of members of the board of directors who are non-executive
β_7	IND	H_4	+/-	Percentage of non-executive members of the board of directors who are independent
β_8	BSIZE	H_5	+/-	Size of the board of directors
β_9	EDUDIV	H_6	+	Educational-level diversity
β_{10}	EDIV	H_7	+	Ethnic diversity
β_{11}	GDIV	H_8	+	Gender diversity

[1] Hypothesis H_1, which proposes a relationship between ownership concentration and the efficiency of value added by a company from its resources, is denoted as $H_{1.1}$ when the Herfindahl index is used to measure ownership concentration; $H_{1.2}$ when the largest shareholding is used to measure ownership concentration; $H_{1.3}$ when the largest three shareholdings are used to measure ownership concentration; and $H_{1.4}$ when the largest five shareholdings are used to measure ownership concentration.

5.10.2 Model 2 (including interaction terms)

Model 2 in the current study deals with Hypothesis H_9, which proposes that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources are moderated by a higher level of ownership concentration. The moderating effect arises owing to a higher level of ownership concentration reducing or aggravating the agency problem, which impacts the availability of resources for the effective management of intellectual capital by the board of directors. The moderating effect is discussed in more detail in Section 4.2.6. Therefore, Model 2 is an extension of Model 1 and is only specified after revising Model 1. For the purposes of Model 2, the data for the continuous ownership concentration and independent variables are standardised in order to minimise the issues arising from multicollinearity before creating the interaction terms that are used to test for the existence of a moderation effect (Aguinis, Gottfredson & Culpepper, 2013; Frazier, Tix & Barron, 2004). A more detailed discussion of interaction terms and effects follows.

5.11 INTERACTION TERMS AND EFFECTS

To deal with Hypothesis H_9, which proposes that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources are moderated by a higher level of ownership concentration, interaction terms are introduced into the regression model. As discussed in Section 4.2.6, ownership concentration is considered as a potential moderator in the current study because a higher level of ownership concentration is considered to be a corporate governance mechanism that can reduce or aggravate agency problems. As a result, a higher level of ownership concentration has the potential to impact the availability of resources for the effective management of intellectual capital by the board of directors. Therefore, a higher level of ownership concentration may influence the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. A moderator alters the strength or direction of the relationship between an independent variable and a dependent variable (Rose, Holmbeck, Coakley & Franks, 2004). This may be referred to as a moderation effect and is a special case of an interaction effect. Although the statistical procedures to analyse interaction effects and moderation effects are the same, the interpretation of the results is different. The concept of the interaction effect was introduced by Saunders (1956). In a multiple regression model with two continuous independent variables (X and Z) and a continuous dependent variable (Y), the additive model specification is commonly expressed as:

$$Y = \alpha_0 + \beta_1 X + \beta_2 Z + \varepsilon$$

where

α_0	= the constant term
β_1	= the coefficient of X
β_2	= the coefficient of Z
ε	= the error term

In order to test for an interaction effect, an additional term is introduced to this model. This is commonly referred to as the interaction term and is the product of X and Z. The model including the interaction effect takes the following form:

$$Y = \alpha_0 + c_1 X + c_2 Z + \beta_3 XZ + \varepsilon$$

These models also apply to the moderation effect. However, the interpretation of interaction effects and moderation effects differs. For interaction effects, X and Z have equal standing as independent variables and the effect of the interaction between these variables (XZ) is considered to be non-linear. In contrast, for moderation effects, X is the primary independent variable in the model, and the moderator variable (Z) refines the relationship between X and Y by changing the strength or direction of this relationship (Hair *et al.*, 2010; Wu & Zumbo, 2008). For both interaction effects and moderation effects, an interaction term is created by multiplying X and Z. It is possible to test for a moderating effect despite empirically finding that a hypothesised relationship between the independent variable and dependent variable is weak or not statistically significant (Baron & Kenny, 1986; Frazier *et al.*, 2004). If a moderation effect is confirmed, a plot is drafted to illustrate the relationship between the independent variable and dependent variable at different levels of the moderator to gain insight into how the moderator variable influences the relationship between the independent variable and dependent variable (Wu & Zumbo, 2008). In the current study, the moderator variables (ownership concentration variables) are continuous variables. Therefore, levels are created for the ownership concentration variables by categorising all values above the median as high and all values below the median as low. In the case of an interaction term with a statistically significant β coefficient, the relationship between the independent variable and the dependent variable is then plotted for both high and low ownership concentration levels, which allows for comparison of the direction and extent of the plotted regression lines. When the moderation effect is statistically significant, there is no need to interpret the separate main effects of the moderator variable and the independent variables on the dependent variable. In such a case, analysing the main effects is not meaningful because the relationship between the independent variable and the dependent variable is not unique, but rather varies according to the level of the moderator variable (Aguinis, Edwards & Bradley, 2017).

In a moderated multiple regression model, multicollinearity does not arise from the data used, but rather from creating an interaction term as the product of at least two predictor variables (Aguinis *et al.*, 2017; McClelland, Irwin, Disatnik & Sivan, 2017; Shieh, 2010). Consequently, McClelland *et al.* (2017) maintain that data transformations may be used to reduce or remove this type of multicollinearity. Data is often mean-centred or standardised in order to minimise the issues arising from multicollinearity (Aguinis *et al.*, 2013; Frazier *et al.*, 2004). In the current study, the data was standardised before calculating the interaction terms. Nevertheless, Aguinis *et al.* (2017) explain that multicollinearity arising from the correlation of the interaction term (XZ) with the predictor variables (X and Z) is not a problem, provided that X, Z and XZ coexist as predictors in the regression model. This results in the moderation test not including XZ in its original form, but rather as the partialed XZ product, which is not correlated with X and Z (Dalal & Zickar, 2012). According to Cohen (1978), the only effect that this has on the regression results is that the regression coefficients are rescaled.

The standardisation of a variable results in that variable having a mean of zero and a standard deviation of 1. The standardised observation values for each variable were calculated as z-scores, as follows (Urdan, 2010):

$$z = \frac{X - \mu}{\sigma}$$

where:

z = z-score for the company-year observation

X = value of the company-year observation

μ = mean for the specific variable across the sample

σ = standard deviation for the specific variable across the sample

5.12 DATA ANALYSIS

The data analysis was done using the *IBM SPSS* and *EViews 12* software packages. Keeping in mind the variables described in Section 5.8 and the research model established in Section 5.10, the data analysis procedures are explained in this section with regard to outliers, panel data regression analysis and the estimation method.

5.12.1 Outliers

Multiple linear regression equations assume that the relationship between the dependent and independent variables is linear (Saunders *et al.*, 2009). This assumption may be violated if isolated cases of extreme values arise for variables. These extreme values are referred to as outliers (Saunders *et al.*, 2009; Urdan, 2010). Outliers may influence the mean of a distribution, but will not have any effect on the median (Urdan, 2010). Therefore, outliers may result in a distribution that is skewed towards the tail containing the outlier.

Three ways to deal with outliers have been identified. Firstly, they may be retained and treated as any other observation (Huck, 2012), secondly, they may be removed from the sample (Huck, 2012; Lusk, Halperin & Heilig, 2011), and thirdly, they may be winsorised (Huck, 2012; Lusk *et al.*, 2011). Care must be taken when retaining outliers in a dataset because this may distort the test results. Similarly, caution should be taken when removing outliers from a dataset because these may be valid observations of particular interest to the researcher (Huck, 2012). When an outlier is winsorised, the value of the outlier is modified in order to bring it closer to the other sample values. In the current study, the outliers were neither retained nor removed, but rather winsorised. Additionally, consideration was given to conducting the regressions on both winsorised and unwinsorised data. However, only winsorised data was used for the final conclusions, after assessing the application of the ordinary least squares (OLS) regression, robust regression and quantile regression methods to the unwinsorised data.

5.12.2 Panel data regression analysis

This study used panel data regression analysis to investigate the relationships between the characteristics of the board of directors and the efficiency of value added to a company by its resources. Panel data combines data for a cross-section of entities with time series data (Baltagi, 2008). This study used panel data, as it examined time series data for the period extending from 2002 to 2018 for a cross-section of companies. The use of panel data has various advantages (Baltagi, 2008; Klevmarken, 1989). Firstly, panel data suggests that entities, such as companies, are heterogeneous. This differs from time series and cross-section data, which could lead to biased results if controls are not implemented to deal with heterogeneity. Secondly, studies using panel data are able to identify and measure effects that are not evident with the use of only time series or cross-section data. Thirdly, panel data enables the study of more complicated behavioural models. Lastly, panel data is better able to study the dynamics of adjustment.

5.12.2.1 Missing data

For panel data regression analysis, it is important to consider whether the panels of data are balanced or unbalanced. For a balanced panel, the data must include observations with respect to each variable for each panel member for every period under consideration (Baltagi, 2008; Greene, 2012; Robson & McCartan, 2016). Two approaches exist for dealing with missing observations (Baltagi, 2008). The first is to replace the missing data with an inferred value, such as the mean or median of available data or an imputed value (Baltagi, 2008; Robson & McCartan, 2016). Caution must be taken not to be too liberal when replacing observations, as this may reduce the variability of the data and the frequency distribution may be distorted. The alternative approach is to exclude panel members with missing data when selecting the sample to be studied (Baltagi, 2008; Greene, 2012). This approach is appropriate when data is missing completely at random (Greene, 2012). The impact on sample size should be considered when excluding panel members to ensure that meaningful results may be drawn from the research. In the current study, the first approach was adopted in the case of companies with not more than one year of missing data owing to a change in financial year-end, suspension or voluntary liquidation between the 2002 and 2017 financial years. The missing data was replaced with the average of the data for the relevant variable in the year immediately preceding and the year immediately following the year in which the data was missing. Data was imputed for companies that were missing data for the 2018 year. This data was calculated by adjusting the company’s 2017 observations for the average year-on-year growth rate of the observations for the 2002 to 2017 years. Less than 5% of the data required replacement. Replacing the missing values resulted in a balanced panel. Companies missing more than one year of data or missing a year of data for reasons other than a change in financial year-end, suspension, voluntary liquidation or delisting were not included in the sample of the study.

5.12.2.2 Assumptions of multiple linear regression models

The following assumptions of multiple linear regression models were considered:

- ***Assumption: No autocorrelation.*** Autocorrelation refers to the situation where the error term is correlated across time (De Jager, 2008). Ignoring the presence of autocorrelation leads to consistent, but inefficient estimates of the regression coefficients and biased standard errors (Baltagi, 2008). The Durbin-Watson test was done in this study to test for the presence of autocorrelation.
- ***Assumption: Homogeneity of residuals*.** The assumption states that regression disturbances are homoscedastic with the same variance across time and entities (Baltagi, 2008). According to Baltagi (2008), this assumption may be limiting for entities of varying sizes that may display different variation. The Breusch-Pagan-Godfrey test was done to test for heteroscedasticity where possible. Alternatively, estimation methods were adopted that dealt with potential heteroscedasticity.
- ***Assumption: Stationarity.*** Time series that display stationarity have properties that do not depend on the time at which the series is observed (Von Sachs & Neumann, 2000). Therefore, time series with trends or seasonality do not display stationarity. Stationarity in panel data avoids the problem of spurious regression, whereas non-stationarity in panel data may lead to biased standard errors and meaningless results (Greene, 2012; Jewell, Lee, Tieslau & Strazicich, 2003). The Levin, Lin and Chu Test was used in this study to test whether the variables were stationary. This test is a panel unit root test that is more powerful than the performance of separate unit root tests for each cross-section (Baltagi, 2008).
- ***Assumption: Residuals are normally distributed.*** Regression analysis assumes a normal distribution of data. Skewness and kurtosis are terms used to describe the distribution of data (Urdan, 2010). A distribution deviates from the bell curve shape if the data is gathered at one end of the curve and a small number of observations pull the tail on the other end of the curve. This is

referred to as skewness and causes the accuracy of the probabilities, based on the normal distribution, to be distorted. Kurtosis refers to the height of the distribution and indicates the percentage of scores near the mean. The acceptable range of values for skewness is between -2 and 2; and for kurtosis, it is between -7 and 7 (Hair *et al.*, 2010). For kurtosis, it is necessary to deduct 3 from the kurtosis results provided by *EViews* before comparing the kurtosis value to the acceptable range of values. However, according to Schmidt and Finan (2018), a violation of the assumption of normally distributed residuals in regression analysis has no influence on bias and does not substantially impact the regression results in the presence of large sample sizes.

- ***Assumption: Multicollinearity.*** A strong correlation between continuous independent variables is referred to as multicollinearity (Urdan, 2010). The existence of multicollinearity in multiple regression analysis may result in difficulty to identify the distinct relationship between each independent variable and the dependent variable (Saunders *et al.*, 2009) and influence the standard error. Following the approach of prior studies on the relationships between corporate governance factors and performance, Pearson correlation and variance inflation factor analysis were conducted to test for multicollinearity (Ho & Williams, 2003; Pamburai *et al.*, 2015; Vafeas & Theodorou, 1998).

5.12.2.3 Regression model considerations

With regard to the regression models, consideration was given to fixed and random effects, seemingly unrelated regressions (SUR) and endogeneity.

Fixed and random effects

The fixed effects model and the random effects model are commonly applied to regression analysis using panel data (Greene, 2012; Gujarati, 2004). Nevertheless, these models are not prescribed and the decision to apply these models depends on the specifics of each individual study.

The majority of panel data applications use a one-way error component model for the error term, which consists of two parts: an unobservable individual-specific effect and any remaining error (Baltagi, 2008). The two dominant approaches for dealing with heterogeneity are the fixed effects and random effects panel data regression models (Clark & Linzer, 2015). These two approaches are distinguished by the nature of unobservable individual-specific effects that form part of the error term. In the fixed effects model, this effect is constant, whereas in the random effects model, this effect is random (Baltagi, 2008). The Hausman test is conducted to determine whether the fixed effects model or the random effects model should be used. The fixed effects model is considered appropriate if the sample consists of a specific set of companies, whereas the random effects model is appropriate when a sample of entities is selected randomly from a large population (Baltagi, 2008). Taking into consideration that the sample of this study was comprised of a specific set of companies, the fixed effects model may appear to be suitable for this study. However, the Hausman test was used to determine the appropriateness of the fixed effects or random effects models.

Seemingly unrelated regressions (SUR)

For a system of equations, the application of Zellner's (1962) SUR model is more efficient than using the least squares method for individual equations owing to the correlation of disturbances across equations (Baltagi, 2008). The SUR model is referred to as such because the equations appear to be unrelated (Wooldridge, 2002). However, the equations are associated by contemporaneous correlations across the errors in different equations (Wooldridge, 2002; Zellner, 1962). The assumptions underlying the SUR model are as follows (Marshall & Young, 2003):

- all disturbances have a zero mean;
- each cross-section may have a different variance, but the disturbance variance is constant across time for a given cross-section;
- two disturbances relating to the same time period, but different cross-sections are correlated; and
- disturbances in different time periods are not correlated, irrespective of whether or not they correspond to the same cross-section.

The panel data model can be formulated as a SUR model with common coefficients and with each period represented by a separate equation (Greene, 2012). The period SUR model corrects for heteroscedasticity and autocorrelation of observations within a given cross-section (Zellner, 1962). The estimated generalised least squares (EGLS) method, which is also known as the feasible generalised least squares method, is used when period SUR models are applied.

Another approach to deal with heteroscedasticity is the White method for calculating robust standard error and covariance estimates (White, 1980). A compelling feature of the White method is its robustness to unknown heteroscedasticity (Greene, 2012). White (diagonal) standard errors and covariance estimation methods were used in conjunction with the period SUR model in the current study. This is a robust method for computing coefficient standard errors and is suitable for unstructured heteroscedasticity and robust covariances. It is robust to observation-specific heteroscedasticity in the error terms, but not to correlation between residuals for different observations.

Endogeneity

Wintoki *et al.* (2012) recognise that endogeneity may be a problem in studies examining the relationships between corporate governance factors and performance. Instrumental variables are often used to resolve endogeneity problems (Love, 2010). However, it is generally not possible to obtain data for such variables, which should ideally not be directly related to performance (Wintoki *et al.*, 2012). Past research has not established a convincing causal relationship between corporate governance and performance (Love, 2010). Owing to the difficulty of obtaining data for ideal instrumental variables, this study did not adopt any instrumental variables.

Consideration was also given to whether lagged variables should be added to the model specification in order to resolve the endogeneity issue. The inclusion of lagged variables allows for the application of the dynamic panel generalised method of moments estimation method (Wintoki *et al.*, 2012). However, an examination of scatter plots for the dependent and independent variables, as well as an investigation of the use of lagged variables in the model, did not warrant the use of a lagged term.

5.12.3 Estimation method

The panel least squares estimation method, which applies OLS to panel data, was not the model of choice in the current study owing to the violation of some of the underlying assumptions. In particular, autocorrelation is evident from the Durbin-Watson statistic. Potential heteroscedasticity is also a problem. According to Wooldridge (2002), when the OLS assumptions are violated, an EGLS method is favoured over the panel least squares estimation method. Consequently, the EGLS estimation method was considered to be more appropriate. This estimation method was applied in the current study, with period SUR weightings and using White (diagonal) standard errors and covariance methods. The EGLS estimation method was also applied by Gaur *et al.* (2015) in a study that aimed to enhance the understanding of the relationships between corporate governance mechanisms and financial performance using a contingency framework. However, rather than applying period SUR weightings and using White (diagonal) standard errors and covariance methods, Gaur *et al.* (2015) used random effects estimation. Gujarati (2004) points out that the EGLS estimation method is insensitive to the presence of outliers and heteroscedasticity. Gaur *et al.* (2015) reiterate the benefit relevant to heteroscedasticity and identify further benefits from the EGLS estimation method, including that it corrects for the presence of autocorrelation and omitted variable bias in pooled time series data. Therefore, the inefficiencies of the panel least squares method are resolved by the EGLS method.

5.13 ETHICAL CONSIDERATIONS

The term *ethics* refers to rules of conduct and is often presented in a code, which indicates what is considered to be acceptable behaviour (Robson & McCartan, 2016; Saunders *et al.*, 2009). Ethical issues were considered throughout the research design, research collection and research analysis and concluding phases of this study. Ethical clearance was obtained from the Faculty of Management and Economic

Sciences at the University of Pretoria to conduct this study. According to Robson and McCartan (2016), anonymity and privacy is an important aspect of ethics. Therefore, data was not published in this study in a form that would specifically identify the entity to which it relates.

5.14 CHAPTER CONCLUSION

Taking into account the main purpose of this study, the relevant characteristics of the board of directors previously identified and the multi-theoretic contingency framework already established, this chapter articulated the research methodology followed in the current study. The research methodology adopted took into consideration the research approach, research paradigm, research strategy, and research method. It also reflected upon the population and sample selection, data sources, data collection, variables, data analysis and research design. Furthermore, attention was paid to the validity and reliability of data and ethical matters were taken into account.

This study adopted a quantitative research approach, which was supported by the positivist research paradigm, a descriptive research design and a quantitative research method. The sample, which formed the subject of the study, was drawn from the population of companies listed on the JSE main board at 1 March 2002. The period subject to study extended from 1 March 2002 to 31 December 2018. The data relevant to this study was secondary data. It was primarily collected from the company annual reports and the *Iress* database, a reputable source of financial data for South African companies. Data was collected with regard to the independent, dependent and control variables and included financial data and data relating to the characteristics of the board of directors for companies included in the sample. Attention was given to the validity and reliability of the data. The research models were presented in this chapter based on the hypotheses identified in Chapter 4, the research approach, research paradigm, research strategy, research design, research method and variables selected.

Data analysis for this study included controlling for outliers. Panel data was used and techniques were applied to test the assumptions of multiple linear regression models. These included tests for autocorrelation, heteroscedasticity, stationarity, normality of the distribution of the residuals and multicollinearity. The suitability of the fixed effects and random effects approaches was also considered. The EGLS method, with period SUR weightings and using White (diagonal) standard errors and covariance methods, was identified as the best-suited estimation method for the current study, because it resolves some of the shortcomings of the panel least squares method, including autocorrelation and potential heteroscedasticity.

The final consideration in this chapter related to ethical matters with regard to the current study. Chapter 6 follows with data analysis and findings.

CHAPTER 6

PRELIMINARY ANALYSIS AND REVISED REGRESSION MODEL

6.1 INTRODUCTION

This chapter presents the preliminary data analysis as well as the consideration of the appropriateness of the model specification in Section 5.10.1. It reports the findings of the analysis for the full sample and for the top four industries. The chapter further presents the analysis of the descriptive statistics, evaluation of the correlations between variables, testing of assumptions, adjustment of the regression model specification and establishment of a suitable estimation method to empirically test the hypotheses.

6.2 DESCRIPTIVE STATISTICS

The variables applicable to the preliminary data analysis are presented in Table 6.1, while Tables 6.2, 6.3 and 6.4(a) to (e) present the descriptive statistics for the dependent, independent and control variables based on preliminary Model 1. The frequency distribution with regard to the dichotomous independent variable for absence of chief executive officer (CEO) duality is presented in Table 6.2, whereas the remainder of the descriptive statistics are presented in Tables 6.3 and 6.4(a) to (e).

6.2.1 Outliers

The descriptive statistics in Tables 6.3 and 6.4(a) are reported for the full sample before the data was winsorised and after the data was winsorised, respectively. A decision was taken to winsorise the data owing to the extent of skewness and kurtosis arising from the occurrence of extreme values. The purpose of winsorising the data was to mitigate the problems associated with outliers (Saunders *et al.*, 2009; Urdan, 2010). In particular, the dependent variables; and the majority of the ownership concentration (moderating) and control variables required winsorisation.

Table 6.1: Summary of variables used in preliminary and revised model specifications

Variable	*Description*	*Definition*
Dependent variables		
VAIC	Value added intellectual coefficient	The extent of value creation for each monetary unit invested in total resources
CEE	Capital employed efficiency	The extent of value creation for each monetary unit invested in physical capital resources
ICE	Intellectual capital efficiency	The extent of value creation for each monetary unit invested in intellectual capital resources
HCE	Human capital efficiency	The extent of value creation for each monetary unit invested in human capital resources
SCE	Structural capital efficiency	The extent of value creation for each monetary unit invested in structural capital resources
Potential moderating variables (Ownership concentration)		
HERF	Herfindahl index based on percentage shareholdings	Sum of the squares of the percentage shareholding held by each shareholder
TOP1	Percentage shareholding of top shareholder	% shareholdings of the top shareholder
TOP3	Percentage shareholding of top three shareholders	Sum of the % shareholdings of the top three shareholders
TOP5	Percentage shareholding of top five shareholders	Sum of the % shareholdings of the top five shareholders
Independent variables (Characteristics of the board of directors)		
NONDUAL	Absence of chief executive officer (CEO) duality	Dummy variable of 1 if the same person serves as CEO and chair of the board of directors, otherwise 0
NONEXEC	Percentage of board members who are non-executive	Number of non-executive board members / Number of board members
IND	Percentage of non-executive board members who are independent	Number of independent board members / Number of non-executive board members
BSIZE	Board size	Number of board members
EDUDIV	Educational-level diversity	Teachman's index based on the number of board members with a doctoral degree, master's degree, honours degree/postgraduate diploma, bachelor's degree or no qualification as their highest level of qualification
EDIV	Ethnic diversity	Blau's index based on number of black and non-black board members
GDIV	Gender diversity	Blau's index based on number of male and female board members
Control variables		
CSIZE	Company size	Natural log of total assets at year-end
DY	Dividend yield	Ordinary dividends per share as a percentage of the share price at year-end
ROA	Return on assets	Operating profit / Total assets (at year-end)
LEV	Leverage	Total debt / Total shareholders' equity (at year-end)
DIROWN	Director ownership	Percentage of total number of ordinary shares held by the board members

Table 6.2: Frequencies of absence of chief executive officer (CEO) duality

Panel A: Full sample			
Variable		***Frequency***	***Percent***
NONDUAL = 1	(CEO is not chairperson of the board of directors)	1904	95.7
NONDUAL = 0	(CEO is chairperson of the board of directors)	85	4.3
	Total	1989	100.0
Panel B: Basic materials			
Variable		***Frequency***	***Percent***
NONDUAL = 1	(CEO is not chairperson of the board of directors)	275	89.9
NONDUAL = 0	(CEO is chairperson of the board of directors)	31	10.1
	Total	306	100.0
Panel C: Consumer services			
Variable		***Frequency***	***Percent***
NONDUAL = 1	(CEO is not chairperson of the board of directors)	422	95.5
NONDUAL = 0	(CEO is chairperson of the board of directors)	20	4.5
	Total	442	100.0
Panel D: Financials			
Variable		***Frequency***	***Percent***
NONDUAL = 1	(CEO is not chairperson of the board of directors)	387	99.0
NONDUAL = 0	(CEO is chairperson of the board of directors)	4	1.0
	Total	391	100.0
Panel E: Industrials			
Variable		***Frequency***	***Percent***
NONDUAL = 1	(CEO is not chairperson of the board of directors)	503	95.4
NONDUAL = 0	(CEO is chairperson of the board of directors)	24	4.6
	Total	527	100.0

This table sets out the frequency distribution for *NONDUAL* for the full sample of companies and by industry (for the basic materials, consumer services, financials and industrials industries) for the period 2002 to 2018. *NONDUAL* is a dummy variable with a value of 1 if the CEO does not serve as chairperson of the board of directors and a value of 0 otherwise.

Table 6.3: Descriptive statistics for the full sample (unwinsorised data)

Variables	*Mean*	*Median*	*Min*	*Max*[2]	*Std. dev.*	*Skewness*	*Kurtosis*	*Observations*
Dependent variables:								
VAIC	3.504	3.100	-411.990	138.280	12.575	- 16.221	624.828	1989
CEE	0.829	0.660	-13.710	58.550	1.692	21.641	707.256	1989
ICE	2.675	2.170	-411.840	137.780	12.510	- 16.309	632.109	1989
HCE	2.333	1.730	-412.840	136.780	12.355	-17.064	667.475	1989
SCE	0.442	0.440	-39.390	47.270	1.831	3.467	357.228	1989
Ownership concentration variables (potential moderators):								
HERF	2 640.404	1937.931	22.010	10 000.000	1 857.707	1.341	1.378	1989
TOP1	0.254	0.186	0.000	2.614	0.192	1.986	12.730	1989
TOP3	0.423	0.385	0.000	2.841	0.243	1.674	10.015	1989
TOP5	0.496	0.481	0.000	3.118	0.265	2.211	17.308	1989
Independent variables:								
NONEXEC	0.665	0.667	0.143	1.000	0.144	- 0.577	0.244	1989
IND	0.689	0.714	0.000	1.000	0.250	- 0.770	0.324	1989
BSIZE	10.460	10.000	3.000	31.000	3.758	0.880	1.410	1989
EDUDIV	1.154	1.221	0.000	1.609	0.288	- 1.215	2.005	1989
EDIV	0.332	0.375	0.000	0.500	0.162	- 0.948	- 0.279	1989
GDIV	0.211	0.219	0.000	0.500	0.155	- 0.052	- 1.147	1989
Control variables:								
CSIZE	15.334	15.314	5.481	21.478	2.275	0.072	0.304	1989
DY	0.042	0.029	- 0.001	1.930	0.094	10.239	146.655	1989
ROA	0.093	0.092	- 3.503	10.400	0.290	20.978	823.509	1989
LEV	1.950	1.015	-12.218	61.723	3.541	6.606	75.033	1989
DIROWN	0.151	0.043	0.000	0.994	0.218	1.670	1.909	1989

The table sets out descriptive statistics for the full sample for all variables used in the preliminary model, other than the *NONDUAL* dummy variable for the sample period 2002 to 2018. *VAIC*, *CEE*, *ICE*, *HCE*, *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive board members who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *CSIZE* is the natural log of total assets at year-end. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. All percentages are shown in decimal format with 0 and 1 representing 0% and 100%, respectively. Ratios are shown as the number of units of the first element in relation to 1 unit of the second element in the ratio. The data was not winsorised.

[2] The maximum ownership percentage for TOP1, TOP3 and/or TOP5 may exceed 1.000 (100%) based on local reporting requirements, corporate actions or timing of filings.

Table 6.4(a): Descriptive statistics for the full sample (winsorised data)

Variables	*Mean*	*Median*	*Min*	*Max*[3]	*Std. dev.*	*Skewness*	*Kurtosis*	*Observations*
Dependent variables:								
VAIC	3.232	3.100	0.595	6.660	1.334	0.640	0.997	1989
CEE	0.748	0.660	0.040	1.915	0.481	0.790	0.139	1989
ICE	2.411	2.170	0.430	5.680	1.179	1.074	1.352	1989
HCE	1.949	1.730	0.390	4.670	0.955	1.207	1.670	1989
SCE	0.451	0.440	-0.035	0.930	0.227	0.044	0.026	1989
Ownership concentration variables (potential moderators):								
HERF	2 640.404	1937.931	22.010	10 000.000	1 857.707	1.341	1.378	1989
TOP1	0.254	0.186	0.013	0.782	0.182	1.015	0.256	1989
TOP3	0.417	0.385	0.023	0.922	0.218	0.372	-0.625	1989
TOP5	0.489	0.481	0.027	1.114	0.229	0.163	0.407	1989
Independent variables:								
NONEXEC	0.665	0.667	0.143	1.000	0.144	-0.577	0.244	1989
IND	0.689	0.714	0.000	1.000	0.250	-0.770	0.324	1989
BSIZE	10.460	10.000	3.000	31.000	3.758	0.880	1.410	1989
EDUDIV	1.154	1.221	0.000	1.609	0.288	-1.215	2.005	1989
EDIV	0.332	0.375	0.000	0.500	0.162	-0.948	-0.279	1989
GDIV	0.211	0.219	0.000	0.500	0.155	-0.052	-1.147	1989
Control variables:								
CSIZE	15.334	15.314	5.481	21.478	2.275	0.072	0.304	1989
DY	0.038	0.029	0.000	0.428	0.057	4.467	24.495	1989
ROA	0.092	0.092	-0.043	0.407	0.123	-0.846	3.609	1989
LEV	1.881	1.015	0.038	15.812	2.776	3.275	11.209	1989
DIROWN	0.151	0.043	0.000	0.994	0.218	1.670	1.909	1989

The table sets out descriptive statistics for the full sample for all variables used in the regression analysis, other than the *NONDUAL* dummy variable for the period 2002 to 2018. *VAIC*, *CEE*, *ICE*, *HCE*, *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive board members who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *CSIZE* is the natural log of total assets at year-end. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. All percentages are shown in decimal format with 0 and 1 representing 0% and 100%, respectively. Ratios are shown as the number of units of the first element in relation to 1 unit of the second element in the ratio. The data for *VAIC, CEE, ICE, HCE* and *SCE* was winsorised at the 5^{th} and 95^{th} percentile values. The data for *TOP1*, *TOP3*, *TOP5, DY*, *ROA* and *LEV* was winsorised at the 1^{st} and 99^{th} percentile values.

[3] The maximum ownership percentage for TOP1, TOP3 and/or TOP5 may exceed 1.000 (100%) based on local reporting requirements, corporate actions or timing of filings.

Table 6.4(b): Descriptive statistics for the basic materials industry (winsorised data)

Variables	*Mean*	*Median*	*Min*	*Max*[4]	*Std. dev.*	*Skewness*	*Kurtosis*	*Observations*
Dependent variables:								
VAIC	3.136	3.055	-0.235	6.202	1.490	-0.059	0.264	306
CEE	0.590	0.550	0.064	1.363	0.344	0.513	-0.350	306
ICE	2.502	2.335	-0.292	5.443	1.341	0.227	0.063	306
HCE	2.071	1.855	0.404	4.519	1.025	0.694	0.088	306
SCE	0.440	0.480	-0.337	0.827	0.284	-1.163	1.216	306
Ownership concentration variables (potential moderators):								
HERF	2943.934	2200.164	22.010	9076.920	2 209.839	1.087	0.436	306
TOP1	0.301	0.257	0.014	0.799	0.216	0.714	-0.448	306
TOP3	0.477	0.489	0.023	1.161	0.249	0.058	-0.582	306
TOP5	0.545	0.578	0.028	1.257	0.261	-0.120	-0.385	306
Independent variables:								
NONEXEC	0.703	0.727	0.250	1.000	0.143	-1.016	0.582	306
IND	0.634	0.667	0.000	1.000	0.255	-0.569	-0.011	306
BSIZE	10.291	10.000	4.000	20.000	2.850	0.250	0.001	306
EDUDIV	1.228	1.280	0.000	1.594	0.265	-1.394	2.840	306
EDIV	0.346	0.397	0.000	0.500	0.155	-1.148	0.250	306
GDIV	0.205	0.219	0.000	0.494	0.156	-0.050	-1.264	306
Control variables:								
CSIZE	15.508	15.589	10.205	19.901	2.171	-0.521	-0.197	306
DY	0.026	0.021	0.000	0.115	0.030	1.450	1.849	306
ROA	0.091	0.087	-0.840	1.307	0.172	0.569	11.627	306
LEV	0.751	0.541	0.058	3.480	0.648	1.777	3.242	306
DIROWN	0.104	0.002	0.000	0.912	0.221	2.579	5.750	306

The table sets out descriptive statistics for the basic materials industry for all variables used in the regression analysis, other than the *NONDUAL* dummy variable for the period 2002 to 2018. *VAIC*, *CEE*, *ICE*, *HCE*, *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive board members who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *CSIZE* is the natural log of total assets at year-end. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. All percentages are shown in decimal format with 0 and 1 representing 0% and 100%, respectively. Ratios are shown as the number of units of the first element in relation to 1 unit of the second element in the ratio. The data for *VAIC, CEE, ICE, HC, SCE and DY* was winsorised at the 5th and 95th percentile values. The data for *TOP1*, *TOP3* and*TOP5* was winsorised at the 1st and 99th percentile values.

[4] The maximum ownership percentage for TOP1, TOP3 and/or TOP5 may exceed 1.000 (100%) based on local reporting requirements, corporate actions or timing of filings.

Table 6.4(c): Descriptive statistics for the consumer services industry (winsorised data)

Variables	*Mean*	*Median*	*Min*	*Max*[5]	*Std. dev.*	*Skewness*	*Kurtosis*	*Observations*
Dependent variables:								
VAIC	3.434	3.385	1.443	5.525	0.983	0.135	-0.167	442
CEE	0.999	0.855	0.302	2.307	0.557	0.871	-0.101	442
ICE	2.382	2.170	1.222	4.349	0.836	0.864	-0.030	442
HCE	1.948	1.740	1.086	3.627	0.678	1.063	0.315	442
SCE	0.436	0.430	0.112	0.730	0.167	-0.029	-0.716	442
Ownership concentration variables (potential moderators):								
HERF	2680.521	1860.013	476.560	10000.000	1920.660	1.256	0.958	442
TOP1	0.263	0.178	0.001	0.793	0.193	0.961	0.052	442
TOP3	0.435	0.384	0.001	1.176	0.241	0.436	-0.837	442
TOP5	0.508	0.493	0.001	1.196	0.243	0.156	-0.794	442
Independent variables:								
NONEXEC	0.641	0.667	0.143	1.000	0.142	-0.422	0.349	442
IND	0.691	0.750	0.000	1.000	0.276	-0.899	0.107	442
BSIZE	9.735	9.500	4.000	17.000	2.759	0.150	-0.518	442
EDUDIV	1.084	1.149	0.000	1.560	0.308	-0.939	0.942	442
EDIV	0.318	0.346	0.000	0.500	0.161	-0.812	-0.446	442
GDIV	0.223	0.219	0.000	0.500	0.162	-0.086	-1.231	442
Control variables:								
CSIZE	14.570	14.658	10.884	17.940	1.539	-0.065	-0.858	442
DY	0.052	0.032	0.000	0.527	0.081	3.743	15.861	442
ROA	0.146	0.138	-0.563	0.447	0.105	-0.443	4.529	442
LEV	1.490	0.865	0.103	6.978	1.519	1.583	2.176	442
DIROWN	0.139	0.049	0.000	0.906	0.198	1.820	2.477	442

The table sets out descriptive statistics for the consumer services industry for all variables used in the regression analysis, other than the *NONDUAL* dummy variable for the period 2002 to 2018. *VAIC*, *CEE*, *ICE*, *HCE*, *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive board members who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *CSIZE* is the natural log of total assets at year-end. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. All percentages are shown in decimal format with 0 and 1 representing 0% and 100%, respectively. Ratios are shown as the number of units of the first element in relation to 1 unit of the second element in the ratio. The data for *VAIC, CEE, ICE, HCE and SCE* was winsorised at the 5th and 95th percentile values. The data for *DY* and *LEV was* winsorised at the 1st and 99th percentile values.

[5] The maximum ownership percentage for TOP1, TOP3 and/or TOP5 may exceed 1.000 (100%) based on local reporting requirements, corporate actions or timing of filings.

Table 6.4(d): Descriptive statistics for the financials industry (winsorised data)

Variables	*Mean*	*Median*	*Min*	*Max*[6]	*Std. dev.*	*Skewness*	*Kurtosis*	*Observations*
Dependent variables:								
VAIC	3.515	2.940	-4.478	21.768	5.211	2.159	5.816	391
CEE	0.303	0.360	-0.210	0.764	0.262	-0.292	-0.766	391
ICE	3.327	2.510	-4.206	24.824	5.733	2.706	7.834	391
HCE	2.545	1.950	-2.734	20.196	4.562	2.954	9.007	391
SCE	0.614	0.540	-1.170	2.372	0.702	0.174	2.112	391
Ownership concentration variables (potential moderators):								
HERF	2832.879	2194.532	508.577	10000.000	1867.577	1.073	0.486	391
TOP1	0.275	0.240	0.038	0.623	0.181	0.586	-0.919	391
TOP3	0.430	0.415	0.076	0.788	0.204	0.049	-1.014	391
TOP5	0.494	0.503	0.087	0.829	0.203	-0.254	-0.743	391
Independent variables:								
NONEXEC	0.713	0.750	0.250	1.000	0.147	-0.620	0.025	391
IND	0.686	0.692	0.000	1.000	0.216	-0.913	1.491	391
BSIZE	11.895	12.000	3.000	25.000	4.882	0.125	-1.035	391
EDUDIV	1.148	1.254	0.000	1.597	0.337	-1.160	1.223	391
EDIV	0.299	0.375	0.000	0.500	0.189	-0.608	-1.185	391
GDIV	0.220	0.245	0.000	0.500	0.137	-0.424	-0.838	391
Control variables:								
CSIZE	16.625	16.788	5.481	21.478	3.217	-0.629	-0.053	391
DY	0.037	0.033	0.000	0.313	0.047	3.239	14.561	391
ROA	-0.012	-0.004	-0.916	0.323	0.165	-2.873	12.065	391
LEV	4.158	1.685	-2.263	27.772	5.177	1.467	1.424	391
DIROWN	0.212	0.145	0.000	0.994	0.230	1.057	0.097	391

The table sets out descriptive statistics for the financials industry for all variables used in the regression analysis, other than the *NONDUAL* dummy variable for the period 2002 to 2018. *VAIC*, *CEE*, *ICE*, *HCE*, *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive board members who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *CSIZE* is the natural log of total assets at year-end. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. All percentages are shown in decimal format with 0 and 1 representing 0% and 100%, respectively. Ratios are shown as the number of units of the first element in relation to 1 unit of the second element in the ratio. The data for *VAIC, CEE, ICE, HCE, SCE, TOP1*, *TOP3 and TOP5* was winsorised at the 5th and 95th percentile values. The data for *DY and ROA* was winsorised at the 1st and 99th percentile values.

[6] The maximum ownership percentage for TOP1, TOP3 and/or TOP5 may exceed 1.000 (100%) based on local reporting requirements, corporate actions or timing of filings.

Table 6.4(e): Descriptive statistics for the industrials industry (winsorised data)

Variables	*Mean*	*Median*	*Min*	*Max*[7]	*Std. dev.*	*Skewness*	*Kurtosis*	*Observations*
Dependent variables:								
VAIC	3.230	3.020	1.654	7.104	1.180	1.923	4.069	527
CEE	0.942	0.880	0.194	2.096	0.477	0.759	0.263	527
ICE	2.146	2.010	1.052	4.474	0.785	1.444	2.190	527
HCE	1.767	1.620	1.028	3.738	0.628	1.805	3.182	527
SCE	0.379	0.380	0.024	0.730	0.169	0.002	-0.072	527
Ownership concentration variables (potential moderators):								
HERF	2333.799	1735.828	576.559	10000.000	1616.450	1.808	3.324	527
TOP1	0.216	0.168	0.006	0.792	0.146	1.215	1.056	527
TOP3	0.374	0.344	0.010	0.981	0.187	0.530	0.099	527
TOP5	0.451	0.447	0.010	1.157	0.205	0.181	-0.179	527
Independent variables:								
NONEXEC	0.622	0.625	0.143	0.941	0.134	-0.798	1.122	527
IND	0.682	0.700	0.000	1.000	0.252	-0.753	0.293	527
BSIZE	10.374	9.000	4.000	31.000	4.078	1.459	3.576	527
EDUDIV	1.142	1.215	0.000	1.609	0.257	-1.680	4.368	527
EDIV	0.335	0.375	0.000	0.500	0.155	-0.906	-0.199	527
GDIV	0.205	0.208	0.000	0.500	0.164	0.121	-1.215	527
Control variables:								
CSIZE	15.070	15.128	10.811	18.832	1.754	-0.148	-0.884	527
DY	0.029	0.027	0.000	0.082	0.024	0.508	-0.531	527
ROA	0.100	0.094	-0.638	0.514	0.101	-1.044	8.928	527
LEV	1.535	1.237	0.041	7.244	1.206	2.080	6.052	527
DIROWN	0.162	0.042	0.000	0.978	0.234	1.548	1.347	527

The table sets out descriptive statistics for the industrials industry for all variables used in the regression analysis, other than the *NONDUAL* dummy variable for the period 2002 to 2018. *VAIC*, *CEE*, *ICE*, *HCE*, *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive board members who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *CSIZE* is the natural log of total assets at year-end. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. All percentages are shown in decimal format with 0 and 1 representing 0% and 100%, respectively. Ratios are shown as the number of units of the first element in relation to 1 unit of the second element in the ratio. The data for *VAIC, CEE, ICE, HCE*, *SCE and DY* was winsorised at the 5th and 95th percentile values. The data for *LEV* was winsorised at the 1st and 99th percentile values.

[7] The maximum ownership percentage for TOP1, TOP3 and/or TOP5 may exceed 1.000 (100%) based on local reporting requirements, corporate actions or timing of filings.

In the financial environment, winsorisation must be considered with great caution (Zellner, 2007). Therefore, the percentiles used for the winsorisation were determined per variable based on the level of winsorisation required to attain an acceptable level of skewness and kurtosis. For the full sample, shown in Table 6.4(a), the data associated with each dependent variable was winsorised at the 5^{th} and 95^{th} percentiles. Similarly, the data for TOP1, TOP3, TOP5, DY, ROA and LEV was winsorised at the 1^{st} and 99^{th} percentiles for the full sample. Based on the skewness and kurtosis values, the other variables did not require winsorisation. For each winsorised dependent variable, any values smaller than the 5^{th} percentile value were increased to that value and any values larger than the 95^{th} percentile value were reduced to the 95^{th} percentile value. The same process was followed for the winsorised ownership concentration and control variables. However, any values smaller than the 1^{st} percentile value were increased to that value and any values larger than the 99^{th} percentile value were reduced to the 99^{th} percentile value. Consequently, there was no change in the number of company-year observations.

For the full sample, Table 6.3 shows that prior to winsorising the data for the dependent variables, the skewness (kurtosis) values for VAIC, CEE, ICE, HCE and SCE were -16.221 (624.828), 21.641 (707.256), -16.309 (632.109), -17.064 (667.475) and 3.467 (357.228), respectively. These skewness and kurtosis values give a strong indication that the unwinsorised data for the dependent variables included outliers. After winsorising the data for the dependent variables, the skewness (kurtosis) values for VAIC, CEE, ICE, HCE and SCE were 0.640 (0.997), 0.790 (0.139), 1.074 (1.352), 1.207 (1.670) and 0.044 (0.026), respectively. This demonstrates a relatively symmetrical distribution of the data. Similarly, the spread of the data for TOP1, TOP3, TOP5, DY, ROA and LEV was more closely aligned to a symmetrical distribution after winsorisation.

The industry data was winsorised in a similar manner to the data for the full sample to achieve an acceptable level of skewness and kurtosis owing to the presence of outliers. After winsorisation, the descriptive statistics were reported for each industry examined, shown in Tables 6.4(b) to (e). The data for the dependent variables for all industries was winsorised at the 5th and 95th percentile values. The data for TOP1, TOP3 and TOP5 was winsorised at the 1st and 99th percentile values for the basic materials industry and at the 5th and 95th percentiles for the financials industry. In addition, the data for ROA was winsorised at the 1st and 99th percentiles for the financials industry. Furthermore, the data for LEV was winsorised at the 1st and 99th percentile values for the consumer services and industrials industries. Lastly, DY was winsorised at the 1st and 99th percentile values for the financials and consumer services industry, and at the 5th and 95th percentile values for the basic materials and industrials industries.

Consideration was initially given to conducting the empirical analysis first using unwinsorised data with panel least squares regression, quantile regression or robust regression estimation methods, as described in Section 6.6. The results were considered unsatisfactory owing to the panel least squares regression indicating the presence of autocorrelation, heteroscedasticity and a very poor percentage of the variance explained. Additionally, both quantile regression (which uses the median) and robust regression were not considered satisfactory due to a low percentage variation explained. Furthermore, the Akaike information criterion was considered. This criterion is often used to decide on the adequacy of a regression model and can be used to compare regression models (Gujarati, 2004). The Akaike information criterion is based on the log-likelihood function and is calculated similarly in *EViews* for the panel least squares regression and robust regression. Thus, the Akaike information criterion values for these two types of regressions can be compared. The regression model with the lowest Akaike information criterion value is favoured (Gujarati, 2004). Because the Akaike information criterion value was substantially higher for robust regression than for panel least squares regression, robust regression was not considered suitable. Therefore, it was decided to apply alternative estimation methods to the winsorised data.

6.2.2 Analysis of descriptive statistics

VAIC is the sum of CEE and ICE. For the full sample, Table 6.4(a) reports the means of VAIC, CEE and ICE as 3.232, 0.748 and 2.411, respectively. VAIC ranges in value from 0.595 to 6.660, whereas CEE ranges in value from 0.040 to 1.915 and ICE ranges in value from 0.430 to 5.680. It is evident that the means and ranges of values for VAIC and ICE are more closely aligned with each other than with the mean, minimum and maximum values for CEE. Therefore, it is more likely that VAIC is driven by the efficiency with which intellectual capital is employed rather than the efficiency with which physical capital is employed. Similar findings were reported by Ho and Williams (2003), who found the means of VAIC, CEE and ICE for companies listed on the Johannesburg Stock Exchange (JSE) in South Africa to be 4.270, 1.359 and 2.910, respectively.

Tables 6.4(b) to (e) indicate that the maximum VAIC and ICE are substantially higher for the financials industry than for the other industries. Nevertheless, the mean VAIC and ICE for the financials industry are relatively closely aligned with these values for the other industries. This suggests that there are companies within the financials industry that are capable of creating value to a greater extent than other companies for each monetary unit of resources invested in intellectual capital resources. However, the means of VAIC and ICE for the different industries indicate that this applies to a limited number of companies in the financials industry. These findings are also true for human capital efficiency (HCE), which implies that the capacity for companies in the financials industry to create more value from investing in intellectual capital resources stems from the investment in human capital.

ICE is the sum of HCE and SCE. Table 6.4(a) indicates that the means of HCE and SCE for the full sample are 1.949 and 0.451, respectively. The minimums (maximums) of HCE and SCE for the full sample are 0.390 (4.670) and -0.035 (0.930), respectively. It is noteworthy that the mean, minimum and maximum values for ICE and HCE are relatively similar. However, there is a distinct difference between these values and the mean, minimum and maximum values for SCE. Consequently, it is probable that the efficiency with which human capital is employed has a stronger influence on ICE than the efficiency with which structural capital is employed. It is also notable that the minimum value for SCE for the full sample is preceded by a negative sign because this indicates the destruction of value instead of the creation of value. However, the median confirms that at least half of the SCE observations are positive and larger than or equal to 0.440. The mean of 0.451 for SCE is also almost identical to the median, which indicates a relatively symmetrical distribution of values for SCE. Taking into account the minimum and maximum values of SCE for the full sample and considering that the winsorisation of the data for SCE already mitigated the problems relating to skewness and kurtosis, the vast majority of the observations for SCE must be positive, denoting value creation.

In Tables 6.4(a) to (e), ownership concentration is represented by four different variables, namely HERF, TOP1, TOP3 and TOP5. Table 6.4(a) displays the mean for HERF for the full sample as 2 640.404, which on average denotes a high level of ownership concentration because the mean Herfindahl index is larger than 2 500. Nevertheless, HERF for the full sample ranges widely from a minimum of 22.010, indicating a very low level of ownership concentration, to a maximum value of 10 000, meaning that ownership is situated in the hands of a single shareholder. This wide range of ownership concentration is also evident from the minimum and maximum values of HERF for the top four industries, shown in Tables 6.4(b) to (e). TOP1, TOP3 and TOP5 represent the percentage ownership of ordinary shares by the largest, three largest and five largest shareholders, respectively. In a similar manner to HERF, these measures of ownership concentration also range broadly from relatively low to relatively high levels of ownership concentration. The means of TOP1, TOP3 and TOP5 for the full sample are 25.4%, 41.7% and 48.9%, respectively. Slightly lower percentages were reported by Dube (2018), who found the means for the percentage ownership of ordinary shares by the largest, three largest and five largest shareholders to be 20.16%, 33.02% and 39.17%, respectively. These lower percentages may be attributable to the time period studied by Dube (2018) only extending from 2004 to 2014 or the use of a different source of data for the ownership concentration measure.

For the full sample of companies, Panel A of Table 6.2 illustrates that in the majority of cases (95.7% of company-year observations), the CEO of a company does not also serve as the chairperson of the board of directors. Similar findings are reported by Tshipa, Brummer, Wolmarans and Du Toit (2018), who found on average that the CEO was not also the chairperson of the board of directors in 93.84% of cases. This may be expected, as it is in line with the recommendations of the versions of the King Report on Corporate Governance in South Africa that were applicable during the period of this study, indicating a culture of adherence to the corporate governance regulations. Panels B to E of Table 6.2 show that the frequency with which the CEO does not also serve as the chairperson of the board of directors is within the range of 89.9% to 99% for all of the top four industries. The financials industry displays the highest percentage in this regard, which demonstrates the more stringent regulations for companies in this industry.

A culture of adherence to the corporate governance regulations is further displayed with regard to the full sample of companies in Table 6.4(a) for NONEXEC and IND. The mean of NONEXEC, which represents the percentage of members of the board of directors who are non-executive, is 66.5%. Similar findings were presented by Pamburai *et al.* (2015). This means that on average two-thirds of the members of the board of directors are non-executive. In addition, the mean of IND, which is the percentage of non-executive members of the board of directors who are independent, is 68.9%. Therefore, on average, almost 70% of non-executive directors are independent. This is supported by the finding of Pamburai *et al.* (2015) and Tshipa *et al.* (2018), who reported that a mean of close to 50% of the entire board of directors, rather than the non-executive directors, was independent. These findings indicate adherence to the King Report on Corporate Governance in South Africa, which recommends that the majority of the members of the board of directors should be non-executive and that the majority of the non-executive directors should be independent. Similar results are reported in Tables 6.4(b) to (e) for the top four industries. Mean NONEXEC ranges between 62.2% and 71.3% for the industrials and financials industries, respectively. Furthermore, mean IND ranges between 63.4% and 69.1% for the basic materials and consumer services industries, respectively.

Table 6.4(a) indicates that the mean size of the board of directors (BSIZE) for the full sample is 10.460. Tables 6.4(b) to (e) present similar results for the industries examined. These range between 9.735 members of the board of directors for the consumer services industry to 11.895 members of the board of directors for the financial services industry. This is in accordance with other findings in South Africa. It is also similar to the mean size of the board of directors reported in the United States of America (US) and the United Kingdom (UK). For example, in 2003, Ho and Williams (2003) reported the mean size of the board of directors to be 13.02 in South Africa and 9.54 in the UK for companies listed on a public stock exchange. In more recent studies, the mean size of the board of directors for companies listed on the Johannesburg Stock Exchange (JSE) was established as 9.94 for the 2012 year (Pamburai *et al.*, 2015) and 11.72 for the period 2002 to 2014 (Tshipa *et al.*, 2018). Coles, Daniel and Naveen (2008) found the average size of the board of directors for companies in the US to be 10.4. As mentioned in Chapter 2, the approaches to corporate governance adopted by the US and UK influenced the development of corporate governance in South Africa. Therefore, the similarity in the size of the board of directors is relevant because the appropriateness of corporate governance practices is often impacted by corporate structure.

EDUDIV is Teachman's index for educational-level diversity. As indicated in Section 5.8.2.4, there are five possible categories of educational level referring to higher education qualifications. These are the doctoral degree, master's degree, honours degree and postgraduate diploma, bachelor's degree, and no qualification. Table 6.4(a) indicates that the minimum value of EDUDIV is zero, which occurs when the educational level of the members of the board of directors is homogeneous. The maximum value of Teachman's index is achieved when each potential category has the same relative frequency and is calculated as the negative value of the natural logarithm of the inverse of the number of categories (- ln (1 / k)). Since there are five possible categories of educational level, a maximum value of 1.609 is expected for EDUDIV. Tables 6.4(b) to (e), which provide descriptive statistics for the top four industries, indicate that the minimum value for EDUDIV is never lower than zero and the maximum value for EDUDIV never exceeds 1.609.

EDIV and GDIV were measured in terms of Blau's index. Each of these indices was compiled based on only two possible classifications. EDIV, representing ethnic diversity, was calculated based on black and non-black classifications. GDIV, representing gender diversity, was calculated based on male and female classifications. As discussed in Sections 5.8.2.5 and 5.8.2.6, since Blau's index was calculated using only two possible classifications, the values calculated for these independent variables range between 0 and 0.5. This can be seen in Table 6.4(a). The minimum and maximum values for both EDIV and GDIV are also never lower than 0 nor higher than 0.5, as shown in Tables 6.4(b) to (e), which present the descriptive statistics for the top four industries.

6.3 CORRELATIONS AND MULTICOLLINEARITY

Pearson correlation coefficients were examined to better understand the bivariate correlations between different continuous variables. Gujarati (2004) proposes on theoretic grounds that only predictor variables that are directly associated with the dependent variable and are not taken into account by the other incorporated variables should form part of the regression model. Including unnecessary variables in the regression model may lead to an overfitted model with multicollinearity issues and a reduction in the efficiency of the estimators (Gujarati, 2004). Additionally, when the correlation between two independent variables is excessive, unreliable regression estimates with high standard errors may occur (Verbeek, 2008). Multicollinearity potentially leads to issues in multiple regression analysis because it may be problematic to detect the unique relationship between each predictor variable and the dependent variable (Urdan, 2010). As a guideline, Gujarati (2004) suggests that a positive or negative correlation coefficient of the association between two predictor variables exceeding 0.8 is high, indicating multicollinearity.

The Pearson correlation coefficients were first considered for the associations between different ownership variables and for associations of ownership concentration variables with dependent variables. Secondly, correlations between different control variables and between control variables and dependent variables were considered.

Thirdly, correlations between the independent variables and the associations of independent variables with other variables were considered.

6.3.1 Ownership concentration variables

As mentioned in Section 5.8.3, the ownership concentration variables (HERF, TOP1, TOP3 and TOP5) were treated as independent variables in Model 1 and moderating variables in Model 2. Ownership concentration was treated as a moderator of the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources because a higher level of ownership concentration has the potential to reduce or aggravate agency problems, which impacts on the resources available for the effective management of intellectual capital by the board of directors. The possible moderating effects were discussed in Section 4.2.6. Model 1 was used to test for the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources. In contrast, Model 2 considers the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. Preliminary Model 1 was specified in Section 5.10.1 and a revised version of this model is specified in Section 6.4, whereas Model 2 is presented in Chapter 8.

6.3.1.1 Full sample

Table 6.5(a) presents the Pearson correlation coefficients for the ownership concentration and dependent variables for the full sample of companies from 2002 to 2018. In order to deal with the issues of unreliable regression estimates and overfitting the model raised by Gujarati (2004), consideration was given to whether or not the inclusion of all four ownership concentration variables was necessary.

With the exception of the correlation coefficients for the associations of SCE with both HERF and TOP1, all correlation coefficients reported in the table are statistically significant at the 1% or 5% level. Both TOP1 and TOP5 are highly correlated with TOP3, as indicated by the correlation coefficients of 0.914 and 0.978, respectively. This is understandable because the largest shareholder also forms part of the top three shareholders. Similarly, the top three shareholders form part of the top five shareholders. The magnitude of these correlation coefficients indicates that TOP1 and TOP5 most likely serve as proxies for TOP3 and vice versa. Consequently, TOP3 should not coexist in the same regression equation as TOP1 and TOP5. The magnitude of these correlation coefficients also justifies using only TOP3 and not TOP1 or TOP5.

The use of TOP3 for the full sample can be further justified. Other than for CEE, the negative correlation coefficients for the associations of the dependent variables with TOP3 and TOP5 are larger than the negative correlation coefficients for the associations between the dependent variables and TOP1. Therefore, the choice of variables may be narrowed down to TOP3 and TOP5 owing to the weaker association of the dependent variables with TOP1. The correlation coefficients in Table 6.5(a) also display similar correlations for TOP3 and TOP5 with VAIC, ICE, HCE and SCE and a slightly stronger correlation between TOP3 and CEE than between TOP5 and CEE. In addition, VAIC is the core dependent variable, because the other dependent variables are subcomponents of VAIC. The correlation coefficients for the association of VAIC with TOP3 and TOP5 are - 0.126 and -0.107, respectively, which indicate a slightly stronger association between VAIC and TOP3. Consequently, TOP1 and TOP5 were removed from Model 1 and only HERF and TOP3 were retained in the revised model.

All further empirical analysis excludes TOP1 and TOP5 from Model 1 for the full sample analysis. The revised model for the full sample is specified separately for VAIC, CEE, ICE, HCE and SCE in Section 6.4.1.

Table 6.5(a): Pearson correlations: Ownership concentration and dependent variables for the full sample

	HERF	*TOP1*	*TOP3*	*TOP5*
HERF	1.000			
TOP1	0.761***	1.000		
TOP3	0.577***	0.914***	1.000	
TOP5	0.448***	0.846***	0.978***	1.000
VAIC	-0.097***	-0.087***	-0.115***	-0.113***
CEE	-0.129***	-0138***	-0.126***	-0.107***
ICE	-0.055**	-0.045**	-0.074***	-0.078***
HCE	-0.050**	-0.045**	-0.070***	-0.073***
SCE	-0.025	-0.016	-0.053**	-0.059***

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for the ownership concentration and dependent variables used in Models 1a, 1b, 1c and 1d and 1e of the regression analysis for the full sample for the period 2002 to 2018, before adjustments to the preliminary models. Correlation coefficients and the statistical significance of these are set out for associations between different ownership concentration variables and associations between dependent variables and ownership concentration variables. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively.

6.3.1.2 Top industries

Table 6.5(b) presents the Pearson correlation coefficients for the ownership concentration and dependent variables by industry.

TOP1, TOP3 and TOP5 are all strongly correlated with each other, indicating that these variables may serve as proxies for each other. This is evidenced by the correlation coefficients for these bivariate associations in Panels A to D of Table 6.5(b), which exceed 0.8 and are statistically significant at the 1% level. Consequently, TOP1, TOP3 and TOP5 should not coexist in the same regression equation and only one of these variables should be retained in revised Model 1 for the industry analysis.

Table 6.5(b) also shows that HERF is more highly correlated with TOP1 than with TOP3 and TOP5 for all of the industries examined. The correlation coefficient of 0.854 for the association between HERF and TOP1 for the basic materials industry exceeds 0.8, suggesting that these two variables serve as proxies for each other.

Table 6.5(b): Pearson correlations: Ownership concentration and dependent variables by industry

Panel A: Basic materials				
	HERF	***TOP1***	***TOP3***	***TOP5***
HERF	1.000			
TOP1	0.854***	1.000		
TOP3	0.626***	0.887***	1.000	
TOP5	0.508***	0.804***	0.979***	1.000
VAIC	-0.009	0.002	-0.018	-0.043
CEE	-0.092	-0.128**	-0.147**	-0.137**
ICE	0.028	0.049	0.043	0.012
HCE	0.030	0.051	0.060	0.027
SCE	0.004	0.024	0.006	-0.020
Panel B: Consumer services				
	HERF	***TOP1***	***TOP3***	***TOP5***
HERF	1.000			
TOP1	0.775***	1.000		
TOP3	0.616***	0.914***	1.000	
TOP5	0.508***	0.865***	0.981***	1.000
VAIC	-0.132***	-0.104**	-0.148***	-0.128***
CEE	-0138***	-0.085*	-0.044	-0.024
ICE	-0.131***	-0.135***	-0.188***	-0.169***
HCE	-0.110**	-0.118**	-0.174***	-0.159***
SCE	-0.208***	-0.191***	-0.222***	-0.192***
Panel C: Financials				
	HERF	***TOP1***	***TOP3***	***TOP5***
HERF	1.000			
TOP1	0.725***	1.000		
TOP3	0.593***	0.938***	1.000	
TOP5	0.477***	0.875***	0.979***	1.000
VAIC	-0.159***	-0.181***	-0.165***	-0.125***
CEE	-0.147***	-0.050	-0.073	-0.057
ICE	-0.134***	-0.196***	-0.179***	-0.144***
HCE	-0.140***	-0.198***	-0.181***	-0.139***
SCE	0.028	-0.001	-0.005	-0.008
Panel D: Industrials				
	HERF	***TOP1***	***TOP3***	***TOP5***
HERF	1.000			
TOP1	0.707***	1.000		
TOP3	0.466***	0.906***	1.000	
TOP5	0.315***	0.828***	0.976***	1.000
VAIC	-0.062	-0.077*	-0.145***	-0.147***
CEE	-0.049	-0.092**	-0.134***	-0.133***
ICE	-0.009	-0.012	-0.061	-0.067
HCE	-0.011	-0.018	-0.068	-0.074*
SCE	-0.006	0.011	-0.031	-0.034

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for the ownership concentration and dependent variables used in Models 1f, 1g, 1h and 1i and 1j of the regression analysis for the basic materials, consumer services, financials and industrials industries for the period 2002 to 2018, before adjustments to the preliminary models. Correlation coefficients and the statistical significance of these are set out for associations between different ownership concentration variables and associations between dependent variables and ownership concentration variables. *HERF* is the Herfindahl index for ownership concentration. *TOP1*, *TOP3* and *TOP5* are the percentage shareholding held by the largest one, three and five shareholders. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively.

Therefore, the choice between TOP1, TOP3 and TOP5 can be narrowed to exclude TOP1 for the basic materials industry. The correlation coefficients reflecting the associations between the control variables and each of the dependent variables, as displayed in Table 6.5(b), are relatively low for all industries examined, and do not indicate a preference for TOP3 or TOP5. Because there is also no consensus in the literature that provides any reason to favour TOP3 or TOP5, the current study removed both TOP1 and TOP5 from Model 1 and only retained TOP3 in the revised model for the industry analysis.

All further empirical analysis excludes TOP1 and TOP5 from Model 1 for the industry analysis. The revised model is specified separately for VAIC, CEE, ICE, HCE and SCE in Section 6.4.2 for the top four industries.

6.3.2 Control variables

The Pearson correlation coefficients for the dependent and control variables are shown in Tables 6.6(a) and (b) for the full sample and by industry, respectively. Spector and Brannick (2011) argue that control variables should not be included blindly in a regression model. The control variables included in preliminary Model 1 were derived from the literature. However, the same set of control variables is not necessarily applicable to all similar studies. Gujarati (2004) also cautions that overfitting the regression model may lead to a reduction in the efficiency of the estimators.

6.3.2.1 Full sample

Table 6.6(a), for the full sample, indicates that the correlation coefficients for the associations between the different control variables are statistically significant at the 1% level only for the associations of ROA, LEV and DIROWN with each other. However, these are weak correlations with negative coefficients smaller than 0.250. Therefore, ROA, LEV and DIROWN are not likely to serve as proxies for each other.

Table 6.6(a): Pearson correlations: Control and dependent variables for the full sample

	CSIZE	*DY*	*ROA*	*LEV*	*DIROWN*
CSIZE	1.000				
DY	-0.008	1.000			
ROA	-0.011	0.018	1.000		
LEV	0.038*	0.033	-0.230***	1.000	
DIROWN	0.003	-0.029	-0.093***	-0.089***	1.000
VAIC	-0.030	-0.025	0.558***	0.049**	-0.106***
CEE	-0.013	-0.049**	0.345***	0.099***	-0.045**
ICE	-0.027	-0.014	0.499***	-0.045**	-0.096***
HCE	-0.035	-0.012	0.523***	-0.063***	-0.084***
SCE	0.019	-0.020	0.314***	-0.007	-0.074***

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for the control and dependent variables used in Models 1a, 1b, 1c and 1d and 1e of the regression analysis for the period 2002 to 2018 for the full sample, before adjustments to the preliminary models. Correlation coefficients and the statistical significance of these are set out for associations between different control variables and associations between dependent variables and control variables. *CSIZE* is the natural log of total assets at year-end. DY is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively.

Table 6.6(a) indicates that the correlation coefficients for the associations between the dependent and control variables are not statistically significant for CSIZE. With the exception of the correlation coefficient for the association between CEE and DY, the same is true for DY. Despite this, the correlation between CEE and DY is very weak (-0.049). Generally, the correlation coefficients for the associations of the dependent variables with LEV and DIROWN are statistically significant at least at the 1% or 5% level. However, only the association between VAIC and DIROWN has a correlation coefficient smaller than -0.100 or exceeding 0.100, and this is only slightly less than -0.100. Therefore, it can be concluded that the correlations of the dependent variables with LEV and DIROWN are very weak when the correlation coefficients are statistically significant at either the 1% or 5% level of significance. In contrast, the correlation coefficients for the associations between the dependent variables and ROA range between 0.314 and 0.558, which reflects moderate correlation. In addition, these correlation coefficients are all positive and significant at the 1% level of significance. As a result, CSIZE, DY, LEV and DIROWN were removed from Model 1 for the full sample and only ROA was retained as a control variable in the revised model. The revised model for the analysis of the full sample is specified separately for VAIC, CEE, ICE, HCE and SCE in Section 6.4.1.

6.3.2.2 Top industries

Table 6.6(b) presents the correlation coefficients for the associations between the different control variables for the top four industries. The statistically significant correlation coefficients for the bivariate associations of CSIZE, DY, ROA, LEV and DIROWN with each other all fall between -0.625 and 0.619, which is within the range between -0.800 and 0.800. Therefore, the control variables are not likely to serve as proxies for each other.

The correlation coefficients for the associations between the dependent and control variables in Table 6.6(b) are between -0.300 and 0.300 for CSIZE and indicate weak associations. The same is true for DIROWN. Other than for the financials industry, the correlation coefficients for the associations between DY and the dependent variables are mostly statistically significant at the 1% level. These correlation coefficients are less than -0.300 for the association between VAIC and DY for the consumer services industry and more than 0.300 for the association of DY with both ICE and HCE for the basic materials industry.

For the basic materials industry, ROA reflects moderate associations with VAIC, CEE, ICE, HCE and SCE, with correlation coefficients ranging between 0.389 and 0.763, which are statistically significant at the 1% level. The only association of ROA with the dependent variables that is statistically significant, but weak (correlation coefficient of 0.242) relates to CEE for the industrials industry. The correlation coefficients for the associations of ROA with CEE and SCE for the consumer services industry and the financials industry, respectively, are not statistically significant. In all other cases for the consumer services, financials and industrials industries, ROA has a moderate association (correlation coefficient between 0.332 and 0.723) with the dependent variables.

Table 6.6(b): Pearson correlations: Control variables by industry

Panel A: Basic materials

	CSIZE	*DY*	*ROA*	*LEV*	*DIROWN*
CSIZE	1.000				
DY	-0.002	1.000			
ROA	0.147**	0.399***	1.000		
LEV	-0.044***	-0.229***	-0.246***	1.000	
DIROWN	-0.549***	0.066	0.030	0.048	1.000
VAIC	0.153***	0.279***	0.763***	-0.077	0.001
CEE	-0.184***	0.075	0.389***	0.532***	0.210***
ICE	0.233***	0.315***	0.753***	-0.272***	-0.052
HCE	0.265***	0.327***	0.771***	-0.270***	-0.042
SCE	0.165***	0.292***	0.563***	-0.175***	-0.104*

Panel B: Consumer services

	CSIZE	*DY*	*ROA*	*LEV*	*DIROWN*
CSIZE	1.000				
DY	-0.292***	1.000			
ROA	-0.004	0.219***	1.000		
LEV	0.219***	-0.162***	-0.302***	1.000	
DIROWN	-0.241***	0.059	-0.203***	-0.217***	1.000
VAIC	0.291***	-0.318***	0.679***	0.072	-0.175***
CEE	0.252***	-0.195***	0.045	0.577***	-0.134***
ICE	0.131***	0.225***	0.723***	-0.346***	-0.105**
HCE	0.113**	-0.210***	0.710***	-0.345**	-0.088*
SCE	0.187***	-0.233***	0.720***	-0.317***	-0.149***

Panel C: Financials

	CSIZE	*DY*	*ROA*	*LEV*	*DIROWN*
CSIZE	1.000				
DY	0.237***	1.000			
ROA	0.155***	0.017	1.000		
LEV	0.619***	0.165***	0.008***	1.000	
DIROWN	-0.625***	-0.180***	-0.089*	-0.416***	1.000
VAIC	-0.064***	-0.076	0.370***	-0.020	0.022
CEE	0.044	-0.051	0.332***	0.306***	-0.182***
ICE	-0.065	-0.068	0.348***	-0.063	0.031
HCE	-0.110**	-0.072	0.363***	-0.076	0.072
SCE	0.057	-0.042	-0.041	-0.005	-0.040

Panel D: Industrials

	CSIZE	*DY*	*ROA*	*LEV*	*DIROWN*
CSIZE	1.000				
DY	0.053	1.000			
ROA	-0.175***	0.204***	1.000		
LEV	0.146***	0.011	-0.111**	1.000	
DIROWN	-0.511***	-0.046	0.045	-0.186***	1.000
VAIC	0.111**	0.184***	0.428***	0.499***	-0.151***
CEE	-0.134***	-0.028	0.242***	0.498***	-0.100**
ICE	0.168***	0.222***	0.505***	0.098**	-0.059
HCE	0.177***	0.221***	0.466***	0.112***	-0.075*
SCE	0.125***	0.211***	0.618***	0.035	0.004

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for the control and dependent variables used in Models 1f, 1g, 1h and 1i and 1j of the regression analysis for the basic materials, consumer services, financials and industrials industries for the period 2002 to 2018 by industry, before adjustments to the preliminary models. Correlation coefficients and the statistical significance of these are set out for associations between different control variables and associations between dependent variables and control variables. *CSIZE* is the natural log of total assets at year-end. DY is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end. *DIROWN* is the percentage of total number of ordinary shares held by the board members. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively.

The association between VAIC and LEV is only statistically significant for the industrials industry. This is a moderate positive relationship that is statistically significant at the 1% level. In contrast, the positive correlation coefficients, which range between 0.306 and 0.577, demonstrate a moderate association of CEE with LEV and are statistically significant at the 1% level for all the top four industries. Although the correlation coefficients for the associations of LEV with ICE, HCE and SCE are statistically significant at the 1% level for both the basic materials industry and the consumer services industry, the association is low (correlation coefficients between -0.175 and -0.300) for the basic materials industry and moderate (between -0.300 and -0.400) for the consumer services industry. The associations of LEV with ICE, HCE and SCE are not statistically significant for the financials industry and are low (less than 0.200), although statistically significant, for ICE and HCE for the industrials industry.

Consequently, in the interest of applying a consistent model for all the top four industries and all the dependent variables, CSIZE and DIROWN were removed from Model 1 and only DY, ROA and LEV were retained as control variables in the revised model for the industry analysis. The revised model for the analysis of the top four industries is specified separately for VAIC, CEE, ICE, HCE and SCE in Section 6.4.2.

6.3.3 Model 1 after reducing the ownership concentration and control variables

Table 6.7(a) reports the Pearson correlation coefficients for the full sample for all variables included in Model 1, after reducing the ownership concentration variables and control variables included in preliminary Model 1. Similarly, Tables 6.7(b) to (e) present the Pearson correlation coefficients for the top four industries. Correlation analysis is conducted on the predictor variables in a similar manner to the assessment done in the studies by Gaur *et al.* (2015) and Pamburai *et al.* (2015). Pearson correlation coefficients that are less than -0.800 or greater than 0.800 provide evidence of multicollinearity when the correlation coefficients are statistically significant (Gujarati, 2004). Therefore, there is no evidence of multicollinearity between the different predictor variables included in Tables 6.7(a) to (e). Similar to the study by Pamburai *et al.* (2015), Tables 6.7(a) to (e) also report variance inflation factors (VIF) for each of the predictor variables. The VIF is an additional indicator of multicollinearity. According to Gujarati (2004), a VIF larger than 10 suggests multicollinearity. Each VIF reported in Tables 6.7(a) to (e) is less than 4, confirming that there is no multicollinearity between the predictor variables for both the full sample and the top four industries.

6.3.3.1 Full sample

With regard to the full sample, for the ownership concentration and independent variables, the highest correlation coefficient is 0.577 and this indicates a moderate positive association between HERF and TOP3, which are both measures of ownership concentration. The next four highest correlation coefficients are for the associations of GDIV with EDIV, BSIZE with EDUDIV, NONEXEC with EDIV and EDUDIV with EDIV. These correlation coefficients are 0.505, 0.453, 0.437 and 0.432, respectively, and relate predominantly to the board size and diversity variables. All five of the strongest correlations, which relate to the ownership concentration and independent variables, are positive and statistically significant at the 1% level.

A moderator variable refines the relationship between a dependent and an independent variable. This leads to the assumption of causality by the moderator variable. However, it is not possible to test this causality directly and correlation of the moderator variable with either the dependent or independent variable may confound the assumption of causality (Hair *et al.*, 2010). Therefore, it is best if the Pearson correlation coefficient, which applies to a linear relationship, is low for the association of the moderator variable with both the dependent and independent variables under consideration. In Table 6.7(a), the correlation coefficient for the association of HERF with IND is -0.216. This is the highest correlation for a potential moderator variable (HERF and TOP3) with a dependent or independent variable for the full sample. All of the other correlation coefficients for the associations of both HERF and TOP3 with the dependent and independent variables fall between -0.200 and 0.200 for the full sample. The magnitude of these correlation coefficients is considered to be low and should not confound the assumption of causality by the moderator variables. Correlation coefficient values between -0.300 and 0.300 indicate a weak linear relationship (Ratner, 2009).

6.3.3.2 Top industries

For the top four industries, there is a moderate positive correlation evident between HERF and TOP3, which are both ownership concentration measures. The correlation coefficients of 0.626 for the basic materials industry, 0.616 for the consumer services industry, 0.593 for the financials industry and 0.466 for the industrials industry are all statistically significant at the 1% level.

As discussed in Section 6.3.3.1, it is best if the Pearson correlation coefficient, which applies to a linear relationship, is low for the association of the moderator variable with both the dependent and independent variables under consideration. According to Ratner (2009), a correlation coefficient of between -0.300 and 0.300 indicates a weak linear relationship. Tables 6.7(b) to (e) indicate that all of the correlation coefficients for the associations of the potential moderator variables (HERF and TOP3) with a dependent or independent variable fall within this range. Therefore, the assumption of causality by the moderator variables should not be confounded.

Table 6.7(a): Pearson correlations and variance inflation factors for the full sample: Revised Model 1

	VAIC	*CEE*	*ICE*	*HCE*	*SCE*	*HERF*	*TOP3*	*NON DUAL*	*NON EXEC*	*IND*	*BSIZE*	*EDU DIV*	*EDIV*	*GDIV*	*ROA*	*VIF*
VAIC	1.000															
CEE	0.339***	1.000														
ICE	0.860***	-0.113***	1.000													
HCE	0.827***	-0.066***	0.945***	1.000												
SCE	0.580***	-0.244***	0.761***	0.665***	1.000											
HERF	-0.097***	-0.129***	-0.055**	-0.050**	-0.025	1.000										1.603
TOP3	-0.115***	-0.126***	-0.074***	-0.070***	-0.053**	0.577***	1.000									1.577
NONDUAL	-0.001	-0.076***	0.048**	0.050**	0.049**	-0.067***	-0.003	1.000								1.079
NONEXEC	0.018***	-0.107***	0.064***	0.038*	0.126***	-0.089***	0.028	0.205***	1.000							1.342
IND	-0.011	0.009	-0.005	-0.015	-0.057**	-0.216***	-0.112***	0.121***	0.081***	1.000						1.144
BSIZE	0.049**	-0.003	0.058***	0.026	0.080***	-0.168***	-0.109***	0.120***	0.299***	0.107***	1.000					1.380
EDUDIV	-0.009	0.008	0.020	0.005	0.010	-0.105***	-0.083***	0.061***	0.323***	0.213***	0.453***	1.000				1.456
EDIV	-0.064***	0.102***	-0.085***	-0.107***	-0.050**	-0.090***	0.026	0.194***	0.437***	0.232***	0.385***	0.432***	1.000			1.787
GDIV	0.027	0.078***	-0.009	-0.022	-0.036	-0.102***	0.045**	0.071***	0.295***	0.208***	0.220***	0.245***	0.505***	1.000		1.391
ROA	0.558***	0.345***	0.499***	0.523**	0.314***	-0.074***	-0.152***	0.025	-0.063***	0.017	-0.034	-0.020	0.019	0.022	1.000	1.036

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for all variables and the variance inflation factors (VIF) for the predictor variables used in Models 1a, 1b, 1c, 1d and 1e of the regression analysis for the full sample for the period 2002 to 2018, after adjusting the preliminary models by removing *TOP1*, *TOP5*, *CSIZE*, *LEV*, *DY* and *DIROWN*. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Table 6.7(b): Pearson correlations and variance inflation factors for the basic materials industry: Revised Model 1

	VAIC	*CEE*	*ICE*	*HCE*	*SCE*	*HERF*	*TOP3*	*NON DUAL*	*NON EXEC*	*IND*	*BSIZE*	*EDU DIV*	*EDIV*	*GDIV*	*DY*	*ROA*	*LEV*	*VIF*
VAIC	1.000																	
CEE	0.466***	1.000																
ICE	0.925***	0.174***	1.000															
HCE	0.875***	0.191***	0.946***	1.000														
SCE	0.714***	0.067	0.808***	0.734***	1.000													
HERF	-0.009	-0.092	0.028	0.030	0.004	1.000												1.605
TOP3	-0.018	-0.147**	0.043	0.060	0.006	0.626***	1.000											1.574
NONDUAL	0.077	-0.119**	0.146**	0.179***	0.086	-0.173***	-0.127**	1.000										1.079
NONEXEC	-0.088	-0.124**	-0.062	-0.070	-0.035	-0.237***	-0.144**	0.553***	1.000									1.357
IND	-0.003	-0.088	-0.008	-0.021	-0.023	-0.215***	-0.115**	0.032	0.110*	1.000								1.145
BSIZE	0.126**	0.041	0.105*	0.125*	0.098*	-0.063	-0.057	0.278***	0.466***	0.199***	1.000							1.512
EDUDIV	0.107*	0.153***	0.067	0.088	0.042	-0.015	-0.085	0.041	-0.074	0.281***	0.296***	1.000						1.459
EDIV	-0.198***	-0.258***	-0.132**	-0.122**	-0.145**	-0.100*	0.010	0.383***	0.519***	0.194***	0.409***	0.046	1.000					1.805
GDIV	-0.089	-0.274***	0.008	0.010	-0.020	-0.125**	-0.148***	0.115**	0.271***	0.391***	0.319***	0.027	0.441***	1.000				1.420
DY	0.279***	0.075	0.315***	0.327***	0.292***	0.001	0.045	-0.076	-0.002	0.012	-0.001	-0.037	-0.218***	-0.003	1.000			1.037
ROA	0.763***	0.389***	0.753***	0.771***	0.563***	-0.012	-0.079	0.073	-0.062	-0.040	0.144**	0.062	-0.183***	0.032	0.399***	1.000		1.077
LEV	-0.077	0.532***	-0.272***	-0.270***	-0.175***	-0.152***	-0.101*	-0.024	0.046	-0.002	0.143**	0.227***	-0.048	-0.198***	-.229***	-.246***	1.000	1.214

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for all variables and the variance inflation factors (VIF) for the predictor variables used in Models 1f, 1g, 1h, 1i and 1j of the regression analysis for the basic materials industry for the period 2002 to 2018, after adjusting the preliminary models by removing *TOP1*, *TOP5*, *CSIZE*, *LEV*, *DY* and *DIROWN*. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

Table 6.7(c): Pearson correlations and variance inflation factors for the consumer services industry: Revised Model 1

	VAIC	*CEE*	*ICE*	*HCE*	*SCE*	*HERF*	*TOP3*	*NON DUAL*	*NON EXEC*	*IND*	*BSIZE*	*EDU DIV*	*EDIV*	*GDIV*	*DY*	*ROA*	*LEV*	*VIF*
VAIC	1.000																	
CEE	0.407***	1.000																
ICE	0.744***	-0.267***	1.000															
HCE	0.739***	-0.279***	0.998***	1.000														
SCE	0.712***	-0.214***	0.944***	0.926***	1.000													
HERF	-0.132***	-0.138***	-0.131***	-0.110**	-0.208***	1.000												1.836
TOP3	-0.148***	-0.044	-0.188***	-0.174***	-0.222***	0.616***	1.000											1.760
NONDUAL	0.004	0.001	0.011	-0.003	0.067	-.111**	-0.019	1.000										1.049
NONEXEC	0.245***	0.111**	0.224***	0.211***	0.270***	-0.194***	-0.107**	0.112**	1.000									1.766
IND	-0.097**	0.047	-0.149***	-0.156***	-0.121**	-0.178***	-0.121***	0.111**	0.166***	1.000								1.325
BSIZE	0.215***	0.302***	0.023	0.003	0.096**	-0.324***	-0.219***	0.109**	0.261***	0.051	1.000							1.563
EDUDIV	-0.010	0.022	0.027	0.015	0.075	-0.255***	-0.174***	0.086*	0.453***	0.331***	0.431***	1.000						1.754
EDIV	0.171***	0.202***	0.075	0.053	0.140***	-0.095**	-0.011	0.131***	0.582***	0.278***	0.365***	0.455***	1.000					2.279
GDIV	0.091	0.272***	-0.111**	-0.114**	-0.102**	0.044	0.168***	-0.005	0.244***	0.203***	0.033	0.127***	0.467***	1.000				1.571
DY	-0.318***	-0.195***	-0.225***	-0.210***	0-.233***	0.194***	0.188***	-0.037	-0.271***	-0.079*	-0.312***	-0.229***	-0.183***	0.217***	1.000			1.436
ROA	0.679***	0.045	0.723***	0.710***	0.720***	-0.288***	-0.313***	0.035	0.223***	-0.085*	0.059	-0.007	0.133***	-0.019	-0.219***	1.000		1.435
LEV	0.072	0.577***	-0.346***	-0.345***	-0.317***	0.027	0.108**	0.019	-0.014	0.163***	0.109**	-0.062	-0.056	0.059	-0.162***	-0.302***	1.000	1.313

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for all variables and the variance inflation factors (VIF) for the predictor variables used in Models 1f, 1g, 1h, 1i and 1j of the regression analysis for the consumer services industry for the period 2002 to 2018, after adjusting the preliminary models by removing *TOP1*, *TOP5*, *CSIZE*, *LEV*, *DY* and *DIROWN*. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

Table 6.7(d): Pearson correlations and variance inflation factors for the financials industry: Revised Model 1

	VAIC	*CEE*	*ICE*	*HCE*	*SCE*	*HERF*	*TOP3*	*NON DUAL*	*NON EXEC*	*IND*	*BSIZE*	*EDU DIV*	*EDIV*	*GDIV*	*DY*	*ROA*	*LEV*	*VIF*
VAIC	1.000																	
CEE	0.279***	1.000																
ICE	0.979***	0.169***	1.000															
HCE	0.901***	0.253***	0.923***	1.000														
SCE	0.259***	-0.311***	0.281***	0.028	1.000													
HERF	-0.159***	-0.147***	-0.134***	-0.140***	0.028	1.000												1.690
TOP3	-0.165***	-0.073	-0.179***	-0.181***	-0.005	0.593***	1.000											1.736
NONDUAL	-0.009	-0.004	0.059	0.060	0.008	-0.032	-0.086*	1.000										1.262
NONEXEC	-0.060	-0.149***	-0.018	-0.064	0.139***	-0.014	-0.013	0.261***	1.000									1.587
IND	0.036	0.126**	0.035	0.023	-0.055	-0.239***	-0.120**	0.323***	0.120**	1.000								1.353
BSIZE	-0.122**	0.164***	-0.143***	-0.185***	0.004	-0.189***	-0.126**	0.159***	0.477***	0.192***	1.000							3.973
EDUDIV	-0.109**	0.103**	-0.137***	-0.163***	-0.024	-0.208***	-0.265***	0.032	0.420***	0.131***	0.746***	1.000						2.885
EDIV	-0.240***	0.041	-0.260***	-0.319***	0.059	-0.153***	-0.107**	0.161***	0.508***	0.195***	0.729***	0.649***	1.000					2.989
GDIV	0.130**	0.152***	0.101**	0.059	0.023	-0.137***	-0.078	0.024	0.198***	0.260***	0.391***	0.447***	0.551***	1.000				1.641
DY	-0.076	-0.051	-0.068	-0.072	-0.042	-0.101**	-0.133**	0.082	0.266***	0.177***	0.222***	0.231***	0.239***	0.072	1.000			1.145
ROA	0.370***	0.332***	0.348***	0.363***	-0.041	-0.029	-0.090*	0.154***	0.085*	0.264***	0.117**	-0.008	0.065	0.157***	0.017	1.000		1.166
LEV	-0.020	0.306***	-0.063	-0.076	-0.005	-0.148***	-0.098*	0.038	0.344***	0.080	0.584***	0.434***	0.353***	0.169***	0.165***	0.008	1.000	1.603

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for all variables and the variance inflation factors (VIF) for the predictor variables used in Models 1f, 1g, 1h, 1i and 1j of the regression analysis for the financials industry for the period 2002 to 2018, after adjusting the preliminary models by removing *TOP1*, *TOP5*, *CSIZE*, *LEV*, *DY* and *DIROWN*. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

Table 6.7(e): Pearson correlations and variance inflation factors for the industrials industry: Revised Model 1

	VAIC	*CEE*	*ICE*	*HCE*	*SCE*	*HERF*	*TOP3*	*NON DUAL*	*NON EXEC*	*IND*	*BSIZE*	*EDU DIV*	*EDIV*	*GDIV*	*DY*	*ROA*	*LEV*	*VIF*
VAIC	1.000																	
CEE	0.288***	1.000																
ICE	0.773***	-0.215***	1.000															
HCE	0.790***	-0.213***	0.996***	1.000														
SCE	0.654***	-0.208***	0.944***	0.912***	1.000													
HERF	-0.062	-0.049	-0.009	-0.011	-0.006	1.000												1.595
TOP3	-0.145***	-0.134***	-0.061	-0.068	-0.031	0.466***	1.000											1.513
NONDUAL	-0.028	-0.111**	0.002	0.009	-0.022	0.047	0.223***	1.000										1.156
NONEXEC	0.000	0.123***	-0.124***	-0.117***	-0.141***	-0.134***	0.159***	0.079*	1.000									1.489
IND	-0.013	-0.032	-0.003	0.013	-0.064	-0.198***	-0.043	0.185***	0.136***	1.000								1.235
BSIZE	0.001	0.004	0.028	0.028	0.027	-0.267***	-0.166***	0.060	0.050	0.169***	1.000							1.280
EDUDIV	-0.122***	0.022	-0.126***	-0.117***	-0.152***	0.002	0.136***	0.138***	0.401***	0.224***	0.318***	1.000						1.510
EDIV	-0.214***	0.215***	-0.295***	-0.304***	-0.245***	-0.041	0.163***	0.250***	0.402***	0.336***	0.227***	0.417***	1.000					2.042
GDIV	-0.156***	0.111**	-0.236***	-0.234***	-0.231***	-0.150***	0.142***	0.114***	0.401***	0.206***	0.129***	0.361***	0.610***	1.000				1.778
DY	0.184***	-0.028	0.222***	0.221***	0.211***	-0.117***	-0.111**	0.056	-0.070	0.071	0.016	-0.097**	-0.112***	-0.054	1.000			1.107
ROA	0.428***	0.242***	0.505***	0.466***	0.618***	0.097**	-0.069	-0.039	-0.099**	-0.050	-0.033	-0.072*	-0.015	-0.076*	0.204***	1.000		1.103
LEV	0.499***	0.498***	0.098**	0.112***	0.035	-0.240***	-0.201***	-0.127***	0.164***	-0.071	-0.014	-0.067	-0.024	-0.032	0.011	-0.111**	1.000	1.171

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table sets out the Pearson correlations for all variables and the variance inflation factors (VIF) for the predictor variables used in Models 1f, 1g, 1h, 1i and 1j of the regression analysis for the industrials industry for the period 2002 to 2018, after adjusting the preliminary models by removing *TOP1*, *TOP5*, *CSIZE*, *LEV*, *DY* and *DIROWN*. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

6.4 REVISED MODEL 1

Model 1 deals with Hypotheses H_1 to H_8, which posit relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources. As discussed in Sections 6.3.1.1 and 6.3.1.2, TOP1 and TOP5 were removed from preliminary Model 1, which was specified in Section 5.10.1, and only HERF and TOP3 were retained as ownership concentration measures for the full sample and the top four industries in the revised model. In addition, only the best set of control variables was retained in revised Model 1, as mentioned in Sections 6.3.2.1 and 6.3.2.2. Therefore, ROA was the only control variable retained in revised Model 1 for the full sample and DY, ROA and LEV were included in revised Model 1 for the top four industries. Revised Model 1 contains no interaction terms and is specified separately for each of the dependent variables.

6.4.1 Full sample

For the full sample, this study used the following model specifications for revised Model 1 for company *i* at period *t*:

Model 1a

$$VAIC_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

Model 1b

$$CEE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

Model 1c

$$ICE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

Model 1d

$$HCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

Model 1e

$$SCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

6.4.2 Top industries

For the top four industries, this study used the following model specifications for revised Model 1 for company *i* at period *t*:

Model 1f

$$VAIC_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

Model 1g

$$CEE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

Model 1h

$$ICE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

Model 1i

$$HCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

Model 1j

$$SCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

6.5 STATIONARITY

The Levin, Lin and Chu unit root test was used to test for stationarity of all variables used in the regression analysis for the full sample and by industry for the sample period 2002 to 2018. Table 6.8 displays the results of the unit root test, which assumes a common unit root process (Levin, Lin & Chu, 2002). The t-statistic probabilities are all less than 0.05. Therefore, the null hypothesis of a unit root is rejected for all variables for the full sample and for the top four industries. This implies that the data is stationary for all variables.

Table 6.8 Results of the Levin, Lin and Chu unit root test by industry

Variable	Full sample			Basic materials			Consumer services			Financials			Industrials		
	t-statistic	Probability#	Stationary	t-statistic	Probability#	Stationary	t-statistic	Probability#	Stationary	t-statistic	Probability#	Stationary	t-statistic	Probability#	Stationary
VAIC	-2 463.98	0.000	Yes	-6.14	0.000	Yes	-2.37	0.009	Yes	-7.52	0.000	Yes	-5.00	0.000	Yes
CEE	-5.59	0.000	Yes	-3.50	0.000	Yes	-4.47	0.000	Yes	-4.88	0.000	Yes	-4.99	0.000	Yes
ICE	-8.49	0.000	Yes	-5.96	0.000	Yes	-2.89	0.002	Yes	-9.11	0.000	Yes	-62.93	0.000	Yes
HCE	-7.19	0.000	Yes	-5.32	0.000	Yes	-2.79	0.003	Yes	-6.86	0.000	Yes	-66.40	0.000	Yes
SCE	-12.23	0.000	Yes	-7.61	0.000	Yes	-3.04	0.001	Yes	-8.66	0.000	Yes	-259.23	0.000	Yes
HERF	-6.28	0.000	Yes	-19.39	0.000	Yes	-8.73	0.000	Yes	-6.44	0.000	Yes	-7.31	0.000	Yes
TOP3	-6.24	0.000	Yes	-14.58	0.000	Yes	-15.29	0.000	Yes	-6.95	0.000	Yes	-6.94	0.000	Yes
NONEXEC	-11.99	0.000	Yes	-5.43	0.000	Yes	-4.48	0.000	Yes	-6.55	0.000	Yes	-5.65	0.000	Yes
IND	-5.03	0.000	Yes	-3.87	0.000	Yes	-5.71	0.000	Yes	-4.90	0.000	Yes	-14.33	0.000	Yes
BSIZE	-5.24	0.000	Yes	-4.50	0.000	Yes	-4.70	0.000	Yes	-3.59	0.000	Yes	-3.94	0.000	Yes
EDUDIV	-9.49	0.000	Yes	-8.00	0.000	Yes	-3.46	0.000	Yes	-2.28	0.011	Yes	-4.77	0.000	Yes
EDIV	-20.74	0.000	Yes	-4.64	0.000	Yes	-3.99	0.000	Yes	-11.19	0.000	Yes	-6.83	0.000	Yes
GDIV	-7.08	0.000	Yes	-2.78	0.003	Yes	-2.13	0.017	Yes	-5.59	0.000	Yes	-2.72	0.000	Yes

Probabilities are calculated assuming asymptotic normality.

The table presents the results of the Levin, Lin and Chu unit root test, which assumes a common unit root process, for all continuous dependent, ownership and independent variables used in Models 1a to 1j of the regression analysis for the period 2002 to 2018 for the full sample and by industry, after revising Model 1. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

6.6 ESTIMATION METHOD

Various estimation methods were considered for both the full sample and the top four industries before deciding on the most suitable method.

6.6.1 Full sample

In order to identify a suitable estimation method, panel least squares regression was first conducted on the unwinsorised data using revised Model 1, as specified in Section 6.4. This estimation method applies the ordinary least squares (OLS) techniques to panel data. Given the distribution of the considered variables, which display high levels of skewness (<-16) and kurtosis (>600), two alternative estimation methods were also considered with regard to the unwinsorised data. The first alternative was robust regression and was taken into consideration because the inclusion of outliers may be important to the data. An M-estimator model was used to minimise a function of the errors rather than minimising the sum of squared errors (Alma, 2011). As a result, the robust regression estimation method was less sensitive to outliers. Quantile regression was the second alternative and was contemplated because, in contrast to panel least squares regression, it regresses to the median rather than the mean, which deals with the skewness of the data (Yu, Lu & Stander, 2003). The results of these regressions, which were based on revised Model 1, are presented separately for each dependent variable in Tables 6.9(a) to (e) for the full sample. For robust regression, the panel data structure was not recognised. Because the data structure is seen as cross-sectional at a single point in time, binary variables were added to the model to represent the 2003 to 2018 years to cater for the multiple periods.

In addition, panel least squares regression was conducted on the winsorised data. The panel least squares regression, which was conducted on both the winsorised and unwinsorised data, detected some issues that needed to be resolved. These included autocorrelation, which was evident from the low Durbin-Watson statistics, and the potential existence of heteroscedasticity. The Durbin-Watson statistic ranged between

0 and 4. Values of 2 or close to this indicate that there is no serious autocorrelation present, with generally accepted thresholds of between 1.5 and 2.5, indicating no serious violation of the assumption of no autocorrelation, whereas values nearer to 0 reflect positive autocorrelation and values nearer to 4 reveal negative autocorrelation (Gujarati, 2004). The Durbin-Watson statistics for the panel least squares regression are 0.585 and 0.643 for the unwinsorised and winsorised data, respectively, pointing to positive autocorrelation. Therefore, alternative estimation methods were considered with regard to the winsorised data. These included random effects and fixed effects modelling, as well as the use of other types of weighted and standard error and covariance and variance estimation methods available to resolve the departures from the acceptable assumptions of the OLS method and statistical thresholds. A more detailed discussion of these estimation methods was presented in Sections 5.12.2.3 and 5.12.2.4. The regression results, based on the application of these estimation methods to revised Model 1 for the full sample, are reported separately for each dependent variable in Tables 6.9(a) to (e). Based on these results, it was concluded that all further empirical analysis would be conducted only on the winsorised data and would adopt the estimated generalised least squares (EGLS) method, with period seemingly unrelated regressions (SUR) weightings and using White (diagonal) standard errors and covariance methods, for the full sample. As explained in Sections 5.12.2 and 5.12.3, this approach mitigates the problems arising from outliers, autocorrelation and any potential heteroscedasticity. Tables 6.9(a) to (c) also display acceptable levels of skewness (<2) and kurtosis (<7) for the EGLS estimation method, with period SUR weightings and using White (diagonal) standard errors and covariance methods. Tables 6.9(d) and (e) indicate that the kurtosis values for HCE (8.841) and SCE (8.185) for this estimation method slightly exceed the statistical threshold of 7. However, Schmidt and Finan (2018) assert that a violation of the assumption of normally distributed residuals in regression analysis has no influence on bias and does not substantially impact the regression results in the presence of large sample sizes. Because a large sample size was used in the current study, the kurtosis for HCE and SCE was not of great concern.

Table 6.9(a): Summary of results of various estimation methods for VAIC for the full sample using revised Model 1(a)

Data type	***Regression type***	***Adjusted R^2***	***Durbin-Watson***	***Akaike information criterion***	***F-statistic (p-value)***	***Skewness of standardised residuals***	***Kurtosis of standardised residuals***	***Statistically significant predictor variables[#]***
Unwinsorised	Panel least squares	0.040	0.585	7.866	9.233 (0.000)	-17.102	652.141	TOP3*** EDIV*** GDIV***
	Robust	0.274	N/A	3098.438	N/A	N/A	N/A	HERF*** TOP3*** NONEXEC*** BSIZE*** EDIV***
	Quantile	0.092	N/A	N/A	N/A	N/A	N/A	HERF** NONEXEC** IND** BSIZE***
Winsorised	Panel least squares	0.336	0.643	3.009	101.815 (0.000)	1.496	3.512	HERF** NONEXEC*** BSIZE*** EDIV*** GDIV***
	EGLS (cross-section random effects, period fixed effects)	0.390	1.158	N/A	49.804 (0.000)	1.625	3.871	TOP3*** EDIV***
	EGLS (period SUR weightings and using White (diagonal) standard errors and covariance methods)	0.477	1.995	N/A	182.338 (0.000)	0.837	6.748	NONEXEC* EDIV***

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. N/A means not applicable.
means that the statistically significant predictor variables exclude the dummy variables for the years 2003 to 2018 for robust regression and the control variables.

The table provides a summary of the results of the regressions done using various estimation methods with VAIC as the dependent variable. *VAIC* measures the extent of value creation for each monetary unit of resources invested by a company. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

Table 6.9(b): Summary of results of various estimation methods for CEE for the full sample using revised Model 1(b)

Data type	*Regression type*	*Adjusted R^2*	*Durbin-Watson*	*Akaike information criterion*	*F-statistic (p-value)*	*Skewness of standardised residuals*	*Kurtosis of standardised residuals*	*Statistically significant predictor variables*
Unwinsorised	Panel least squares	0.020	0.893	3.875	5.110 (0.000)	22.466	732.415	TOP3** NONEXEC** GDIV*
	Robust	0.191	N/A	2395.624	N/A	N/A	N/A	HERF*** NONDUAL*** NONEXEC*** BSIZE* EDUDIV*** EDIV***
	Quantile	0.088	N/A	N/A	N/A	N/A	N/A	HERF*** TOP3** NONDUAL*** NONEXEC*** EDIV*** GDIV*
Winsorised	Panel least squares	0.167	0.236	1.196	40.872 (0.000)	1.129	1.063	HERF*** NONDUAL*** NONEXEC*** IND** EDIV*** GDIV**
	Panel least squares (cross-section fixed effects, period fixed effects)	0.707	0.651	N/A	34.742 (0.000)	0.866	4.341	HERF*** NONDUAL*** IND* EDUDIV*** EDIV***
	EGLS (period SUR weightings and using White (diagonal) standard errors and covariance methods)	0.319	1.924	N/A	94.117 (0.000)	0.626	3.232	NONEXEC***

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. N/A means not applicable.
means that the statistically significant predictor variables exclude the dummy variables for the years 2003 to 2018 for robust regression and the control variables.

The table provides a summary of the results of the regressions done using various estimation methods with CEE as the dependent variable. *CEE* measures the extent of value creation for each monetary unit of resources invested by a company in physical capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

Table 6.9(c): Summary of results of various estimation methods for ICE for the full sample using revised Model 1(c)

Data type	*Regression type*	*Adjusted R^2*	*Durbin-Watson*	*Akaike information criterion*	*F-statistic (p-value)*	*Skewness of standardised residuals*	*Kurtosis of standardised residuals*	*Statistically significant predictor variables*
Unwinsorised	Panel least squares	0.042	0.579	7.854	9.706 (0.000)	-17.273	665.553	TOP3*** EDIV*** GDIV***
	Robust	0.212	N/A	3054.420	N/A	N/A	N/A	NONEXEC*** IND** BSIZE*** EDIV** GDIV**
	Quantile	0.076	N/A	N/A	N/A	N/A	N/A	NONDUAL*** NONEXEC*** BSIZE*** EDIV*** GDIV*
Winsorised	Panel least squares	0.290	0.549	2.831	82.079 (0.000)	1.493	2.767	NONDUAL* NONEXEC*** BSIZE*** EDIV***
	EGLS (cross-section random effects, period fixed effects)	0.382	1.220	N/A	48.177 (0.000)	1.627	3.042	TOP3*** EDUDIV*** EDIV***
	EGLS (period SUR weightings and using White (diagonal) standard errors and covariance methods)	0.429	1.998	N/A	150.249 (0.000)	0.728	2.913	TOP3*** NONEXEC** EDIV***

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. N/A means not applicable.
means that the statistically significant predictor variables exclude the dummy variables for the years 2003 to 2018 for robust regression and the control variables.

The table provides a summary of the results of the regressions done using various estimation methods with ICE as the dependent variable. *ICE* measures the extent of value creation for each monetary unit of resources invested by a company in intellectual capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

Table 6.9(d): Summary of results of various estimation methods for HCE for the full sample using revised Model 1(d)

Data type	*Regression type*	*Adjusted R^2*	*Durbin-Watson*	*Akaike information criterion*	*F-statistic (p-value)*	*Skewness of standardised residuals*	*Kurtosis of standardised residuals*	*Statistically significant predictor variables*
Unwinsorised	Panel least squares	0.042	0.555	7.828	9.770 (0.000)	-18.074	703.020	TOP3*** EDIV*** GDIV***
	Robust	0.200	N/A	3311.296	N/A	N/A	N/A	NONEXEC*** IND*** BSIZE*** GDIV***
	Quantile	0.074	N/A	N/A	N/A	N/A	N/A	HERF* NONEXEC*** BSIZE*** EDIV* GDIV**
Winsorised	Panel least squares	0.312	0.425	2.377	91.055 (0.000)	1.535	2.957	NONDUAL** NONEXEC*** BSIZE*** EDUDIV* EDIV***
	EGLS (cross-section random effects, period random effects)	0.419	1.064	N/A	144.088 (0.000)	1.684	3.269	TOP3*** NONDUAL*** EDUDIV*** EDIV***
	EGLS (period SUR weightings and using White (diagonal) standard errors and covariance methods)	0.477	2.012	N/A	182.055 (0.000)	0.935	8.841	TOP3*** NONEXEC** IND* EDIV***

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. N/A means not applicable.
means that the statistically significant predictor variables exclude the dummy variables for the years 2003 to 2018 for robust regression and the control variables.

The table provides a summary of the results of the regressions done using various estimation methods with HCE as the dependent variable. *HCE* measures the extent of value creation for each monetary unit of resources invested by a company in human capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

Table 6.9(e): Summary of results of various estimation methods for SCE for the full sample using revised Model 1(e)

Data type	*Regression type*	*Adjusted R^2*	*Durbin-Watson*	*Akaike information criterion*	*F-statistic (p-value)*	*Skewness of standardised residuals*	*Kurtosis of standardised residuals*	*Statistically significant predictor variables*
Unwinsorised	Panel least squares	-0.001	1.696	4.054	0.755 (0.000)	3.450	360.279	None
	Robust	0.188	N/A	2825.890	N/A	N/A	N/A	NONEXEC*** BSIZE*** EDIV*** GDIV**
	Quantile	0.045	N/A	N/A	N/A	N/A	N/A	NONDUAL* NONEXEC*** BSIZE*** EDIV***
Winsorised	Panel least squares	0.146	0.661	-0.282	35.065 (0.000)	0.756	1.622	NONEXEC*** IND** BSIZE*** EDIV***
	EGLS (cross-section fixed effects, period random effects)	0.525	1.257	N/A	18.416 (0.000)	0.181	6.740	NONEXEC* IND*** EDUDIV**
	EGLS (period SUR weightings and using White (diagonal) standard errors and covariance methods)	0.215	1.998	N/A	55.387 (0.000)	0.466	8.185	NONEXEC** EDIV*

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. N/A means not applicable.
means that the statistically significant predictor variables exclude the dummy variables for the years 2003 to 2018 for robust regression and the control variables.

The table provides a summary of the results of the regressions done using various estimation methods with SCE as the dependent variable. *SCE* measures the extent of value creation for each monetary unit of resources invested by a company in structural capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

6.6.2 Top industries

The same approach was applied to determine the best estimation method for the top four industries. The results of the evaluation of the estimation methods were similar to those for the full sample. Therefore, the EGLS estimation method, with period SUR weightings and using White (diagonal) standard errors and covariance methods, was adopted for each of the dependent variables for all four top industries.

6.7 BEST SET OF INDEPENDENT VARIABLES

As discussed in Section 5.8.2, the best set of independent variables for inclusion in revised Model 1 were identified using backward elimination. This process was followed for both the full sample and for the top four industries.

As indicated in Appendix 2, the adjusted R^2 increased from 0.477032 to 0.477791 for VAIC (for the full sample) when NONDUAL was removed from revised Model 1a, then to 0.477810 when IND was removed from this model and to 0.478186 when GDIV was removed from this model. However, this was only a marginal improvement, because the changes in the adjusted R^2 only occurred in the 3rd or 4th decimal place. Since the independent variables were found to be important by previous studies and based on the results from the full sample for VAIC, the decision was made to retain all of the independent variables in revised Model 1. In the interests of maintaining consistency, this decision was applied to all dependent variables and across the top four industries. Maintaining the original full set of independent variables also allowed for a more extensive examination of the moderation effects of a higher level of ownership concentration on the relationships between the independent and dependent variables. Therefore, no further changes were made to revised Model 1, specified in Section 6.4.

6.8 CHAPTER CONCLUSION

This chapter reported the findings of the preliminary data analysis for the full sample and for the top four industries. The descriptive statistics were reviewed to gain an understanding of the data. Correlations between variables were also considered and it was decided to revise Model 1 by reducing the ownership concentration and control variables. Additionally, assumptions of regression models, such as stationarity of the data, absence of autocorrelation and the normal distribution of the residuals were evaluated. Furthermore, various estimation methods were considered before deciding to adopt the EGLS estimation method, with period SUR weightings and using White (diagonal) standard errors and covariance methods. The next chapter applies this method to revised Model 1 to test Hypotheses H_1 to H_8, which propose relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources.

CHAPTER 7

ANALYSIS OF THE RELATIONSHIPS OF OWNERSHIP CONCENTRATION AND BOARD CHARACTERISTICS WITH THE EFFICIENCY OF VALUE ADDED BY A COMPANY FROM ITS RESOURCES

7.1 INTRODUCTION

This chapter presents the results of the testing of relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources. Using winsorised data, the selected estimation method is applied to revised Model 1, which is specified in Section 6.4, for this purpose. Findings are reported firstly for the full sample and secondly, for the top four industries for the period 2002 to 2018.

7.2 REGRESSION ANALYSIS OF THE FULL SAMPLE: HYPOTHESES H_1 TO H_8

Regressions are conducted on the data for each of the dependent variables (VAIC, CEE, ICE, HCE and SCE) to test Hypotheses H_1 to H_8[8], which propose relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources. The estimated generalised least squares (EGLS) method, which is also known as the feasible generalised least squares method, estimated with period seemingly unrelated regressions (SUR) as weighting method and using White (diagonal) standard errors and covariance

[8] Each hypothesis (H_1 to H_8) can be expressed in terms of a) the efficiency of value added by a company from its total resources (VAIC); b) the efficiency of value added by a company from its physical capital resources (CEE); c) the efficiency of value added by a company from its intellectual capital resources (ICE); d) the efficiency of value added by a company from its human capital resources (HCE); and e) the efficiency of value added by a company from its structural capital resources (SCE). For example, Hypothesis H_{2a} proposes that there is a relationship between the absence of CEO duality and the efficiency of value added by a company from its total resources and Hypothesis H_{2c} proposes that there is a relationship between the absence of CEO duality and the efficiency of value added by a company from its intellectual capital resources. This applies to both the full sample and the top industries.

methods, is used for this purpose. This estimation method is applied to revised Model 1, which is specified in Section 6.4.1 for the full sample. The variables applicable to revised Model 1 are presented in Table 7.1.

Table 7.1: Descriptions and measures of variables used in revised Model 1 to test the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources

Variable	Description	Measure
Dependent variables		
VAIC	Value added intellectual coefficient	The extent of value creation for each monetary unit invested in total resources
CEE	Capital employed efficiency	The extent of value creation for each monetary unit invested in physical capital resources
ICE	Intellectual capital efficiency	The extent of value creation for each monetary unit invested in intellectual capital resources
HCE	Human capital efficiency	The extent of value creation for each monetary unit invested in human capital resources
SCE	Structural capital efficiency	The extent of value creation for each monetary unit invested in structural capital resources
Independent variables (Ownership concentration and characteristics of the board of directors)		
HERF	Herfindahl index based on percentage shareholdings	Sum of the squares of the percentage shareholding held by each shareholder
TOP3	Percentage shareholding of top three shareholders	Sum of the % shareholdings of the top three shareholders
NONDUAL	Absence of CEO duality	Dummy variable of 1 if the same person serves as CEO and chair of the board of directors, otherwise 0
NONEXEC	Percentage of board members who are non-executive	Number of non-executive board members / Number of board members
IND	Percentage of non-executive board members who are independent	Number of independent board members / Number of non-executive board members
BSIZE	Board size	Number of board members
EDUDIV	Educational-level diversity	Teachman's index based on the number of board members with a doctoral degree, master's degree, honours degree/postgraduate diploma, bachelor's degree or no qualification as their highest level of qualification
EDIV	Ethnic diversity	Blau's index based on number of black and non-black board members
GDIV	Gender diversity	Blau's index based on number of male and female board members
Control variables (applicable to full sample and top industries – Models 1a to 1j)		
ROA	Return on assets	Operating profit / Total assets (at year-end)
Control variables (applicable to top industries only – Models 1f to 1j)		
DY	Dividend yield	Ordinary dividends per share as a percentage of the share price at year-end
LEV	Leverage	Total debt / Total shareholders' equity (at year-end)

The results of the regression analysis of the relationships of ownership concentration and the characteristics of the board of directors and the efficiency of value added by a company from its resources follow. Owing to the nature of the methodology used (as discussed in Chapter 5), the array of dependent variables and the various industries, the result cannot be anything other than repetitive.

7.2.1 VAIC

This section deals with the regressions for the entire set of data for the period 2002 to 2018, with VAIC as the dependent variable. VAIC is a measure of the efficiency of value added by a company from both its physical and intellectual capital resources. Revised Model 1a, which is applicable when VAIC serves as the dependent variable, is as follows for company *i* at period *t:*

$$VAIC_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

The results of Model 1a are reported in Table 7.2. The adjusted R^2 of 0.477 indicates that the predictor variables explain approximately 48% of the variance in VAIC. The Durbin-Watson statistic of 1.995, which is close to 2, reflects that there is no serious autocorrelation present in the data. The F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

HERF and TOP3 both represent ownership concentration. However, HERF has a negative β coefficient, whereas TOP3 has a positive β coefficient. This may be explained by TOP3 being calculated based only on ownership by the largest three shareholders of a company, which contrasts with the calculation of HERF, which is based on the ownership by all shareholders of a company. According to Mavruk *et al.* (2020), these measures of ownership concentration may be suitable for different purposes. For example, Mavruk *et al.* (2020) suggest that ownership by a number of the largest shareholders may be appropriate when examining the principal-agent agency problem, whereas it is unclear whether the Herfindahl index is better suited to represent ownership concentration with regard to the principal-agent or principal-principal agency problem. Nevertheless, neither HERF nor TOP3 has a statistically significant relationship with VAIC. Consequently, Hypotheses $H_{1.1a}$ and $H_{1.3a}$, which propose a relationship between ownership concentration and the efficiency of value added by a company from its total resources, are not supported. This result differs from the findings of Gaur *et al.* (2015) and Waheed and Malik (2019), who found a statistically significant positive relationship between ownership concentration and corporate performance, which supports the idea that a greater level of ownership concentration reduces agency problems and diminishes the effort required for the monitoring and control role of the directors. Gaur *et al.* (2015) and Waheed and Malik (2019) measured ownership concentration as the shareholdings of the largest and five largest shareholders, respectively. However, Gaur *et al.* (2015) used return on assets, a financial performance measure, for performance rather than VAIC. In addition, Waheed and Malik (2019) reported a statistically significant positive relationship between ownership concentration and performance when return on equity replaced return on assets as the dependent variable. Waheed and Malik (2019) also considered Tobin's Q as a measure of performance and presented mixed results of the relationship between Tobin's Q and ownership concentration, the majority of which had no statistical significance. This provides some support for the findings in the current study.

There is a statistically significant positive relationship at the 10% level between VAIC and NONEXEC. This means that a greater percentage of non-executive members on the board of directors enhances the board's monitoring and control role, and is associated with a higher level of efficiency of value added by a company from its total resources. This finding supports Hypothesis H_{3a}, proposing the existence of a relationship between the percentage of non-executive members on the board of directors and the efficiency of value added by a company from its total resources. This is in line with agency theory. Appuhami and Bhuyan (2015) and Ho and Williams (2003) provide support for this finding.

The only other statistically significant relationship occurs at the 1% level between VAIC and EDIV. Since this is a negative relationship, Hypothesis H_{7a}, which proposes a positive relationship between the board of directors' ethnic diversity and the efficiency of value added by a company from its total resources, is not supported. In addition, this relationship is weak, as indicated by the zero-order, partial and part correlations, presented in Appendix 2, of -0.064, -0.157 and -0.129, respectively. Zero-order correlation is the same as Pearson correlation and refers to the bivariate relationship between two variables without controlling for the impact of other variables. Correlation coefficients indicate the degree of association between two variables, but may be misleading if additional confounding variables are related to both variables under consideration. Partial correlation deals with this problem by considering the association between a dependent and an independent variable after controlling for the impact of potential confounding variables on both the dependent and independent variables (Gujarati, 2004; Hair *et al.*, 2010). In contrast, part correlation determines the relationship between the dependent and independent variables after controlling for the influence of potential confounding variables on only the independent variables (Hair *et al.*, 2010). This indicates the extent of the unique variance explained by the independent variable under consideration in relation to the total variance of the dependent variable, as opposed to only the variance unaccounted for by the potential confounding variables. Therefore, as the statistically significant negative relationship is not supported and is weak, it is advisable that further research be conducted to confirm the results. This will also apply to similar situations.

Hypotheses H_{2a}, H_{4a}, H_{5a}, H_{6a} and H_{8a} are not supported because the regression coefficients (β) of NONDUAL, IND, BSIZE, EDUDIV and GDIV, respectively, are not statistically significant. These hypotheses were stated in Section 4.2.

7.2.2 CEE

This section deals with the regressions for the entire set of data for the period 2002 to 2018, with CEE as the dependent variable. CEE is a measure of the efficiency of value added by a company from its physical capital resources. Regression analysis is conducted using revised Model 1b, which is specified as follows for company *i* at period *t:*

$$CEE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

The regression results of Model 1b are reported in Table 7.2. The adjusted R^2 of 0.319 indicates that the predictor variables explain approximately 32% of the variance in CEE. The Durbin-Watson statistic of 1.925 indicates no serious autocorrelation in the final model. The F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

Although HERF has a negative β coefficient and TOP3 has a positive β coefficient when VAIC is the dependent variable, both of these ownership concentration variables have negative β coefficients when CEE serves as the dependent variable. Nevertheless, irrespective of whether VAIC or CEE is the dependent variable, neither the β coefficient of HERF nor the β coefficient of TOP3 is statistically significant. Therefore, Hypotheses $H_{1.1b}$ and $H_{1.3b}$, which propose a relationship between ownership concentration and the efficiency of value added by a company from its physical capital resources, are not supported.

There is a statistically significant negative relationship at the 1% level between CEE and NONEXEC. Hypothesis H_{3b}, which proposes a relationship between the percentage of members of the board of directors who are non-executive and the efficiency of value added by a company from its physical capital resources, is supported based on this finding. This is in line with stewardship theory. Muth and Donaldson (1998) suggest that superior performance is achieved when the board of directors consists of a majority of inside directors, because the depth of knowledge, expertise and commitment of insiders facilitate the strategic role of the board of directors.

Hypotheses H_{2b}, H_{4b}, H_{5b}, H_{6b}, H_{7b} and H_{8b} are all rejected because the regression coefficients (β) of NONDUAL, IND, BSIZE, EDUDIV, EDIV and GDIV, respectively, are not statistically significant. These hypotheses were stated in Section 4.2.

Table 7.2: Revised Model 1 regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources for the full sample

	VAIC (Revised Model 1a)	***CEE (Revised Model 1b)***	***ICE (Revised Model 1c)***	***HCE (Revised Model 1d)***	***SCE (Revised Model 1e)***
Intercept	2.623***	0.839***	1.536**	1.208***	0.311***
	(0.217)	(0.071)	(0.168)	(0.132)	(0.042)
HERF	-1.58E-05	-1.37E-06	-1.62E-05	-6.02E-06	2.89E-06
	(1.25E-05)	(4.15E-06)	(1.02E-05)	(8.60E-06)	(2.40E-06)
TOP3	0.142	-0.051	0.250***	0.213***	0.010
	(0.110)	(0.034)	(0.091)	(0.068)	(0.022)
NONDUAL	0.026	-0.035	0.068	0.064	-0.008
	(0.101)	(0.029)	(0.071)	(0.059)	(0.017)
NONEXEC	0.322*	-0.180***	0.439**	0.219*	0.130**
	(0.194)	(0.060)	(0.176)	(0.128)	(0.052)
IND	0.0428	-0.027	0.081	0.107*	-0.035
	(0.094)	(0.031)	(0.072)	(0.054)	(0.022)
BSIZE	0.014	-0.002	0.004	0.005	0.002
	(0.010)	(0.003)	(0.007)	(0.006)	(0.002)
EDUDIV	-0.141	-0.036	0.030	0.072	0.018
	(0.100)	(0.031)	(0.074)	(0.058)	(0.020)
EDIV	-0.940***	0.089	-0.719***	-0.581***	-0.073*
	(0.193)	(0.062)	(0.167)	0.128	(0.040)
GDIV	0.156	-0.016	0.187	0.076	-0.052
	(0.184)	(0.055)	(0.147)	0.111	(0.034)
ROA	6.522***	1.302***	4.895***	4.134***	0.701***
	(0.269)	(0.073)	(0.228)	0.186	(0.062)
R^2	0.480	0.322	0.432	0.479	0.219
Adjusted R^2	0.477	0.319	0.429	0.477	0.215
Durbin-Watson	1.995	1.925	1.998	2.012	1.999
F-statistic	182.338	94.117	150.249	182.055	55.387
Probability (F-statistic)	0.000	0.000	0.000	0.000	0.000

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The unstandardised β coefficients are shown before the parentheses. The standard error is in parentheses.

The table presents the results of the EGLS regressions with period SUR weightings and using White (diagonal) standard errors and covariance estimation methods for the full sample for the period 2002 to 2018. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

7.2.3 ICE

In this section, the data analysis and results of the regressions (with ICE as dependent variable) are discussed for the entire set of data for the period 2002 to 2018. ICE is a measure of the efficiency of value added by a company from its intellectual capital resources. Revised Model 1c, which is applicable when ICE serves as the dependent variable, is as follows for company *i* at period *t:*

$$ICE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

Table 7.2 reports the results of Model 1c. The adjusted R^2 of 0.429 indicates that the predictor variables explain approximately 43% of the variance in ICE, which is a subcomponent of VAIC. The Durbin-Watson statistic of 1.998 is very close to 2, which means that there is no serious autocorrelation present. The F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

HERF has a negative β coefficient and TOP3 has a positive β coefficient when ICE is the dependent variable. This follows the same pattern as when VAIC is the dependent variable and was discussed in Section 7.2.1. The β coefficient of HERF is not statistically significant when ICE is the dependent variable. TOP3 has a statistically significant positive β coefficient at the 1% level when ICE is the dependent variable. This finding is supported by the studies of Gaur *et al.* (2015) and Waheed and Malik (2019), who found a statistically significant positive relationship between ownership concentration and traditional measures of corporate performance, which supports the idea that a greater level of ownership concentration reduces agency problems and diminishes the effort required for the monitoring and control role of the directors. Consequently, the proposal of a relationship between ownership concentration and the efficiency of value added by a company from its intellectual capital resources is supported when ownership concentration is represented by TOP3 (Hypothesis $H_{1.3c}$), but not when it is measured by HERF (Hypothesis $H_{1.1c}$).

There is a statistically significant positive relationship at the 5% level between NONEXEC and ICE. Therefore, Hypothesis H_{3c}, which proposes a relationship between the percentage of members of the board of directors who are non-executive and the efficiency of value added by a company from its intellectual capital resources, is supported. The studies of Dahya and McConnell (2007), Dehaene *et al.* (2001), Rosenstein and Wyatt (1990) provide support for this finding using alternative measures of performance. This finding is reinforced by agency theory.

There is a statistically significant negative relationship at the 1% level between EDIV and ICE. Therefore, Hypothesis H_{7c}, which posits a positive relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources, is not supported. The negative relationship between EDIV and ICE is a weak relationship as indicated by the zero-order, partial and part correlation coefficients of -0.085, -0.197 and -0.169, respectively, presented in Appendix 3.

Hypotheses H_{2c}, H_{4c}, H_{5c}, H_{6c} and H_{8c} are not supported because the β coefficients of NONDUAL, IND, BSIZE, EDUDIV and GDIV, respectively, are not statistically significant. These hypotheses were stated in Section 4.2.

7.2.4 HCE

In this section, the data analysis and results of the regressions (with HCE as dependent variable) are discussed for the entire set of data for the period 2002 to 2018. HCE is a measure of the efficiency of value added by a company from its human capital resources, which forms part of its intellectual capital resources. Consequently, revised Model 1d, which is applicable when HCE serves as the dependent variable, is as follows for company *i* at period *t:*

$$HCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

Table 7.2 reports the results of Model 1d. The adjusted R^2 of 0.477 indicates that the predictor variables explain approximately 48% of the variance in HCE, which is a subcomponent of ICE. The Durbin-Watson statistic of 2.012 is very close to 2, which means that there is no serious autocorrelation present. The F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

Similar to when ICE serves as the dependent variable, HERF has a negative β coefficient, which is not statistically significant, and TOP3 has a positive β coefficient, which is statistically significant at the 1% level. Therefore, the proposal of a relationship between ownership concentration and the efficiency of value added by a company from its human capital resources is supported when ownership concentration is represented by TOP3 (Hypothesis $H_{1.3d}$), but not when it is denoted by HERF (Hypothesis $H_{1.1d}$). Section 7.2.3 provided a more detailed discussion concerning this matter.

At the 10% level of statistical significance, there is a positive relationship between NONEXEC and HCE. This supports agency theory and the monitoring and control role of the directors (Agrawal & Knoeber, 1996). It implies that a greater percentage of non-executive members on the board of directors is associated with a higher level of efficiency of value added by a company from its human capital resources. Therefore, Hypothesis H_{3d}, which posits a relationship between the percentage of non-executive members of the board of directors and the efficiency of value added by a company from its human capital resources, is supported.

There is a statistically significant positive relationship at the 10% level between HCE and IND. The β coefficient of IND is positive, which is in line with agency theory and supports the monitoring and control role of the directors (Agrawal & Knoeber, 1996). This means that a greater percentage of independent non-executives on the board of directors is associated with a higher level of efficiency of value added by a company from its human capital resources. Therefore, Hypothesis H_{4d}, which posits a relationship between the percentage of non-executive members of the board of directors who are independent and the efficiency of value added by a company from its human capital resources, is supported.

There is a statistically significant negative relationship at the 1% level between HCE and EDIV. The negative relationship between EDIV and HCE is a weak relationship as indicated by the zero-order, partial and part correlation coefficients of -0.107, -0.207 and -0.175, respectively, presented in Appendix 3. Therefore, Hypothesis H_{7d}, which posits a relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its human capital resources, is not supported.

Hypotheses H_{2d}, H_{5d}, H_{6d} and H_{8d} are not supported because the β coefficients of NONDUAL, BSIZE, EDUDIV and GDIV, respectively, are not statistically significant. These hypotheses were stated in Section 4.2.

7.2.5 SCE

In this section, the data analysis and results of the regressions (with SCE as dependent variable) are discussed for the entire set of data for the period 2002 to 2018. SCE is a measure of the efficiency of value added by a company from its structural capital resources, which form part of its intellectual capital resources. Consequently, revised Model 1e, which is applicable when ICE serves as the dependent variable, is as follows for company *i* at period *t:*

$$SCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} ROA_{it} + \varepsilon_{it}$$

Table 7.2 reports the results of Model 1e. The adjusted R^2 of 0.215 indicates that the predictor variables explain approximately 21% of the variance in SCE, which is a subcomponent of ICE. The Durbin-Watson statistic of 1.999 is very close to 2, which means that there is no serious autocorrelation present. The F-statistic for the regression model is statistically significant (p<0.001), indicating that all the β coefficients differ significantly from zero.

HERF and TOP3 both have positive β coefficients that are not statistically significant. Therefore, Hypotheses $H_{1.1e}$ and $H_{1.3e}$, which propose a relationship between ownership concentration and the efficiency of value added by a company from its structural capital resources, are not supported.

There is a statistically significant positive relationship at the 5% level between SCE and NONEXEC. This is in line with agency theory and supports the monitoring and control role of the directors (Agrawal & Knoeber, 1996). This means that a greater percentage of non-executives on the board of directors is associated with a higher level of efficiency of value added by a company from its structural capital resources. Therefore, Hypothesis H_{3e}, which proposes a relationship between the percentage of members of the board of directors who are non-executive and the efficiency of value added by a company from its structural capital resources, is supported.

There is a statistically significant negative relationship at the 10% level between EDIV and SCE. Therefore, Hypothesis H_{7e}, which posits a statistically significant positive relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its structural capital resources, is not supported. The negative relationship between EDIV and SCE is a weak relationship as indicated by the zero-order, partial and part correlation coefficients of -0.050, -0.124 and -0.115, respectively, presented in Appendix 3.

Hypotheses H_{2e}, H_{4e}, H_{5e}, H_{6e} and H_{8e} are not supported because the β coefficients of NONDUAL, IND, BSIZE, EDUDIV and GDIV, respectively, are not statistically significant. These hypotheses were stated in Section 4.2.

7.2.6 Summary of results of the full sample: Hypotheses H_1 to H_8

Table 7.3 summarises the results of the regressions done to test Hypotheses H_1 to H_8.

Table 7.3: Summary of the regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources for the full sample: Hypotheses H_1 to H_8

Hypotheses	***Predictor variable***	***Predicted sign***	***Findings (β coefficient sign and underpinning theory)***				
			VAIC	***CEE***	***ICE***	***HCE***	***SCE***
$H_{1.1a} – H_{1.1e}$	HERF	+/-	- (AT)	- (AT)	- (AT)	- (AT)	+ (AT)
$H_{1.3a} – H_{1.3e}$	TOP3	+/-	+ (AT)	- (AT)	+ (AT)	+ (AT)	+ (AT)
$H_{2a} – H_{2e}$	NONDUAL	+/-	+ (AT)	- (ST)	+ (AT)	+ (AT)	- (ST)
$H_{3a} – H_{3e}$	NONEXEC	+/-	+ (AT)	- (ST)	+ (AT)	+ (AT)	+ (AT)
$H_{4a} – H_{4e}$	IND	+/-	+ (AT)	- (ST)	+ (AT)	+ (AT)	- (ST)
$H_{5a} – H_{5e}$	BSIZE	+/-	+(SH/RDT)	- (AT)	+(SH/RDT)	+(SH/RDT)	+(SH/RDT)
$H_{6a} – H_{6e}$	EDUDIV	+	-	-	+(AT/SH/RDT)	+(AT/SH/RDT)	+(AT/SH/RDT)
$H_{7a} – H_{7e}$	EDIV	+	-	+(AT/SH/RDT)	-	-	-
$H_{8a} – H_{8e}$	GDIV	+	+(AT/SH/RDT)	-	+(AT/SH/RDT)	+(AT/SH/RDT)	-

Supported: Statistically significant relationship

Not supported: Statistically significant relationship, but direction of relationship not as hypothesised

Not supported: Relationship not statistically significant

AT = agency theory; ST = stewardship theory; SH = stakeholder theory; and RDT = resource dependence theory.

The table provides a summary of the results of the regressions conducted to test Hypotheses H_1 to H_8 for the top industries. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

7.2.7 Robustness of the regressions

Random permutation tests on sample splits were done to determine whether the regressions using revised Model 1, presented in Sections 7.2.1 to 7.2.5, were robust. A random permutation test (also referred to as a randomisation test) is a type of statistical significance test in which the regression is conducted on random samples of the total population. For the purposes of this study, ten random samples were created in SPSS, each using approximately 50% of the total sample. This resulted in sample sizes of approximately 1 000 company-year observations. For each of the random samples, the regression was conducted using revised Model 1.

For all ten random samples, the independent variables NONEXEC and EDIV were found to be statistically significant predictors of VAIC, consistent with the findings reported in Section 7.2.1 for the full sample. NONEXEC was also found to be a statistically significant predictor of CEE for all ten random samples, consistent with the findings documented in Section 7.2.2 for the full sample. Therefore, the regression results of revised Model 1a and revised Model 1b, with VAIC and CEE as the dependent variables, respectively, were considered robust.

Using Model 1c, for all ten random samples, the independent variables NONEXEC and EDIV were statistically significant predictors of ICE, consistent with the results of the full sample documented in Section 7.2.3. However, the β coefficient of TOP3, presented in Section 7.2.3, which was found to be statistically significant for the full sample (with ICE as the dependent variable), was only statistically significant for nine of the ten random samples. Because the statistically significant predictors of the dependent variable, ICE, in the random permutation tests correspond in the majority (90%) of cases with the statistically significant predictors reported in Section 7.2.3, the regression results of Model 1c were accepted as robust.

Using Model 1d, Section 7.2.4 indicates that TOP3, NONEXEC, IND and EDIV were found to be statistically significant predictors of HCE for the full sample. The findings of the ten random permutation tests correspond with these findings for TOP3, NONEXEC and EDIV; however. IND was only found to be a statistically significant predictor of HCE for two of the ten random samples. Results were also inconsistent when structural permutations were used as an alternative approach for robustness testing. For the structural permutations, regression Model 1d was tested eight times, with the exclusion of one industry in each iteration. Because this study was not able to prove the robustness of the statistical result for the role of the percentage of non-executive members of the board of directors who are independent as a statistically significant predictor of the efficiency of value added by a company from its human capital resources, it is advisable that further research be conducted to confirm the robustness of this result.

For all ten random samples, the independent variables NONEXEC and EDIV were found to be statistically significant predictors of SCE, consistent with the findings reported in Section 7.2.5 for the full sample. Consequently, the regression results of revised Model 1e, with SCE as the dependent variable, were considered robust.

7.3 REGRESSION ANALYSIS OF THE TOP INDUSTRIES: HYPOTHESES H_1 TO H_8

One of the objectives stated in Section 1.4 of this study was to empirically determine the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources for each of the top industries represented on the Johannesburg Stock Exchange (JSE). The aim of this objective was not to research the fundamental differences between industries, but rather to study the results within industries. Fundamental differences between industries are vast (e.g. labour-intensive industries versus capital-intensive industries and differences in inflation sensitivity between industries). Therefore, no attempt was made to explain the fundamental differences between industries that gave rise to the variations in the results.

The EGLS method, with period SUR weightings and using White (diagonal) standard errors and covariance estimation methods, was applied to Model 1f, Model 1g, Model 1h, Model 1i and Model 1j, which were specified in Section 6.4.2 for the top four industries. This was done for each of the dependent variables (VAIC, CEE, ICE, HCE and SCE) to test Hypotheses H_1 to H_8, which propose relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources.

7.3.1 VAIC

This section deals with the regressions for the top four industries for the period 2002 to 2018, with VAIC as the dependent variable. VAIC is a measure of the efficiency of value added by a company from both its physical and intellectual capital resources. Model 1f, which is applicable to the industry analysis when VAIC serves as the dependent variable, is as follows for company *i* at period *t:*

$$VAIC_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

The results of Model 1f are reported in Table 7.4. The adjusted R^2 ranges between 0.774 for the industrials industry and 0.998 for the basic materials industry, indicating that the predictor variables explain a large portion of the variance in VAIC. The Durbin-Watson statistic ranges between 1.839 for the consumer services industry and 2.066 for the basic materials industry. This is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

HERF is a measure of ownership concentration and has a statistically significant β coefficient at the 1% level for the basic materials, consumer services and financials industries. The β coefficient of HERF is negative for the basic materials industry and positive for the consumer services and financials industries. It is not statistically significant for the industrials industry. Therefore, the proposal of a relationship between ownership concentration and the efficiency of value added by a company from its total resources is supported when ownership concentration is measured in terms of the Herfindahl index (Hypothesis $H_{1.1a}$) for the basic materials, consumer services and financials industries, but not for the industrials industry. HERF was calculated based on the ownership by all shareholders of a company.

Table 7.4: Regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its total resources (VAIC) for the top four industries (Model 1f)

	Basic materials	***Consumer services***	***Financials***	***Industrials***
Intercept	2.220***	2.014***	7.065***	1.507***
	(0.025)	(0.139)	(0.926)	(0.166)
HERF	-1.92E-05***	3.72E-05***	3.37E-04***	1.83E-05
	(1.68E-06)	(7.46E-06)	(4.66E-05)	(9.90E-06)
TOP3	0.343***	-0.012	-2.218***	0.008
	(0.020)	(0.058)	(0.359)	(0.086)
NONDUAL	0.341***	-0.027	-0.737	0.361***
	(0.012)	(0.061)	(0.819)	(0.090)
NONEXEC	-0.547***	0.105	3.565***	0.074
	(0.027)	(0.106)	(0.729)	(0.143)
IND	0.370***	-0.242***	-1.366***	0.236***
	(0.019)	(0.055)	(0.344)	(0.073)
BSIZE	0.023***	0.031***	-0.018	0.017**
	(0.001)	(0.007)	(0.024)	(0.007)
EDUDIV	0.024*	-0.147**	-0.467	-0.027
	(0.014)	(0.059)	(0.311)	(0.088)
EDIV	-0.385***	0.129	-11.560***	-1.284***
	(0.028)	(0.111)	(0.754)	(0.227)
GDIV	-1.052***	0.379***	10.456***	0.115
	(0.014)	(0.129)	(0.707)	(0.187)
DY	-0.968***	-0.825***	-2.754***	1.956***
	(0.090)	(0.205)	(0.501)	(0.585)
ROA	6.792***	6.304***	11.094***	5.769***
	(0.014)	(0.227)	(0.330)	(0.297)
LEV	0.203***	0.186***	0.045*	0.474***
	(0.007)	(0.017)	(0.024)	(0.025)
R^2	0.998	0.806	0.857	0.779
Adjusted R^2	0.998	0.800	0.853	0.774
Durbin-Watson	2.066	1.839	1.882	1.968
F-statistic	15 586.670	148.169	189.205	151.220
Probability (F-statistic)	0.000	0.000	0.000	0.000

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The unstandardised β coefficients are shown before the parentheses. The standard error is in parentheses.

The table presents the results of the EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance estimation methods for the top four industries, with VAIC as dependent variable. *VAIC* measures the extent of value creation for each monetary unit of resources invested by a company. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

The negative β coefficient of HERF for the basic materials industry supports the notion that a higher level of ownership concentration aggravates the agency problem and is associated with a decreased efficiency of value added by a company from its total resources. This may be due to a higher level of ownership concentration resulting in excessive monitoring that impedes the management function (Edmans & Holderness, 2017) or management being pressurised into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010). The positive β coefficients of HERF indicate that an increase in HERF is associated with an increase in the efficiency of value added by a company from its total resources, which supports agency theory, because it suggests a decrease in agency costs owing to a closer alignment of the interests of a company's management and shareholders (Hu & Izumida, 2008). This indicates that HERF is a suitable measure of ownership concentration to mitigate the principal-agent agency problem and reduce agency costs within the consumer services and financials industries when VAIC is the dependent variable.

TOP3 is also a measure of ownership concentration, but only takes into account the shareholdings of the largest shareholders. At the 1% level of statistical significance, TOP3 has a positive β coefficient for the basic materials industry and a negative β coefficient for the financials industry. The β coefficients of TOP3 are not statistically significant for the consumer services and industrials industries. Therefore, the proposal of a relationship between ownership concentration and the efficiency of value added by a company from its total resources is supported when ownership concentration is calculated based on the largest three shareholdings (Hypothesis $H_{1.3a}$) for the basic materials and financials industries, but not for the consumer services and industrials industries. With regard to the basic materials industry, the positive β coefficient indicates that a greater extent of ownership concentration is associated with increased efficiency of value added by a company from its total resources. This provides support for agency theory and the mitigation of misaligned interests of a company's management and shareholders by a higher level of ownership concentration (Hu & Izumida, 2008). The negative β coefficient of TOP3 for the financials industry suggests that a higher level of ownership concentration is associated with decreased efficiency of value added by a company from its total resources. This provides support for the view that a higher level of ownership concentration aggravates the agency problem and may hinder the management function (Edmans & Holderness, 2017) or lead to management focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010).

There is a statistically significant positive relationship at the 1% level between NONDUAL and the efficiency of value added by a company from its total resources for the basic materials and industrials industries. The β coefficients of NONDUAL are not statistically significant for the consumer services and financials industries. Therefore, Hypothesis H_{2a}, which proposes a relationship between absence of CEO duality and the efficiency of value added by a company from its total resources, is supported for the basic materials and industrials industries, and not for the consumer services and financials industries. The positive β coefficients indicate that the absence of CEO duality is associated with increased efficiency of value added by a company from its total resources, which is in line with agency theory (Eisenhardt, 1989).

At the 1% level of statistical significance, NONEXEC has a negative β coefficient for the basic materials industry and a positive β coefficient for the financials industry. For Australian service companies, Appuhami and Bhuyan (2015) found a statistically significant positive relationship between a greater extent of outside directors and VAIC, which provides support for the finding for the financials industry. The β coefficients of NONEXEC for the consumer services and industrials industries are not statistically significant. Therefore, Hypothesis H_{3a}, which proposes a relationship between the percentage of non-executives on the board of directors and the efficiency of value added by a company from its total resources, is supported for the basic materials and financials industries, but not for the consumer services and industrials industries. For the basic materials industry, this means that a greater percentage of non-executives on the board of directors is associated with decreased efficiency of value added by a company from its total resources, which is in line with stewardship theory (Muth & Donaldson, 1998). In contrast, for the financials industry, this means that a higher percentage of non-executives on the board of directors is associated with increased efficiency of value added by a company from its total resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Zahra & Pearce, 1989).

The β coefficients of IND are statistically significant at the 1% level for all the top four industries. Consequently, Hypothesis H_{4a}, which proposes a relationship between the percentage of non-executive members of the board of directors who are independent and the efficiency of value added by a company from its total resources, is supported for all the top four industries. For Australian service companies, Appuhami and Bhuyan (2015) found a statistically significant positive relationship between a greater extent of outside directors and VAIC, which provides support for the findings for the basic materials and industrials industries. For these industries, the positive β coefficients of IND imply that a higher percentage of non-executives on the board of directors who are independent is associated with greater efficiency of value added by a company from its total resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Pearce & Zahra, 1992; Zahra & Pearce, 1989). In contrast, for the consumer services and financials industries, the negative β coefficient of IND implies that a higher percentage of non-executives on the board of directors who are independent is associated with less efficiency of value added by a company from its total resources, which is in line with stewardship theory (Muth & Donaldson, 1998).

BSIZE has a statistically significant positive β coefficient at the 1% level for the basic materials and consumer services industries, and at the 5% level for the industrials industry. The β coefficient of BSIZE for the financials industry is not statistically significant. This finding for the financials industry is supported by the study by Appuhami and Bhuyan (2015), which found no significant relationship between the size of the board of directors and VAIC for Australian service companies. Therefore, Hypothesis H_{5a}, which proposes a relationship between the size of the board of directors and the efficiency of value added by a company from its total resources, is supported for the basic materials, consumer services and industrials industries, but not for the financials industry. The positive β coefficient means that a larger size of the board of directors is associated with increased efficiency of value added by a company from its total resources, which supports stakeholder theory (Freeman *et al.*, 2004) and resource dependence theory (Pfeffer, 1972).

The β coefficient of EDUDIV is statistically significant at the 10% level for the basic materials industry and at the 5% level for the consumer services industry. However, the β coefficient of EDUDIV is positive for the basic materials industry and negative for the consumer services industry. The negative relationship between EDUDIV and VAIC for the consumer services industry is very weak, as indicated by the zero-order, partial and part correlation coefficients of -0.010, -0.073 and -0.046, respectively, presented in Appendix 4. Mahadeo *et al.* (2012) also found that a greater extent of educational-level diversity is associated with decreased performance in an emerging market; however, this finding was not specific to any industry. Although Bantel (1993) found that greater educational-level diversity led to better decision-making in the banking industry, the β coefficient of EDUDIV for the financials industry is not statistically significant. For the industrials industry, the β coefficient of EDUDIV is also not statistically significant. Therefore, Hypothesis H_{6a}, which proposes a positive relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its total resources, is supported for the basic materials industry, but not for the consumer services, financials, and industrials industries. The positive β coefficient of EDUDIV for the basic materials industry indicates that a greater extent of educational-level diversity of the board of directors is associated with increased efficiency of value added by a company from its total resources, which supports agency theory (Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995; Hillman *et al.*, 2001; Triana *et al.*, 2013) and resource dependence theory (Pfeffer, 1972).

The negative β coefficients of EDIV are statistically significant at the 1% level for the basic materials, financials and industrials industries. The β coefficient of EDIV is not statistically significant for the consumer services industry. Therefore, Hypothesis H_{7a}, which proposes a positive relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its total resources, is not supported for any of the top four industries. The partial correlation coefficients for the association between EDIV and VAIC for the financials and industrials industries are -0.343 and -0.310, respectively, reflecting a moderate correlation between these variables. For the basic materials industry, the zero-order, partial and part correlation coefficients presented in Appendix 4 of -0.198, -0.045 and -0.028, respectively, reflect a weak association between EDIV and VAIC.

The β coefficients of GDIV are statistically significant at the 1% level for the basic materials, consumer services and financials industries. However, the β coefficient of GDIV is negative for the basic materials industry, while it is positive for the consumer services and financials industries. For the industrials industry, the β coefficient of GDIV is not statistically significant. Therefore, Hypothesis H_{8a}, which proposes a positive relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its total resources, is supported for the consumer services and financials industries, but not for the basic materials and industrials industries. The positive β coefficients of GDIV for the consumer services and financials industries indicate that a greater extent of gender diversity of the board of directors is associated with increased efficiency of value added by a company from its total resources, which supports agency theory (Triana *et al.*, 2013), stakeholder theory (Donaldson & Davis, 1991) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between GDIV and VAIC for the basic materials industry is weak. Appendix 4 indicates that the zero-order, partial and part correlation coefficients of -0.089, -0.138 and -0.086, respectively, reflect a weak association between GDIV and VAIC. A negative relationship between GDIV and performance was reported in the literature; however, these findings were neither specific to the efficiency of value added by a company from its resources nor to a particular industry (Adams & Ferreira, 2009; Ahern & Dittmar, 2012).

7.3.2 CEE

This section deals with the regressions for the top four industries for the period 2002 to 2018, with CEE as the dependent variable. CEE is a measure of the efficiency of value added by a company from its physical capital resources.

Model 1g, which is applicable to the industry analysis when CEE serves as the dependent variable, is as follows for company *i* at period *t:*

$$CEE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

The results of Model 1g are reported in Table 7.5. The adjusted R^2 ranges between 0.668 for the industrials industry and 0.986 for the basic materials industry, indicating that the predictor variables explain a moderate to large portion of the variance in CEE. The Durbin-Watson statistic ranges between 1.832 for the consumer services industry and 2.124 for the basic materials industry. This is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

HERF has a statistically significant β coefficient at the 1% level for the basic materials and financials industries. The β coefficients of HERF are not statistically significant for the consumer services and industrials industries. The β coefficient of HERF is positive for the basic materials industry and negative for the financials industry. Consequently, when ownership concentration is measured in terms of the Herfindahl index, Hypothesis $H_{1.1b}$, which proposes a relationship between ownership concentration and the efficiency of value added by a company from its physical capital resources, is supported for the basic materials and financials industries, but not for the consumer services and industrials industries. The negative β coefficient of HERF for the financials industry supports the idea that a higher level of ownership concentration aggravates the agency problem and is associated with decreased efficiency of value added by a company from its resources. This may be due to a higher level of ownership concentration resulting in excessive monitoring that impedes the management function (Edmans & Holderness, 2017) or management being pressurised into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010). The positive β coefficient of HERF for the basic materials industry indicates that an increase in HERF is associated with an increase in the efficiency of value added by a company from its resources, which supports agency theory, because it suggests a decrease in agency costs owing to a closer alignment of the interests of a company's management and shareholders (Hu & Izumida, 2008). This indicates that HERF is a suitable measure of ownership concentration to mitigate the principal-agent agency problem and reduce agency costs.

Table 7.5: Regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its physical capital resources (CEE) for the top four industries (Model 1g)

	Basic materials	*Consumer services*	*Financials*	*Industrials*
Intercept	0.506***	0.640***	0.364***	0.584***
	(0.022)	(0.075)	(0.086)	(0.088)
HERF	8.35E-06***	-1.01E-05	-1.37E-05***	1.17E-05
	(1.13E-06)	(5.32E-06)	(2.81E-06)	(6.06E-06)
TOP3	-0.130***	-0.092	0.091***	-0.048
	(0.011)	(0.038)	(0.025)	(0.049)
NONDUAL	-0.146***	-0.016	0.126**	-0.063
	(0.005)	(0.034)	(0.061)	(0.043)
NONEXEC	0.059***	-0.303***	-0.481***	-0.030
	(0.021)	(0.071)	(0.044)	(0.065)
IND	0.006	-0.145***	0.010	-0.046
	(0.010)	(0.034)	(0.026)	(0.037)
BSIZE	-0.009***	0.017***	-1.07E-04	-0.001
	(0.001)	(0.004)	(0.002)	(0.004)
EDUDIV	-0.021***	-0.046	0.076***	-0.023
	(0.008)	(0.042)	(0.019)	(0.050)
EDIV	0.048**	0.195**	-0.075**	0.214**
	(0.022)	(0.083)	(0.045)	(0.102)
GDIV	-0.280***	0.554***	0.115***	0.006
	(0.017)	(0.078)	(0.036)	(0.078)
DY	-0.055	-0.231***	-0.216***	-0.891***
	(0.054)	(0.057)	(0.077)	(0.237)
ROA	1.171***	1.082***	0.603***	1.475***
	(0.012)	(0.109)	(0.028)	(0.081)
LEV	0.339***	0.211***	0.019***	0.191***
	(0.004)	(0.012)	(0.002)	(0.008)
R^2	0.986	0.682	0.727	0.676
Adjusted R^2	0.986	0.673	0.718	0.668
Durbin-Watson	2.124	1.832	2.003	1.914
F-statistic	1 730.488	76.606	83.878	89.392
Probability (F-statistic)	0.000	0.000	0.000	0.000

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The unstandardised β coefficients are shown before the parentheses. The standard error is in parentheses.

The table presents the results of the EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance estimation methods, for the top four industries, with CEE as dependent variable. *CEE* measures the extent of value creation for each monetary unit of resources invested in physical capital. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

TOP3, which is also a measure of ownership concentration, was calculated based on the shareholdings of only the largest three shareholders. At the 1% level of statistical significance, TOP3 has a negative β coefficient for the basic materials industry and a positive β coefficient for the financials industry. The β coefficients of TOP3 for the consumer services and industrials industries are not statistically significant. Therefore, Hypothesis $H_{1.3b}$, which proposes a relationship between ownership concentration and the efficiency of value added by a company from its physical capital resources, is supported when ownership concentration is calculated based on the largest three shareholdings for the basic materials and financials industry, but not for the consumer services and industrials industries. For the financials industry, since a higher level of ownership concentration (TOP3) is associated with greater efficiency of value added by a company from its physical capital resources, there is support for agency theory and the notion that the interests of a company's management and shareholders are more closely aligned by a greater extent of ownership concentration (Hu & Izumida, 2008). The negative β coefficient of TOP3 for the basic materials industry supports the idea that a higher level of ownership concentration aggravates the agency problem and is associated with decreased efficiency of value added by a company from its resources. This may be due to a higher level of ownership concentration resulting in excessive monitoring that impedes the management function (Edmans & Holderness, 2017) or management being pressurised into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010).

NONDUAL has a negative β coefficient for the basic materials industry and a positive β coefficient for the financials industry. For the basic materials industry, at the 1% level of statistical significance, absence of CEO duality is associated with decreased efficiency of value added by a company from its physical capital resources, which supports stewardship theory (Donaldson & Davis, 1991). In contrast, at the 5% level of statistical significance, absence of CEO duality is associated with increased efficiency of value added by a company from its physical capital resources for the financials industry. This supports agency theory (Appuhami & Bhuyan, 2015; Eisenhardt, 1989). The β coefficients of NONDUAL are not statistically significant for the consumer services and industrials industries. Therefore, Hypothesis H_{2b}, which proposes a relationship between absence of CEO duality and the efficiency of value added by a company from its physical capital resources, is supported for the basic materials and financials industries, but not for the consumer services and industrials industries.

At the 1% level of statistical significance, NONEXEC has a positive β coefficient for the basic materials industry and a negative β coefficient for the consumer services and financials industries. The β coefficient of NONEXEC for the industrials industry is not statistically significant. Therefore, Hypothesis H_{3b}, which proposes a relationship between the percentage of non-executives on the board of directors and the efficiency of value added by a company from its physical capital resources, is supported for the basic materials, consumer services and financials industries, but not for the industrials industry. For the basic materials industry, the positive β coefficient of NONEXEC means that a greater percentage of non-executives on the board of directors is associated with increased efficiency of value added by a company from its physical capital resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Zahra & Pearce, 1989). In contrast, for the consumer services and financials industries, the negative β coefficient means that a higher percentage of non-executives on the board of directors is associated with decreased efficiency of value added by a company from its physical capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998).

For the consumer services industry, the β coefficient of IND is statistically significant at the 1% level. The β coefficients of IND for the basic materials, financials, and industrials industries are not statistically significant. Consequently, Hypothesis H_{4b}, which proposes a relationship between the percentage of non-executives on the board of directors who are independent and the efficiency of value added by a company from its physical capital resources, is supported for the consumer services industry, but not for the basic materials, financials and industrials industries. The negative β coefficient of IND for the consumer services industry implies that a higher percentage of non-executives on the board of directors who are independent is associated with less efficiency of value added by a company from its physical capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998).

BSIZE has a statistically significant relationship, at the 1% level, with the efficiency of value added by a company from its physical capital resources for the basic materials and consumer services industries. The relationship between BSIZE and CEE is not statistically significant for the financials and industrials industries. Therefore, Hypothesis H_{5b}, which proposes a relationship between the size of the board of directors and the efficiency of value added by a company from its physical capital resources, is supported for the basic materials and consumer services industries, but not for the financials and industrials industries. The β coefficient of BSIZE is negative for the basic materials industry, implying that a smaller size of the board of directors is associated with increased efficiency of value added by a company from its physical capital resources, which supports agency theory (Eisenberg *et al.*, 1998; Yermack, 1996). For the consumer services industry, the β coefficient of BSIZE is positive, meaning that a larger size of the board of directors is associated with increased efficiency of value added by a company from its physical capital resources, which supports stakeholder theory (Freeman *et al.*, 2004) and resource dependence theory (Pfeffer, 1972).

The β coefficients of EDUDIV are statistically significant at the 1% level for the basic materials and financials industries. For the basic materials industry, the β coefficient of EDUDIV is negative and for the financials industry, the β coefficient of EDUDIV is positive. For the consumer services and industrials industries, the β coefficient of EDUDIV is not statistically significant. Therefore, Hypothesis H_{6b}, which proposes a positive relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its physical capital resources, is supported for the financials industry, but not for the basic materials, consumer services and industrials industries. The statistically significant negative relationship between EDUDIV and CEE is weak for the basic materials industry, as indicated by the zero-order, partial and part correlation coefficients of 0.153, -0.018 and -0.011, respectively, presented in Appendix 5. Mahadeo *et al.* (2012) also found that a greater extent of educational-level diversity was associated with decreased performance in an emerging market; however, this finding was not specific to any industry. The positive β coefficient of EDUDIV for the financials industry means that a greater extent of educational-level diversity of the board of directors is associated with increased efficiency of value added by a company from its physical capital resources, which supports agency theory (Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Davis, 1991; Hillman *et al.*, 2001) and resource dependence theory (Pfeffer, 1972). This finding is supported by Bantel (1993), who found that greater educational-level diversity led to better decision-making in the banking industry.

The β coefficients of EDIV are statistically significant at the 5% level for all the top four industries. These coefficients are positive for the basic materials, consumer services and industrials industries and negative for the financials industry. Therefore, Hypothesis H_{7b}, which proposes a positive relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its physical capital resources, is supported for the basic materials, consumer services and industrials industries, but not for the financials industry. The positive β coefficient of EDIV for the basic materials, consumer services and industrials industries indicates that a greater extent of ethnic diversity of the board of directors is associated with increased efficiency of value added by a company from its physical capital resources, which supports agency theory (Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between EDIV and CEE for the financials industry is weak. Appendix 5 indicates that the zero-order, partial and part correlation coefficients of 0.041, -0.027 and -0.022, respectively, reflect a very weak association between EDIV and CEE for the financials industry.

The β coefficients of GDIV are statistically significant at the 1% level for the basic materials, consumer services and financials industries. However, the β coefficient of GDIV is negative for the basic materials industry, while it is positive for the consumer services and financials industries. For the industrials industry, the β coefficient of GDIV is not statistically significant. Therefore, Hypothesis H_{8b}, which proposes a positive relationship between gender diversity of the board of directors and the efficiency of value added by a company from its physical capital resources, is supported for the consumer services and financials industries, but not for the basic materials and industrials industries. The positive β coefficients of GDIV for the consumer services and financials industries indicate that a greater extent of gender diversity of the board of directors is associated with increased efficiency of value added by a company from its physical capital resources, which supports agency theory (Triana *et al.*, 2013), stakeholder theory (Donaldson & Davis, 1991) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between GDIV and CEE for the basic materials industry is weak. Appendix 5 indicates that the zero-order, partial and part correlation coefficients of -0.274, -0.192 and -0.120, respectively, reflect a weak association between GDIV and CEE. A negative relationship between GDIV and performance was reported in the literature; however, these findings were neither specific to the efficiency of value added by a company from its physical capital resources nor to a particular industry (Adams & Ferreira, 2009; Ahern & Dittmar, 2012).

7.3.3 ICE

This section deals with the regressions for the top four industries for the period 2002 to 2018, with ICE as the dependent variable. ICE is a measure of the efficiency of value added by a company from its intellectual capital resources. Model 1h, which is applicable to the industry analysis when ICE serves as the dependent variable, is as follows for company *i* at period *t:*

$$\begin{aligned} ICE_{it} = \quad & \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} \\ & + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it} \end{aligned}$$

The results of Model 1h are reported in Table 7.6. The adjusted R^2 ranges between 0.687 for the industrials industry and 0.971 for the basic materials industry, indicating that the predictor variables explain a moderate to large portion of the variance in ICE. The Durbin-Watson statistic ranges between 1.874 for the consumer services industry and 1.943 for the basic materials industry. This is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for the regression model is statistically significant (p<0.001), indicating that all the β coefficients differ significantly from zero.

Table 7.6: Regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its intellectual capital resources (ICE) for the top four industries (Model 1h)

	Basic materials	***Consumer services***	***Financials***	***Industrials***
Intercept	1.594***	1.376***	3.770***	1.321***
	(0.105)	(0.080)	(1.119)	(0.137)
HERF	-2.49E-05***	2.30E-05***	2.29E-04***	-1.02E-05
	(6.33E-06)	(6.33E-06)	(4.57E-05)	(7.24E-06)
TOP3	0.626***	0.114***	-3.325***	0.289***
	(0.063)	(0.035)	(0.354)	(0.066)
NONDUAL	0.624***	0.009	2.258**	0.240***
	(0.040)	(0.034)	(0.937)	(0.058)
NONEXEC	-0.764***	0.469***	6.063***	0.115
	(0.128)	(0.081)	(0.887)	(0.103)
IND	0.114**	-0.146***	-1.761***	0.175***
	(0.046)	(0.039)	(0.405)	(0.052)
BSIZE	0.004	-0.001	0.021	0.022***
	(0.005)	(0.005)	(0.021)	(0.006)
EDUDIV	0.162***	0.142***	-1.401***	-0.054
	(0.048)	(0.041)	(0.363)	(0.068)
EDIV	-0.062	-0.116	-13.294***	-1.068***
	(0.118)	(0.080)	(0.867)	(0.152)
GDIV	-0.248***	-0.275***	11.474***	-0.121
	(0.083)	(0.069)	(0.840)	(0.107)
DY	0.636	-0.639***	-1.601**	1.061***
	(0.459)	(0.149)	(0.716)	(0.390)
ROA	5.583***	4.932***	10.344***	3.759***
	(0.065)	(0.125)	(0.522)	(0.198)
LEV	-0.211***	-0.042***	-0.046*	0.081***
	(0.020)	(0.009)	(0.024)	(0.011)
R^2	0.972	0.866	0.794	0.694
Adjusted R^2	0.971	0.862	0.787	0.687
Durbin-Watson	1.943	1.874	1.892	1.899
F-statistic	850.730	230.913	121.181	97.299
Probability (F-statistic)	0.000	0.000	0.000	0.000

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The unstandardised β coefficients are shown before the parentheses. The standard error is in parentheses.

The table presents the results of the EGLS regressions, with period SUR weightings and using the White (diagonal) standard errors and covariance estimation methods, for the top four industries, with ICE as dependent variable. *ICE* measures the extent of value creation for each monetary unit of resources invested in intellectual capital. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

The findings for the relationship between HERF and ICE are similar to those for the relationship between HERF and VAIC. A more detailed discussion of these results can be found in Section 7.3.1. TOP3 is also a measure of ownership concentration, but only takes into account the shareholdings of the largest three shareholders. At the 1% level of statistical significance, TOP3 has a positive β coefficient for the basic materials, consumer services and industrials industries, and a negative β coefficient for the financials industry. Therefore, Hypothesis $H_{1.3c}$, which proposes a relationship between ownership concentration and the efficiency of value added by a company from its intellectual capital resources, is supported when ownership concentration is measured in terms of the top three shareholdings for all the top four industries. With regard to the basic materials, consumer services and industrials industries, since a higher level of ownership concentration (TOP3) is associated with greater efficiency of value added by a company from its intellectual capital resources, there is support for agency theory and the notion that the interests of a company's management and shareholders can be more closely aligned by a higher level of ownership concentration (Hu & Izumida, 2008). The negative β coefficient of TOP3 for the financials industry supports the idea that a higher level of ownership concentration aggravates the agency problem and is associated with decreased efficiency of value added by a company from its resources. This may be due to a higher level of ownership concentration resulting in excessive monitoring that impedes the management function (Edmans & Holderness, 2017) or management being pressurised into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010).

There is a statistically significant positive relationship between NONDUAL and the efficiency of value added by a company from its intellectual capital resources at the 1% level for the basic materials and industrials industries, and at the 5% level for the financials industry. The β coefficient of NONDUAL is not statistically significant for the consumer services industry. Therefore, Hypothesis H_{2c}, which proposes a relationship between absence of CEO duality and the efficiency of value added by a company from its intellectual capital resources, is supported for the basic materials, financials and industrials industries, but not for the consumer services industry. The positive β coefficients indicate that the absence of CEO duality is associated with increased efficiency of value added by a company from its intellectual capital resources, which is in line with agency theory (Appuhami & Bhuyan, 2015; Eisenhardt, 1989).

At the 1% level of statistical significance, NONEXEC has a negative β coefficient for the basic materials industry and positive β coefficients for the consumer services and financials industries. The β coefficient of NONEXEC for the industrials industry is not statistically significant. Therefore, Hypothesis H_{3c}, which proposes a relationship between the percentage of non-executives on the board of directors and the efficiency of value added by a company from its intellectual capital resources, is supported for the basic materials, consumer services and financials industries, but not for the industrials industry. For the basic materials industry, this means that a greater percentage of non-executives on the board of directors is associated with decreased efficiency of value added by a company from its intellectual capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998). In contrast, for the consumer services and financials industries, the positive coefficients mean that a higher percentage of non-executives on the board of directors is associated with increased efficiency of value added by a company from its intellectual capital resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Zahra & Pearce, 1989).

The β coefficients of IND are statistically significant at the 1% level for the consumer services, financials and industrials industries, and at the 5% level for the basic materials industry. Consequently, Hypothesis H_{4c}, which proposes a relationship between the percentage of non-executives on the board of directors who are independent and the efficiency of value added by a company from its intellectual capital resources, is supported for all the top four industries. For the basic materials and industrials industries, the positive β coefficient of IND implies that a higher percentage of non-executives on the board of directors who are independent is associated with greater efficiency of value added by a company from its intellectual capital resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Zahra & Pearce, 1989). In contrast, for the consumer services and financials industries, the negative β coefficient of IND implies that a higher percentage of non-executives on the board of directors is associated with less efficiency of value added by a company from its intellectual capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998).

BSIZE has a statistically significant positive β coefficient at the 1% level for the industrials industry. This is contrary to the findings of the study by Yermack (1996), which found a negative relationship between the size of the board of directors and performance for the industrials industry in the United States of America (US). However, Tobin's Q and ROA were used to measure performance in the study by Yermack (1996). The β coefficient of BSIZE is not statistically significant for the basic materials, consumer services and financial services industries. Therefore, Hypothesis H_{5c}, which proposes a relationship between the size of the board of directors and the efficiency of value added by a company from its intellectual capital resources, is supported only for the industrials industry. The positive β coefficient means that a larger size of the board of directors is associated with increased efficiency of value added by a company from its intellectual capital resources, which supports stakeholder theory (Freeman *et al.*, 2004) and resource dependence theory (Pfeffer, 1972).

The β coefficients of EDUDIV are statistically significant at the 1% level for the basic materials, consumer services and financials industries. The β coefficient of EDUDIV is not statistically significant for the industrials industry. The positive β coefficient of EDUDIV for the basic materials and consumer services industries indicates that a greater extent of educational-level diversity of the board of directors is associated with increased efficiency of value added by a company from its intellectual capital resources, which supports agency theory (Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995; Hillman *et al.*, 2001) and resource dependence theory (Pfeffer, 1972). The statistically significant, but negative relationship of EDUDIV with ICE for the financial services industry is very weak. This is evident from the zero-order, partial and part correlation coefficients of 0.067, 0.045, and 0.028, respectively, presented in Appendix 6. Mahadeo *et al.* (2012) also found that a greater extent of educational-level diversity was associated with decreased performance in an emerging market; however, this finding was not specific to any industry. Therefore, Hypothesis H_{6c}, which proposes a positive relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources, is supported for the basic materials and consumer services industries, but not for the financials and industrials industries.

The negative β coefficients of EDIV are statistically significant at the 1% level for the financials and industrials industries. The β coefficient of EDIV is not statistically significant for the basic materials and consumer services industries. Therefore, Hypothesis H_{7c}, which proposes a positive relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources, is not supported for any of the top four industries. The partial correlation coefficients, presented in Appendix 6, for the association between EDIV and ICE for the financials and industrials industries are -0.367 and -0.317, respectively, reflecting a moderate correlation between these variables. In addition, the part correlation coefficient for the association between EDIV and ICE for the financials industry is -0.323, providing additional evidence of a moderate association between these variables. The negative relationship between EDIV and ICE may be explained by a higher level of ethnic diversity resulting in conflict that may impede strategic decision-making. Alternatively, this may be justified by a scarcity of directors with appropriate skills and experience and poor enforcement of corporate regulations, despite the existence of broad-based black economic empowerment (BBBEE) regulations, which aim to advance economic transformation and enhance the participation of black individuals, who were previously disadvantaged, in the South African economy (Ntim *et al.*, 2015).

The β coefficients of GDIV are statistically significant at the 1% level for the basic materials, consumer services and financials industries. For the basic materials and consumer services industries, the β coefficients of GDIV are negative, whereas for the financials industry, the β coefficient of GDIV is positive. The β coefficient of GDIV is not statistically significant for the industrials industry. Therefore, Hypothesis H_{8c}, which proposes a positive relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources, is supported for the financials industry, but not for the basic materials, consumer services and industrials industries. The positive β coefficient of GDIV for the financials industry indicates that a greater extent of gender diversity of the board of directors is associated with increased efficiency of value added by a company from its intellectual capital resources, which supports agency theory (Triana *et al.*, 2013; Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between GDIV and ICE is very weak for the basic materials industry, as indicated by the zero-order, partial and part correlation coefficients of 0.008, -0.027 and -0.017, respectively, presented in Appendix 6. There is also a weak negative relationship between GDIV and ICE for the consumer services industry, as suggested by the zero-order, partial and part correlation coefficients of -0.111, -0.086 and -0.056, respectively, presented in Appendix 6. A negative relationship between GDIV and performance was reported in the literature; however, these findings were neither specific to the efficiency of value added by a company from its intellectual capital resources nor to a particular industry (Adams & Ferreira, 2009; Ahern & Dittmar, 2012).

7.3.4 HCE

This section deals with the regressions for the top four industries for the period 2002 to 2018, with HCE as the dependent variable. HCE is a measure of the efficiency of value added by a company from its human capital resources. Model 1i, which is applicable to the industry analysis when HCE serves as the dependent variable, is as follows for company *i* at period *t:*

$$HCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

The results of Model 1i are reported in Table 7.7. The adjusted R^2 ranges between 0.644 for the industrials industry and 0.989 for the basic materials industry, indicating that the predictor variables explain a moderate to large portion of the variance in HCE. The Durbin-Watson statistic ranges between 1.827 for the financials industry and 2.001 for the basic materials industry. This is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

The findings for the relationship between HERF and HCE are similar to those for the relationship of HERF with both VAIC and ICE. A more detailed discussion of these results can be found in Section 7.3.1. TOP3, which is also a measure of ownership concentration, was calculated based on the shareholdings of only the largest three shareholders. At the 1% level of statistical significance, TOP3 has a positive β coefficient for the basic materials, consumer services and industrials industries, and a negative β coefficient for the financials industry. Therefore, Hypothesis $H_{1.3d}$, which proposes a relationship between ownership concentration and the efficiency of value added by a company from its human capital resources, is supported when ownership concentration is calculated based on the largest three shareholdings for all the top four industries. With regard to the basic materials, consumer services and industrials industries, since a higher level of ownership concentration (TOP3) is associated with greater efficiency of value added by a company from its human capital resources, there is support for agency theory and the notion that the interests of a company's management and shareholders can be more closely aligned by a higher level of ownership concentration (Hu & Izumida, 2008). The negative β coefficient of TOP3 for the financials industry supports the idea that a higher level of ownership concentration aggravates the agency problem and is associated with decreased efficiency of value added by a company from its human capital resources. This may be due to a higher level of ownership concentration resulting in excessive monitoring that impedes the management function (Edmans & Holderness, 2017) or management being pressurised into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010).

Table 7.7: Regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its human capital resources (HCE) for the top four industries (Model 1i)

	Basic materials	***Consumer services***	***Financials***	***Industrials***
Intercept	1.276***	1.177***	2.346*	1.086***
	(0.027)	(0.068)	(1.256)	(0.110)
HERF	-3.85E-05***	2.07E-05***	1.92E-04***	-3.99E-06
	(2.74E-06)	(5.49E-06)	(4.78E-05)	(5.78E-06)
TOP3	0.676***	0.098***	-1.959***	0.189***
	(0.027)	(0.032)	(0.360)	(0.052)
NONDUAL	0.684***	-0.016	2.244**	0.203***
	(0.018)	(0.028)	(0.962)	(0.047)
NONEXEC	-0.907***	0.371***	3.348***	0.077
	(0.047)	(0.066)	(0.776)	(0.081)
IND	-0.010	-0.115***	-0.665*	0.136***
	(0.019)	(0.031)	(0.342)	(0.041)
BSIZE	0.016***	-0.003	0.009	0.019***
	(0.003)	(0.004)	(0.024)	(0.005)
EDUDIV	0.158***	0.125***	-0.224	-0.017
	(0.023)	(0.036)	(0.371)	(0.050)
EDIV	-0.146***	-0.147**	-11.675***	-0.869***
	(0.042)	(0.070)	(0.955)	(0.123)
GDIV	-0.075**	-0.188***	7.775***	-0.028
	(0.031)	(0.062)	(0.768)	(0.080)
DY	0.905***	-0.413***	-0.545	0.851**
	(0.166)	(0.127)	(0.754)	(0.332)
ROA	4.290***	3.901***	8.836***	2.671***
	(0.026)	(0.113)	(0.444)	(0.163)
LEV	-0.154***	-0.036***	-0.036	0.069***
	(0.012)	(0.007)	(0.024)	(0.009)
R^2	0.990	0.835	0.747	0.653
Adjusted R^2	0.989	0.830	0.739	0.644
Durbin-Watson	2.001	1.848	1.827	1.856
F-statistic	2 317.982	180.857	93.136	80.437
Probability (F-statistic)	0.000	0.000	0.000	0.000

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The unstandardised β coefficients are shown before the parentheses. The standard error is in parentheses.

The table presents the results of the EGLS regressions weighted for period SUR and using White (diagonal) standard error and covariance estimation methods for the top four industries, with HCE as dependent variable. *HCE* measures the extent of value creation for each monetary unit of resources invested in human capital. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

There is a statistically significant positive relationship between NONDUAL and the efficiency of value added by a company from its human capital resources at the 1% level for the basic materials and industrials industries, and at the 5% level for the financials industry. The β coefficient of NONDUAL is not statistically significant for the consumer services industry. Therefore, Hypothesis H_{2d}, which proposes a relationship between the absence of CEO duality and the efficiency of value added by a company from its human capital resources, is supported for the basic materials, financials and industrials industries, but not for the consumer services industry. The positive β coefficients indicate that the absence of CEO duality is associated with increased efficiency of value added by a company from its human capital resources, which is in line with agency theory (Appuhami & Bhuyan, 2015; Eisenhardt, 1989).

At the 1% level of statistical significance, NONEXEC has a negative β coefficient for the basic materials industry and a positive β coefficient for the consumer services and financials industries. The β coefficient of NONEXEC for the industrials industry is not statistically significant. Therefore, Hypothesis H_{3d}, which proposes a relationship between the percentage of non-executive members on the board of directors and the efficiency of value added by a company from its human capital resources, is supported for the basic materials, consumer services and financials industries, but not for the industrials industry. For the basic materials industry, this means that a greater percentage of non-executive members on the board of directors is associated with decreased efficiency of value added by a company from its human capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998). In contrast, for the consumer services and financials industries, this means that a higher percentage of non-executives on the board of directors is associated with increased efficiency of value added by a company from its human capital resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Zahra & Pearce, 1989).

The β coefficients of IND are statistically significant at the 1% level for the consumer services and industrials industries, and at the 10% level for the financials industry. The β coefficient of IND is not statistically significant for the basic materials industry. Consequently, Hypothesis H_{4d}, which proposes a relationship between the percentage of non-executives on the board of directors who are independent and the efficiency of value added by a company from its human capital resources, is supported for the consumer services, financials and industrials industries, but not for the basic materials industry. For the consumer services and financials industries, the negative β coefficient of IND implies that a higher percentage of non-executive members of the board of directors who are independent is associated with less efficiency of value added by a company from its human capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998). For the industrials industry, the positive β coefficient of IND implies that a higher percentage of non-executives on the board of directors who are independent is associated with greater efficiency of value added by a company from its human capital resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Zahra & Pearce, 1989).

BSIZE has a statistically significant positive β coefficient at the 1% level for the basic materials and industrials industries. The findings for the industrials industry are contrary to the findings of a study by Yermack (1996), which found a negative relationship between the size of the board of directors and performance for this industry. However, Tobin's Q and ROA were used to measure performance in the study by Yermack (1996). The β coefficient of BSIZE is not statistically significant for the consumer services and financials industries. Therefore, Hypothesis H_{5d}, which proposes a relationship between the size of the board of directors and the efficiency of value added by a company from its human capital resources, is supported for the basic materials and industrials industries, but not for the consumer services and financials industries. The positive β coefficient means that a larger size of the board of directors is associated with increased efficiency of value added by a company from its human capital resources, which supports stakeholder theory (Freeman *et al.*, 2004) and resource dependence theory (Pfeffer, 1972).

The β coefficients of EDUDIV are statistically significant at the 1% level for the basic materials and consumer services industries. The β coefficient of EDUDIV is not statistically significant for the financials and industrials industries. For the financials industry, this is contrary to the finding of a study by Bantel (1993), which found that greater educational-level diversity led to better decision-making in the banking industry. Therefore, Hypothesis H_{6d}, which proposes a positive relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its human capital resources, is supported for the basic materials and consumer services industries, but not for financials and industrials industries. The positive β coefficients of EDUDIV for the basic materials and consumer services industries indicate that a greater extent of educational-level diversity of the board of directors is associated with increased efficiency of value added by a company from its human capital resources, which supports agency theory (Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995; Hillman *et al.*, 2001) and resource dependence theory (Pfeffer, 1972).

The negative β coefficients of EDIV are statistically significant at the 1% level for the basic materials, financials and industrials industries, and at the 5% level for the consumer services industry. Therefore, Hypothesis H_{7d}, which proposes a positive relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its human capital resources, is not supported for all the top four industries. Appendix 7 indicates that the zero-order, partial and part correlation coefficients of EDIV are between -0.300 and 0.300 for the basic materials and consumer services industries, reflecting a weak association between EDIV and HCE. However, for the financials industry, these correlations are -0.319, -0.402 and -0.348, respectively, and for the industrials industry, these correlations are -0.304, -0.331 and -0.274, respectively, implying a moderate association between EDIV and HCE. For the financials and industrials industries, the negative relationship may be explained by the higher level of ethnic diversity resulting in conflict that may impede strategic decision-making. Alternatively, this may be justified by a scarcity of directors with appropriate skills and experience and poor enforcement of corporate regulations, despite the existence of broad-based black economic empowerment (BBBEE) regulations, which aim to advance economic transformation and enhance the participation of black individuals, who were previously disadvantaged, in the South African economy (Ntim *et al.*, 2015).

The β coefficient of GDIV is statistically significant at the 5% level for the basic materials industry and at the 1% level for the consumer services and financials industries. For the basic materials and consumer services industries, the β coefficients of GDIV are negative, whereas for the financials industry, the β coefficient of GDIV is positive. The β coefficient of GDIV is not statistically significant for the industrials industry. Therefore, Hypothesis H_{8d}, which proposes a positive relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its human capital resources, is supported for the financials industry, but not for the basic materials, consumer services and industrials industries. The positive β coefficient of GDIV for the financials industry indicates that a greater extent of gender diversity of the board of directors is associated with increased efficiency of value added by a company from its human capital resources, which supports agency theory (Triana *et al.*, 2013; Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between GDIV and HCE is weak for the basic materials and consumer services industries. As indicated in Appendix 7, for the basic materials industry, the zero-order, partial and part correlation coefficients of 0.010, -0.014 and -0.008, respectively, reflect a very weak association between GDIV and HCE. For the consumer services industry, the zero-order, partial and part correlation coefficients of -0.114, -0.083 and -0.055, respectively, also reflect a weak association between GDIV and HCE. A negative relationship between GDIV and performance was reported in the literature; however, these findings were neither specific to the efficiency of value added by a company from its human capital resources nor to a particular industry (Adams & Ferreira, 2009; Ahern & Dittmar, 2012).

7.3.5 SCE

This section deals with the regressions for the top four industries for the period 2002 to 2018, with SCE as the dependent variable. SCE is a measure of the efficiency of value added by a company from its structural capital resources. Model 1j, which is applicable to the industry analysis when SCE serves as the dependent variable, is as follows for company *i* at period *t:*

$$SCE_{it} = \alpha_0 + \beta_1 HERF_{it} + \beta_2 TOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 NONEXEC_{it} + \beta_5 IND_{it} + \beta_6 BSIZE_{it} + \beta_7 EDUDIV_{it} + \beta_8 EDIV_{it} + \beta_9 GDIV_{it} + \beta_{10} DY_{it} + \beta_{11} ROA_{it} + \beta_{12} LEV_{it} + \varepsilon_{it}$$

The results of Model 1j are reported in Table 7.8. The adjusted R^2 ranges between 0.607 for the financials industry and 0.944 for the basic materials industry, indicating that the predictor variables explain a moderate to large portion of the variance in SCE. The Durbin-Watson statistic ranges between 1.940 for the industrials industry and 2.008 for the financials industry. This is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for the regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

HERF has a statistically significant β coefficient at the 1% level for the financials and industrials industries, and at the 5% level for the basic materials industry. The β coefficient of HERF is negative for the basic materials and industrials industries, and positive for the financials industry. The β coefficient of HERF for the consumer services industry is not statistically significant. Therefore, Hypothesis $H_{1.1e}$, which proposes a relationship between ownership concentration and the efficiency of value added by a company from its structural capital resources, is supported when ownership concentration is measured in terms of the Herfindahl index for the basic materials, financials and industrials industries, but not for the consumer services industry. Regarding the financials industry, since a higher level of ownership concentration (HERF) is associated with greater efficiency of value added by a company from its structural capital resources, there is support for agency theory and the notion that the interests of a company's management and shareholders can be more closely aligned by a higher level of ownership concentration (Hu & Izumida, 2008). The negative β coefficient of HERF for the basic materials and industrials industries supports the idea that a higher level of ownership concentration aggravates the agency problem and is associated with decreased efficiency of value added by a company from its structural capital resources. This may be due to a higher level of ownership concentration resulting in excessive monitoring that impedes the management function (Edmans & Holderness, 2017) or management being pressurised into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010).

Table 7.8: Regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its structural capital resources (SCE) for the top four industries (Model 1j)

	Basic materials	***Consumer services***	***Financials***	***Industrials***
Intercept	0.300***	0.250***	0.583***	0.281***
	(0.023)	(0.021)	(0.089)	(0.027)
HERF	-3.44E-06**	1.11E-07	1.93E-05***	-6.87E-06***
	(1.81E-06)	(9.64E-07)	(4.43E-06)	(1.76E-06)
TOP3	0.051***	0.004	-0.291***	0.102***
	(0.014)	(0.007)	(0.042)	(0.016)
NONDUAL	0.077***	-0.001	-0.130	0.023**
	(0.009)	(0.008)	(0.107)	(0.011)
NONEXEC	-0.066***	0.082***	0.791***	0.005
	(0.023)	(0.015)	(0.075)	(0.020)
IND	2.17E-04	-0.032***	-0.082**	0.003
	(0.018)	(0.008)	(0.033)	(0.010)
BSIZE	0.006***	0.001	-0.005*	0.004***
	(0.001)	(0.001)	(0.003)	(0.001)
EDUDIV	0.010	0.027***	-0.243***	-0.025**
	(0.008)	(0.009)	(0.033)	(0.015)
EDIV	-0.072**	0.036**	0.229***	-0.153***
	(0.033)	(0.017)	(0.064)	(0.028)
GDIV	-0.086***	-0.080***	0.171**	-0.092***
	(0.017)	(0.017)	(0.067)	(0.026)
DY	0.681***	-0.089***	-1.039***	0.133*
	(0.082)	(0.018)	(0.106)	(0.080)
ROA	0.826***	0.959***	-0.247***	1.039***
	(0.014)	(0.037)	(0.040)	(0.039)
LEV	-0.029***	-0.008***	-0.005***	0.013***
	(0.006)	(0.002)	(0.002)	(0.002)
R^2	0.947	0.814	0.619	0.783
Adjusted R^2	0.944	0.809	0.607	0.778
Durbin-Watson	1.958	1.957	2.008	1.940
F-statistic	433.348	156.391	51.236	154.437
Probability (F-statistic)	0.000	0.000	0.000	0.000

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. The unstandardised β coefficients are shown before the parentheses. The standard error is in parentheses.

The table presents the results of the EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance estimation methods, for the top four industries, with SCE as dependent variable. *SCE* measures the extent of value creation for each monetary unit of resources invested in structural capital. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *DY* is the ratio of ordinary dividends per share to the share price at year-end. *ROA* is the ratio of operating profit to total assets at year-end. *LEV* is the ratio of total debt to total shareholders' equity at year-end.

TOP3 is also a measure of ownership concentration, but only takes into account the shareholdings of the largest three shareholders. At the 1% level of statistical significance, TOP3 has a positive β coefficient for the basic materials and industrials industries, and a negative β coefficient for the financials industry. For the basic materials and industrials industries, since a higher level of ownership concentration (TOP3) is associated with greater efficiency of value added by a company from its structural capital resources, there is support for agency theory and the notion that the interests of a company's management and shareholders can be more closely aligned by a higher level of ownership concentration. The negative β coefficient of TOP3 for the financials industry supports the idea that a higher level of ownership concentration aggravates the agency problem and is associated with decreased efficiency of value added by a company from its structural capital resources. This may be due to a higher level of ownership concentration resulting in excessive monitoring that hinders the management function (Edmans & Holderness, 2017) or management being pressurised into focusing on short-term rather than long-term performance (Guthrie & Sokolowsky, 2010). Therefore, Hypothesis $H_{1.3e}$, which proposes a relationship between ownership concentration and the efficiency of value added by a company from its structural capital resources, is supported when ownership concentration is calculated based on the largest three shareholdings for the basic materials, financials and industrials industries, but not for the consumer services industry.

There is a statistically significant positive relationship between NONDUAL and the efficiency of value added by a company from its structural capital resources at the 1% level for the basic materials industry and at the 5% level for the industrials industry. The β coefficients of NONDUAL are not statistically significant for the consumer services and financials industries. Therefore, Hypothesis H_{2e}, which proposes a relationship between absence of CEO duality and the efficiency of value added by a company from its structural capital resources, is supported for the basic materials and industrials industries, but not for the consumer services and financials industries. The positive β coefficients of NONDUAL indicate that the absence of CEO duality is associated with increased efficiency of value added by a company from its structural capital resources, which is in line with agency theory (Appuhami & Bhuyan, 2015; Eisenhardt, 1989).

At the 1% level of statistical significance, NONEXEC has a negative β coefficient for the basic materials industry and a positive β coefficient for the consumer services and financials industries. The β coefficient of NONEXEC for the industrials industry is not statistically significant. Therefore, Hypothesis H_{3e}, which proposes a relationship between the percentage of non-executives on the board of directors and the efficiency of value added by a company from its structural capital resources, is supported for the basic materials, consumer services and financials industries, but not for the industrials industry. For the basic materials industry, this means that a greater percentage of non-executive members on the board of directors is associated with decreased efficiency of value added by a company from its structural capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998). In contrast, for the consumer services and financials industries, the positive coefficients of NONEXEC mean that a higher percentage of non-executive members on the board of directors is associated with increased efficiency of value added by a company from its structural capital resources, which is in line with agency theory (Agrawal & Knoeber, 1996; Zahra & Pearce, 1989).

The β coefficient of IND is statistically significant at the 1% level for the consumer services industry and at the 5% level for the financials industries. The β coefficients of IND for the basic materials and industrials industries are not statistically significant. Consequently, Hypothesis H_{4e}, which proposes a relationship between the percentage of non-executive members on the board of directors who are independent and the efficiency of value added by a company from its structural capital resources, is supported for the consumer services and financials industries, but not for the basic materials and industrials industries. For the consumer services and financials industries, the negative β coefficient of IND implies that a higher percentage of non-executive members on the board of directors who are independent is associated with less efficiency of value added by a company from its structural capital resources, which is in line with stewardship theory (Muth & Donaldson, 1998).

BSIZE has a positive β coefficient for the basic materials and industrials industries at the 1% level of statistical significance and a negative β coefficient for the financials industry at the 10% level of statistical significance. The findings for the industrials industry are contrary to the findings of a study by Yermack (1996), which found a negative relationship between the size of the board of directors and performance for this industry. However, Tobin's Q and ROA were used to measure performance in the study by Yermack (1996). The β coefficient of BSIZE is not statistically significant for the consumer services industry. Therefore, Hypothesis H_{5e}, which proposes a relationship between the size of the board of directors and the efficiency of value added by a company from its structural capital resources, is supported for the basic materials, financials and industrials industries, but not for the consumer services industry. For the basic materials and industrials industries, the positive β coefficient means that a larger size of the board of directors is associated with increased efficiency of value added by a company from its structural capital resources, which supports stakeholder theory (Freeman *et al.*, 2004) and resource dependence theory (Pfeffer, 1972). In contrast, for the financials industry, a larger size of the board of directors is associated with less efficiency of value added by a company from its structural capital resources, which supports agency theory (Eisenberg *et al.*, 1998; Yermack, 1996).

The β coefficients of EDUDIV are statistically significant at the 1% level for the consumer services and financials industries, and at the 5% level for the industrials industry. For the consumer services industry, the β coefficient of EDUDIV is positive and for the financials and industrials industries, the β coefficient of EDUDIV is negative. The β coefficient of EDUDIV is not statistically significant for the basic materials industry. Therefore, Hypothesis H_{6e}, which proposes a positive relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its structural capital resources, is supported for the consumer services industry, but not for the basic materials, financials and industrials industries. The positive β coefficient of EDUDIV for the consumer services industry indicates that a greater extent of educational-level diversity of the board of directors is associated with increased efficiency of value added by a company from its structural capital resources, which supports agency theory (Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995; Hillman *et al.*, 2001) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between EDUDIV and SCE for the financials and industrials industries is weak. As indicated in Appendix 8, the zero-order, partial and part correlation coefficients for the financials industry of -0.024, -0.094, and -0.092, respectively, and the industrials industry of -0.152, -0.041 and -0.030, respectively, reflect a weak association between EDUDIV and SCE. Mahadeo *et al.* (2012) also found that a greater extent of educational-level diversity was associated with decreased performance in an emerging market; however, this finding was not specific to any industry.

The β coefficients of EDIV are statistically significant at the 5% level for the basic materials and consumer services industries, and at the 1% level for the financials and industrials industries. For the basic materials and industrials industries, the β coefficients of EDIV are negative, while for the consumer services and financials industries, the β coefficients of EDIV are positive. Therefore, Hypothesis H_{7e}, which proposes a positive relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its structural capital resources, is supported for the consumer services and financials industries, but not for the basic materials and industrials industries. The positive β coefficients of EDIV for the consumer services and financials industries indicate that a greater extent of ethnic diversity of the board of directors is associated with increased efficiency of value added by a company from its structural capital resources, which supports agency theory (Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between EDIV and SCE for the basic materials and industrials industries is weak. As indicated in Appendix 8, the zero-order, partial and part correlation coefficients for the basic material industry of -0.145, -0.067 and -0.054, respectively, and for the industrials industry of -0.245, -0.231 and -0.170, respectively, reflect a weak association between EDIV and SCE.

The β coefficients of GDIV are statistically significant at the 1% level for the basic materials, consumer services and industrials industries, and at the 5% level for the financials industry. For the basic materials, consumer services and industrials industries, the β coefficients of GDIV are negative, whereas for the financials industry, the β coefficient of GDIV is positive. Therefore, Hypothesis H_{8e}, which proposes a positive relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its structural capital resources, is supported for the financials industry, but not for the basic materials, consumer services and industrials industries. The positive β coefficient of GDIV for the financials industry indicates that a greater extent of gender diversity of the board of directors is associated with increased efficiency of value added by a company from its structural capital resources, which supports agency theory (Triana *et al.*, 2013; Van der Walt & Ingley, 2003), stakeholder theory (Donaldson & Preston, 1995) and resource dependence theory (Pfeffer, 1972). The statistically significant negative relationship between GDIV and SCE is weak for the basic materials, consumer services and industrials industries. As shown in Appendix 8, the zero-order, partial and part correlation coefficients of -0.020, -0.033 and -0.027, respectively, reflect a very weak association between GDIV and SCE for the basic materials industry. In addition, the zero-order, partial and part correlation coefficients of -0.102, -0.124 and -0.083, respectively, for the consumer services industry and -0.231, -0.081 and -0.058, respectively, for the industrials industry also indicate a weak association between GDIV and SCE. A negative relationship between GDIV and performance was reported in the literature. However, these findings were neither specific to the efficiency of value added by a company from its structural capital resources nor to a particular industry (Adams & Ferreira, 2009; Ahern & Dittmar, 2012).

7.3.6 Summary of results of top industries: Hypotheses H_1 to H_8

For the top four industries, a summary of the results of the regressions done to test Hypotheses H_1 to H_8, which propose relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources, is presented in Table 7.9. This summary includes the predicted signs, in terms of the hypotheses, and the actual signs of the β coefficients for the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources. In addition, the actual signs of the β coefficients are linked to the underpinning theories of this study, including agency theory, stewardship theory, stakeholder theory and resource dependence theory.

Table 7.9: Summary of the regression results of the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources for the top four industries: Hypotheses H_1 to H_8

Hypotheses	*Predictor variable*	*Predicted sign*	*Findings (β coefficient sign and underpinning theory)*			
			Basic materials	*Consumer services*	*Financials*	*Industrials*
Panel A: VAIC						
$H_{1.1a} - H_{1.1e}$	HERF	+/-	- (AT)	+ (AT)	+ (AT)	+ (AT)
$H_{1.3a} - H_{1.3e}$	TOP3	+/-	+ (AT)	- (AT)	- (AT)	+ (AT)
$H_{2a} - H_{2e}$	NONDUAL	+/-	+ (AT)	- (ST)	- (ST)	+ (AT)
$H_{3a} - H_{3e}$	NONEXEC	+/-	- (ST)	+ (AT)	+ (AT)	+ (AT)
$H_{4a} - H_{4e}$	IND	+/-	+ (AT)	- (ST)	- (ST)	+ (AT)
$H_{5a} - H_{5e}$	BSIZE	+/-	+(SH/RDT)	+(SH/RDT)	- (AT)	+(SH/RDT)
$H_{6a} - H_{6e}$	EDUDIV	+	+(AT/SH/RDT)	-	-	-
$H_{7a} - H_{7e}$	EDIV	+	-	+(AT/SH/RDT)	-	-
$H_{8a} - H_{8e}$	GDIV	+	-	+(AT/SH/RDT)	+(AT/SH/RDT)	+(AT/SH/RDT)
Panel B: CEE						
$H_{1.1a} - H_{1.1e}$	HERF	+/-	+ (AT)	- (AT)	- (AT)	+ (AT)
$H_{1.3a} - H_{1.3e}$	TOP3	+/-	- (AT)	- (AT)	+ (AT)	- (AT)
$H_{2a} - H_{2e}$	NONDUAL	+/-	- (ST)	- (ST)	+ (AT)	- (ST)
$H_{3a} - H_{3e}$	NONEXEC	+/-	+ (AT)	- (ST)	- (ST)	- (ST)
$H_{4a} - H_{4e}$	IND	+/-	+ (AT)	- (ST)	+ (AT)	- (ST)
$H_{5a} - H_{5e}$	BSIZE	+/-	- (AT)	+(SH/RDT)	- (AT)	- (AT)
$H_{6a} - H_{6e}$	EDUDIV	+	-	-	+(AT/SH/RDT)	-
$H_{7a} - H_{7e}$	EDIV	+	+(AT/SH/RDT)	+(AT/SH/RDT)	-	+(AT/SH/RDT)
$H_{8a} - H_{8e}$	GDIV	+	-	+(AT/SH/RDT)	+(AT/SH/RDT)	+(AT/SH/RDT)
Panel C: ICE						
$H_{1.1a} - H_{1.1e}$	HERF	+/-	- (AT)	+ (AT)	+ (AT)	- (AT)
$H_{1.3a} - H_{1.3e}$	TOP3	+/-	+ (AT)	+ (AT)	- (AT)	+ (AT)
$H_{2a} - H_{2e}$	NONDUAL	+/-	+ (AT)	+ (AT)	+ (AT)	+ (AT)
$H_{3a} - H_{3e}$	NONEXEC	+/-	- (ST)	+ (AT)	+ (AT)	+ (AT)
$H_{4a} - H_{4e}$	IND	+/-	+ (AT)	- (ST)	- (ST)	+ (AT)
$H_{5a} - H_{5e}$	BSIZE	+/-	+(SH/RDT)	- (AT)	+(SH/RDT)	+(SH/RDT)
$H_{6a} - H_{6e}$	EDUDIV	+	+(AT/SH/RDT)	+(AT/SH/RDT)	-	-
$H_{7a} - H_{7e}$	EDIV	+	-	-	-	-
$H_{8a} - H_{8e}$	GDIV	+	-	-	+(AT/SH/RDT)	-
Panel D: HCE						
$H_{1.1a} - H_{1.1e}$	HERF	+/-	- (AT)	+ (AT)	+ (AT)	- (AT)
$H_{1.3a} - H_{1.3e}$	TOP3	+/-	+ (AT)	+ (AT)	- (AT)	+ (AT)
$H_{2a} - H_{2e}$	NONDUAL	+/-	+ (AT)	- (ST)	+ (AT)	+ (AT)
$H_{3a} - H_{3e}$	NONEXEC	+/-	- (ST)	+ (AT)	+ (AT)	+ (AT)
$H_{4a} - H_{4e}$	IND	+/-	- (ST)	- (ST)	- (ST)	+ (AT)
$H_{5a} - H_{5e}$	BSIZE	+/-	+(SH/RDT)	- (AT)	+(SH/RDT)	+(SH/RDT)
$H_{6a} - H_{6e}$	EDUDIV	+	+(AT/SH/RDT)	+(AT/SH/RDT)	-	-
$H_{7a} - H_{7e}$	EDIV	+	-	-	-	-
$H_{8a} - H_{8e}$	GDIV	+	-	-	+(AT/SH/RDT)	-
Panel E: SCE						
$H_{1.1a} - H_{1.1e}$	HERF	+/-	- (AT)	+ (AT)	+ (AT)	- (AT)
$H_{1.3a} - H_{1.3e}$	TOP3	+/-	+ (AT)	+ (AT)	- (AT)	+ (AT)
$H_{2a} - H_{2e}$	NONDUAL	+/-	+ (AT)	- (ST)	- (ST)	+ (AT)
$H_{3a} - H_{3e}$	NONEXEC	+/-	- (ST)	+ (AT)	+ (AT)	+ (AT)
$H_{4a} - H_{4e}$	IND	+/-	+ (AT)	- (ST)	- (ST)	+ (AT)
$H_{5a} - H_{5e}$	BSIZE	+/-	+(SH/RDT)	+(SH/RDT)	- (AT)	+(SH/RDT)
$H_{6a} - H_{6e}$	EDUDIV	+	+(AT/SH/RDT)	+(AT/SH/RDT)	-	-
$H_{7a} - H_{7e}$	EDIV	+	-	+(AT/SH/RDT)	+(AT/SH/RDT)	-
$H_{8a} - H_{8e}$	GDIV	+	-	-	+(AT/SH/RDT)	-

Supported: Statistically significant relationship

Not supported: Statistically significant relationship, but direction of relationship not as hypothesised

Not supported: Relationship not statistically significant

AT = agency theory; ST = stewardship theory; SH = stakeholder theory; and RDT = resource dependence theory.

The table provides a summary of the results of the regressions done to test Hypotheses H_1 to H_8 for the top industries. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively.

7.4 CHAPTER CONCLUSION

In this chapter, Hypotheses H_1 to H_8, which propose relationships of ownership concentration and board characteristics with the efficiency of value added by a company from its resources, were tested. The results were analysed for the full sample for the period 2002 to 2018 and for the top four industries. An important finding from the full sample is that only TOP3 has statistically significant β coefficients, despite HERF and TOP3 both representing ownership concentration. For the top four industries, HERF and TOP3 have statistically significant β coefficients in some cases, but the statistical significance and signs of the β coefficients are not consistent for all of the dependent variables or all of the industries. Therefore, the measure of ownership concentration plays a role. HERF and TOP3 may be suitable as measures of ownership concentration, which serves as a corporate governance mechanism that reduces or aggravates the agency problem, for specific industries and dependent variables, and not for others. For example, the β coefficient of HERF is positive for the consumer services and financials industries when VAIC, ICE or HCE serves as the dependent variable. This indicates that the interests of a company's management and shareholders are more closely aligned by a higher level of ownership concentration (HERF), which is associated with increased efficiency of value added by a company from its resources. HCE is a subcomponent of ICE, which is a subcomponent of VAIC. This suggests that value created from human capital is the driving force behind value created from intellectual capital, which is the driving force behind value created from total resources.

Hypotheses H_{2a} to H_{2e}, H_{5a} to H_{5e}, H_{6a} to H_{6e} and H_{8a} to H_{8e}, which posit relationships of the efficiency of value added by a company from its resources with the absence of CEO duality, the size of the board of directors, educational-level diversity and gender diversity, respectively, for each of the dependent variables for the full sample, were not supported. However, statistically significant results were found for these relationships when the top four industries were analysed.

In many cases, the diversity measures (EDUDIV, EDIV and GDIV) were found to have negative relationships and weak correlations with the dependent variables. For the full sample, this only applied to EDIV, whereas it applied to EDUDIV, EDIV and GDIV for the top four industries. For the financials and industrials industries, EDIV has a negative relationship, but moderate correlations with ICE and HCE. This negative relationship may be explained by the higher level of ethnic diversity resulting in conflict that may impede strategic decision-making. Alternatively, this may be justified by a scarcity of directors with appropriate skills and experience and poor enforcement of corporate regulations, despite the existence of BBBEE regulations, which aim to advance economic transformation and enhance the participation of black individuals, who were previously disadvantaged, in the South African economy (Ntim *et al.*, 2015).

The next chapter analyses the data and presents findings for Hypothesis H_9, which proposes that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources are moderated by a higher level of ownership concentration.

CHAPTER 8

ANALYSIS OF THE MODERATING EFFECTS OF A HIGHER LEVEL OF OWNERSHIP CONCENTRATION

8.1 INTRODUCTION

This chapter presents the results of the tests for Hypothesis H_9. This hypothesis posits that a higher level of ownership concentration, as a corporate governance mechanism that reduces or aggravates the agency problem, has a moderating effect on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. Model 2 is first devised. As discussed in Section 6.6, the estimated generalised least squares (EGLS) method, estimated with period seemingly unrelated regressions (SUR) as weighting method and using White (diagonal) standard errors and covariance estimation methods, is applied to this model to test Hypothesis H_9. Findings are reported for the full sample and the top four industries for the period 2002 to 2018.

8.2 MODEL 2

Model 2 is introduced to deal with Hypothesis H_9[9], which proposes that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources are moderated by a higher level of

[9] Hypothesis H_9, which proposes that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources are moderated by a higher level of ownership concentration, is denoted as $H_{9.1}$ when ownership concentration is measured using the Herfindahl index and as $H_{9.2}$ when ownership concentration is measured in terms of the largest three shareholdings. Hypotheses $H_{9.1}$ and $H_{9.2}$ can be expressed in terms of a) the efficiency of value added by a company from its total resources (VAIC); b) the efficiency of value added by a company from its physical capital resources (CEE); c) the efficiency of value added by a company from its intellectual capital resources (ICE); d) the efficiency of value added by a company from its human capital resources (HCE); and e) the efficiency of value added by a company from its structural capital resources (SCE). For example, Hypothesis $H_{9.1a}$ proposes that the relationship between the characteristics of the board of directors and the efficiency of value added by a company from its total resources is moderated by a higher level of ownership concentration, as measured by the Herfindahl index, and Hypothesis $H_{9.2c}$ proposes that the relationship between the characteristics of the board of directors and the efficiency of value added by a company from its intellectual capital resources is moderated by a higher level of ownership concentration, as measured by the largest three shareholdings. This applies to both the full sample and the top industries.

ownership concentration. These moderating effects were discussed in more detail in Section 4.2.6. Interaction terms are introduced into Model 2 to examine the potential moderating effect of a higher level of ownership concentration on the relationships between the independent variables and dependent variables. As discussed in Section 5.11, the continuous ownership concentration and independent variables (HERF, TOP3, NONEXEC, IND, BSIZE, EDUDIV, EDIV and GDIV) used in revised Model 1 are standardised for the purposes of Model 2, and multicollinearity arising from the creation of the interaction term is not of concern in moderated multiple regression. After standardising the continuous ownership concentration and independent variables, these variables are denoted as ZHERF, ZTOP3, ZNONEXEC, ZIND, ZBSIZE, ZEDUDIV, ZEDIV and ZGDIV in Model 2. The variables applicable to revised Model 2 are presented in Table 8.1.

As discussed in Section 4.2.6, a higher level of ownership concentration (represented by ZHERF and ZTOP3) is a potential moderator of the relationships between the independent variables and the dependent variables. Therefore, the interaction terms are created by multiplying each of the potential moderators (ZHERF and ZTOP3) by each of the independent variables (NONDUAL, ZNONEXEC, ZIND, ZBSIZE, ZEDUDIV, ZEDIV and ZGDIV). These interaction terms are not all combined into a single regression model, which would imply additional interaction terms (Da Silva Faia & Vieira, 2018; Dawson, 2014), but are rather introduced individually into the regressions to examine the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources.

The basic regression equation for a linear relationship between an independent variable (W) and a dependent variable Y is specified as follows:

$$Y = \alpha_0 + \beta_1 W + \varepsilon$$

where

α_0	= the constant term
β_1	= the coefficient of W
ε	= the error term

This basic regression equation is expanded to cater for moderation. First, a moderator variable (Mod) is introduced. Then an interaction term (Mod*W) is created by multiplying Mod by W. This is referred to as a two-way interaction because the interaction term, which is created from an independent variable and a moderator variable, is the product of two variables. The interaction terms with statistically significant β coefficients provide evidence of moderating effects of a higher level of ownership concentration on the relationships between specific dependent and independent variables (Da Silva Faia & Vieira, 2018; Dawson, 2014).

The expanded regression equation, including the moderator and the interaction term, is expressed as follows:

$$Y = \alpha_0 + \beta_1 W + \beta_2 Mod + \beta_3 (Mod*W) + \varepsilon$$

Table 8.1: Descriptions and definitions of variables used in revised Model 1 to test the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources

Variable	*Description*	*Measure*
Dependent variables		
VAIC	Value added intellectual coefficient	The extent of value creation for each monetary unit invested in total resources
CEE	Capital employed efficiency	The extent of value creation for each monetary unit invested in physical capital resources
ICE	Intellectual capital efficiency	The extent of value creation for each monetary unit invested in intellectual capital resources
HCE	Human capital efficiency	The extent of value creation for each monetary unit invested in human capital resources
SCE	Structural capital efficiency	The extent of value creation for each monetary unit invested in structural capital resources
***Moderator variables (Ownership concentration)**$^{\$}$*		
ZHERF$^{\#}$	Herfindahl index based on percentage shareholdings	Sum of the squares of the percentage shareholding held by each shareholder
ZTOP3$^{\#}$	Percentage shareholding of top three shareholders	Sum of the % shareholdings of the top three shareholders
***Independent variables (Characteristics of the board of directors)**$^{\$}$*		
NONDUAL	Absence of chief executive officer (CEO) duality	Dummy variable of 1 if the same person serves as CEO and chair of the board of directors, otherwise 0
ZNONEXEC$^{\#}$	Percentage of board members who are non-executive	Number of non-executive board members / Number of board members
ZIND$^{\#}$	Percentage of non-executive board members who are independent	Number of independent board members / Number of non-executive board members
ZBSIZE$^{\#}$	Board size	Number of board members
ZEDUDIV$^{\#}$	Educational-level diversity	Teachman's index based on the number of board members with a doctoral degree, master's degree, honours degree/postgraduate diploma, bachelor's degree or no qualification as their highest level of qualification
ZEDIV$^{\#}$	Ethnic diversity	Blau's index based on number of black and non-black board members
ZGDIV$^{\#}$	Gender diversity	Blau's index based on number of male and female board members
Control variables (applicable to full sample and top industries – Models 2a to 2j)		
ROA	Return on assets	Operating profit / Total assets (at year-end)
Control variables (applicable to top industries only – Models 2f to 2j)		
DY	Dividend yield	Ordinary dividends per share as a percentage of the share price at year-end
LEV	Leverage	Total debt / Total shareholders' equity (at year-end)
# = Variable standardised to have a mean of zero and a standard deviation of 1.		
$ = The interaction terms are created by multiplying each of the moderator variable by each of the independent variables.		

The results of the regression analysis for the moderating effects of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources follow. Owing to the nature of the methodology used (as discussed in Chapter 5), the array of dependent variables and the various industries, the results cannot be anything other than repetitive.

8.3 REGRESSION ANALYSIS OF THE FULL SAMPLE: HYPOTHESIS H_9

Model 2 is specified separately for each of the dependent variables (VAIC, CEE, ICE, HCE and SCE) for the full sample for the period 2002 to 2018.

8.3.1 VAIC – Model 2a

Model 2a relates specifically to the case when VAIC serves as the dependent variable for the full sample. Based on revised Model 1a in Section 6.4.1, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2a for company *i* at period *t*:

$$VAIC_{it} = \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it} * W_{it}) + \beta_{11} ROA_{it} + \varepsilon_{it}$$

The interaction terms were introduced individually to isolate the moderation effects. This resulted in 14 regression models (i.e. i – xiv)[10]. The regression results are presented in Tables 8.2(a) and 8.2(b). The adjusted R^2 values indicate that the predictor variables explain a moderate portion of the variance in VAIC. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each regression model is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

[10] The specific interaction term introduced per model is i) ZHERF*NONDUAL, ii) ZHERF*ZNONEXEC, iii) ZHERF*ZIND, iv) ZHERF*ZBSIZE, v) ZHERF*ZEDUDIV, vi) ZHERF*ZEDIV, vii) ZHERF*ZGDIV, viii) ZTOP3*NONDUAL, ix) ZTOP3*ZNONEXEC, x) ZTOP3*ZIND, xi) ZTOP3*ZBSIZE, xii) ZTOP3*ZEDUDIV, xiii) ZTOP3*ZEDIV and xiv) ZTOP3*ZGDIV. This applies to the 14 regression models throughout this chapter.

Table 8.2(a): Results of regressions introducing interaction terms individually for the full sample with VAIC as the dependent variable and HERF as the moderator variable (Model 2a)

	I	*ii*	*iii*	*Iv*	*v*	*vi*	*vii*
Intercept	2.579	2.581***	2.584***	2.577***	2.584***	2.581***	2.587***
	(0.126)	(0.124)	(0.124)	(0.125)	(0.125)	(0.124)	(0.124)
ZHERF$^{\#}$	0.065	-0.033	-0.034	-0.039*	-0.028	-0.037*	-0.041*
	(0.063)	(0.024)	(0.024)	(0.022)	(0.025)	(0.022)	(0.023)
ZTOP3$^{\#}$	0.028	0.031	0.030	0.035	0.031	0.032	0.034
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
NONDUAL$^{\#}$	0.032	0.032	0.025	0.029*	0.027	0.029	0.023
	(0.102)	(0.101)	(0.100)	(0.101)	(0.101)	(0.101)	(0.101)
ZNONEXEC$^{\#}$	0.047*	0.046*	0.047*	0.049	0.048*	0.048*	0.043
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
ZIND$^{\#}$	0.011	0.010	0.012	0.011	0.011	0.0124	0.011
	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)	(0.023)	(0.023)
ZBSIZE$^{\#}$	0.054	0.051	0.051	0.048	0.051	0.052	0.051
	(0.037)	(0.037)	(0.038)	(0.037)	(0.038)	(0.038)	(0.037)
ZEDUDIV$^{\#}$	-0.042	-0.039	-0.040	-0.038	-0.040***	-0.038	-0.037
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
ZEDIV$^{\#}$	-0.152***	-0.150***	-0.152***	-0.151***	-0.153	-0.148***	-0.154***
	(0.031)	(0.031)	(0.031)	(0.032)	(0.031)	(0.031)	(0.031)
ZGDIV$^{\#}$	0.023	0.024	0.024	0.024	0.024	0.022	0.028
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
ZHERF*NONDUAL	-0.100						
	(0.064)						
ZHERF*ZNONEXEC		-0.011					
		(0.017)					
ZHERF*ZIND			-0.018				
			(0.016)				
ZHERF*ZBSIZE				-0.027			
				(0.023)			
ZHERF*ZEDUDIV					-0.002		
					(0.019)		
ZHERF*ZEDIV						-0.036**	
						(0.018)	
ZHERF*ZGDIV							-0.035
							(0.018)
ROA	6.522***	6.507***	6.514***	6.519***	6.527***	6.520***	6.521***
	(0.269)	(0.269)	(0.269)	(0.270)	(0.269)	(0.269)	(0.268)
R^2	0.480	0.476	0.479	0.479	0.479	0.479	0.481
Adjusted R^2	0.477	0.473	0.476	0.476	0.476	0.476	0.478
Durbin-Watson	1.993	1.993	1.994	1.993	1.994	1.992	1.995
F-statistic	165.942	163.431	165.283	165.111	165.377	165.288	166.679
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. $^{\#}$ means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2a with *VAIC* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *VAIC* measures the extent of value creation for each monetary unit invested in resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Table 8.2(b): Results of regressions introducing interaction terms individually for the full sample with VAIC as the dependent variable and TOP3 as the moderator variable (Model 2a)

	Viii	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Intercept	2.606^{***}	2.580^{***}	2.579^{***}	2.585^{***}	2.586^{***}	2.585^{***}	2.581^{***}
	(0.129)	(0.125)	(0.124)	(0.125)	(0.125)	(0.125)	(0.125)
ZHERF#	-0.030	-0.031	-0.030	-0.029	-0.031	-0.030	-0.031
	(0.023)	(0.024)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
ZTOP3#	0.156^{**}	0.035	0.024	0.030	0.036	0.037	0.038
	(0.078)	(0.025)	(0.025)	(0.024)	(0.024)	(0.023)	(0.024)
NONDUAL#	0.007	0.032	0.031	0.028	0.031	0.027	0.028
	(0.107)	(0.102)	(0.100)	(0.101)	(0.102)	(0.101)	(0.101)
ZNONEXEC#	0.047^{*}	0.046	0.047^{*}	0.046^{*}	0.045	0.046^{*}	0.047
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
ZIND#	0.016	0.012	0.010	0.011	0.010	0.011	0.010
	(0.023)	(0.024)	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)
ZBSIZE#	0.054	0.051	0.050	0.052	0.052	0.052	0.053
	(0.037)	(0.037)	(0.037)	(0.038)	(0.037)	(0.038)	(0.037)
ZEDUDIV#	-0.044	-0.039	-0.039	-0.041	-0.044	-0.041	-0.042
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
ZEDIV#	-0.153^{***}	-0.152^{***}	-0.152^{***}	-0.152^{***}	-0.157^{***}	-0.154^{***}	-0.151^{***}
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
ZGDIV#	0.024	0.024	0.026	0.024	0.024	0.024	0.021
	(0.029)	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)	(0.030)
ZTOP3*NONDUAL	-0.133						
	(0.078)						
ZTOP3*ZNONEXEC		0.015					
		(0.017)					
ZTOP3*ZIND			-0.019				
			(0.015)				
ZTOP3*ZBSIZE				-0.001			
				(0.019)			
ZTOP3*ZEDUDIV					0.038^{**}		
					(0.018)		
ZTOP3*ZEDIV						0.016	
						(0.018)	
ZTOP3*ZGDIV							0.024
							(0.019)
ROA	6.529^{***}	6.530^{***}	6.519^{***}	6.522^{***}	6.520^{***}	6.521^{***}	6.529^{***}
	(0.267)	(0.271)	(0.268)	(0.269)	(0.268)	(0.269)	(0.268)
R^2	0.481	0.479	0.480	0.480	0.482	0.480	0.480
Adjusted R^2	0.478	0.476	0.477	0.477	0.479	0.477	0.477
Durbin-Watson	1.995	1.991	1.995	1.995	1.997	1.996	1.996
F-statistic	166.252	164.923	166.011	165.780	167.281	165.856	166.067
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2a with *VAIC* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *VAIC* measures the extent of value creation for each monetary unit invested in resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

For the full sample, the β coefficients of ZHERF*NONDUAL, ZHERF*ZNONEXEC, ZHERF*ZIND, ZHERF*ZBSIZE, ZHERF*ZEDUDIV, ZHERF*ZGDIV, ZTOP3*NONDUAL, ZTOP3*ZNONEXEC, ZTOP3*ZIND, ZTOP3*ZBSIZE, ZTOP3*ZEDIV and ZTOP3*ZGDIV are not statistically significant, indicating that a higher level of ownership concentration does not have a moderating effect on the relationships between the board characteristics and the efficiency of value added by a company from its total resources in these specific cases. For the full sample, the β coefficients of ZHERF*ZEDIV and ZTOP3*ZEDUDIV are statistically significant at the 5% level, confirming the moderating effect of a higher level of ZHERF and ZTOP3 (ownership concentration) on the relationships of the ethnic diversity of the board of directors and the educational-level diversity of the board of directors, respectively, with the efficiency of value added by a company from its total resources. Both the independent variables that form part of these interactions (EDIV and EDUDIV) are diversity measures.

ZHERF*ZEDIV has a negative β coefficient, whereas ZTOP3*ZEDUDIV has a positive β coefficient. Plots of the two-way interaction effects were drafted to obtain an enhanced understanding of these effects[11]. In Figure 8.1, the negative slope of the line for low ZHERF is slightly steeper than the negative slope of the line for high ZHERF and suggests that for low ownership concentration, the mean VAIC decreases from 3.50 to 3.30 as ethnic diversity moves from a low to a high level, while for high ownership concentration, the mean VAIC decreases more slightly from just above 3.10 to 3.00 as ethnic diversity moves from a low to a high level.

Al-Musali and Ku Ismail (2015) considered the moderating effect of the effectiveness of board meetings, rather than ownership concentration, on the relationship between educational-level diversity and VAIC and found no moderating effect. Figure 8.2

[11] The moderator variables (ZHERF and ZTOP3), which represent ownership concentration, are continuous in nature. Therefore, levels are created for the ownership concentration variables by categorising all values above the median as high and all values below the median as low. The continuous independent variables (ZNONEXEC, ZIND, ZBSIZE, ZEDUDIV, ZEDIV and ZGDIV) are similarly categorised into low and high levels. In the case of an interaction term with a statistically significant β coefficient, the relationship between the independent variable and the dependent variable is then plotted for both high and low ownership concentration levels, which allows for comparison of the direction and extent of the plotted regression lines.

illustrates the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between mean VAIC and educational-level diversity (ZEDUDIV). The line for low ownership concentration, with a mean VAIC that decreases from 3.45 to just above 3.30 as educational-level diversity moves from a low to a high level, has a negative slope and the line for high ownership concentration has a positive slope, which has a mean VAIC that increases from 3.05 to 3.10 as educational-level diversity moves from a low to a high level.

Figure 8.1: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between ethnic diversity of the board of directors (ZEDIV) and the efficiency of value added by a company from its total resources (VAIC)

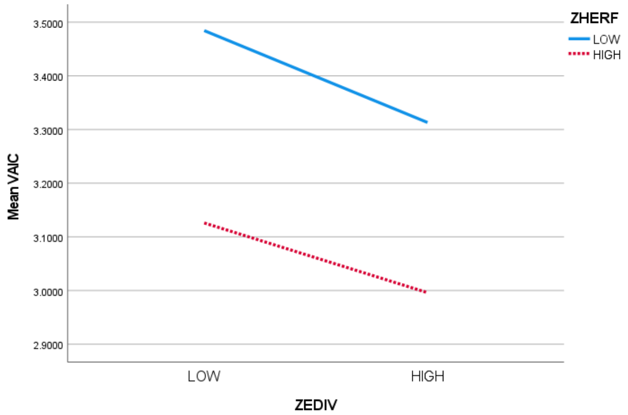
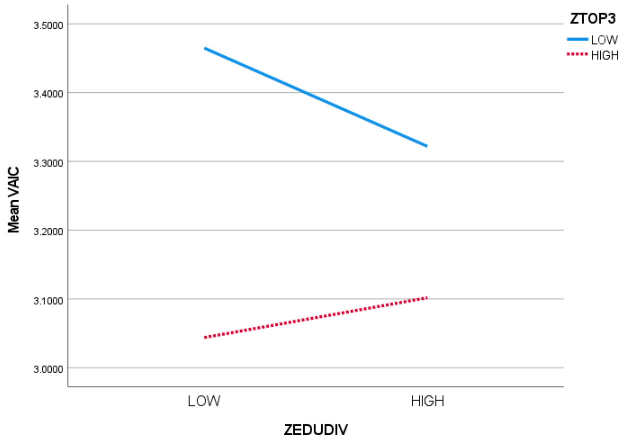


Figure 8.2: Interaction plot for the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between educational-level diversity of the board of directors (ZEDUDIV) and the efficiency of value added by a company from its total resources (VAIC)



For the full sample, Hypotheses $H_{9.1a}$ and $H_{9.2a}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its total resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1a}$ is supported for the ethnic diversity of the board of directors when ownership concentration is represented by the Herfindahl index, whereas Hypothesis $H_{9.1b}$ is supported for the educational-level diversity of the board of directors when TOP3 is used to measure ownership concentration. These hypotheses are not supported for the full sample when the characteristic of the board of directors is absence of chief executive officer (CEO) duality, the percentage of non-executive members of the board of directors, the percentage of non-executive members of the board of directors who are independent, the size of the board of directors or the gender diversity of the board of directors.

8.3.2 CEE – Model 2b

Model 2b relates specifically to the case when CEE serves as the dependent variable for the full sample. Based on revised Model 1b in Section 6.4.1, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2b for company *i* at period *t*:

$$CEE_{it} = \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it} {*} W_{it}) + \beta_{11} ROA_{it} + \varepsilon_{it}$$

The interaction terms were introduced individually to isolate the moderation effects. This resulted in 14 regression models (i.e. i – xiv). The regression results are presented in Tables 8.3(a) and 8.3(b). The adjusted R^2 values indicate that the predictor variables explain a moderate portion of the variance in CEE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

Table 8.3(a): Results of regressions introducing interaction terms individually for the full sample with CEE as the dependent variable and HERF as the moderator variable (Model 2b)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Intercept	0.640***	0.635***	0.641***	0.640***	0.634***	0.642***	0.640***
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
ZHERF#	0.000	-0.005	-0.005	-0.002	-0.003	-0.002	-0.005
	(0.028)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ZTOP3#	-0.011	-0.010	-0.011	-0.011	-0.010	-0.011	-0.011
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
NONDUAL#	-0.033	-0.031	-0.037	-0.034	-0.033	-0.035	-0.034
	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)	(0.029)	(0.029)
ZNONEXEC#	-0.026***	-0.026***	-0.027***	-0.026***	-0.026***	-0.026***	-0.027***
	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
ZIND#	-0.007	-0.007	-0.006	-0.007	-0.009	-0.007	-0.007
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ZBSIZE#	-0.007	-0.006	-0.009	-0.006	-0.007	-0.007	-0.007
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
ZEDUDIV#	-0.010	-0.011	-0.008	-0.010	-0.010	-0.010	-0.010
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
ZEDIV#	0.015	0.016	0.015	0.0144	0.015	0.014	0.014
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
ZGDIV#	-0.002	-0.003	-0.003	-0.002	-0.003	-0.002	-0.002
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
ZHERF*NONDUAL	-0.003						
	(0.027)						
ZHERF*ZNONEXEC		-0.008					
		(0.005)					
ZHERF*ZIND			-0.012**				
			(0.006)				
ZHERF*ZBSIZE				-0.000			
				(0.007)			
ZHERF*ZEDUDIV					-0.002		
					(0.006)		
ZHERF*ZEDIV						0.003	
						(0.005)	
ZHERF*ZGDIV							-0.007
							(0.005)
ROA	1.301***	1.307***	1.295***	1.305***	1.312***	1.303***	1.301***
	(0.072)	(0.073)	(0.072)	(0.073)	(0.074)	(0.073)	(0.072)
R^2	0.323	0.327	0.322	0.324	0.322	0.322	0.323
Adjusted R^2	0.319	0.323	0.318	0.320	0.319	0.319	0.319
Durbin-Watson	1.923	1.922	1.916	1.925	1.909	1.923	1.925
F-statistic	85.636	87.144	85.244	85.991	85.504	85.512	85.756
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2b with *CEE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *CEE* measures the extent of value creation for each monetary unit of resources invested in physical capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Table 8.3(b): Results of regressions introducing interaction terms individually for the full sample with CEE as the dependent variable and TOP3 as the moderator variable (Model 2b)

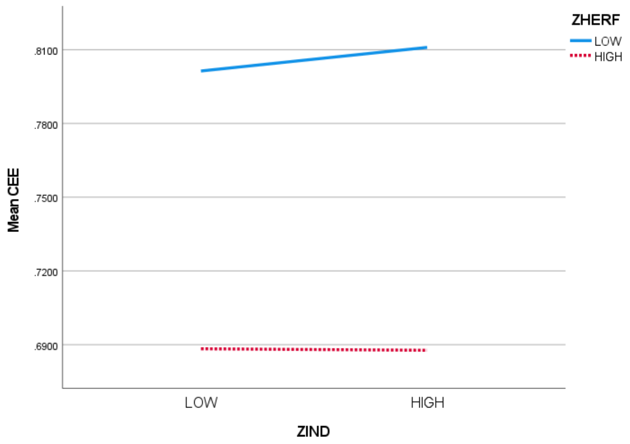
	viii	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Intercept	0.643***	0.641***	0.641***	0.642***	0.642***	0.640***	0.642***
	(0.044)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
ZHERF#	-0.003	-0.003	-0.003	-0.003	-0.002	-0.003	-0.004
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ZTOP3#	0.011	-0.010	-0.012*	-0.010	-0.011	-0.009	-0.009
	(0.024)	(0.008)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
NONDUAL#	-0.037	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035
	(0.030)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
ZNONEXEC#	-0.026***	-0.027***	-0.026***	-0.026***	-0.026***	-0.027***	-0.026***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
ZIND#	-0.006	-0.007	-0.006	-0.007	-0.007	-0.007	-0.007
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ZBSIZE#	-0.006	-0.007	-0.007	-0.007	-0.007	-0.007	-0.005
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
ZEDUDIV#	-0.011	-0.010	-0.010	-0.010	-0.010	-0.011	-0.011
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
ZEDIV#	0.014	0.014	0.015	0.014	0.015	0.013	0.014
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
ZGDIV#	-0.002	-0.002	-0.003	-0.002	-0.002	-0.002	-0.003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
ZTOP3*NONDUAL	-0.024						
	(0.023)						
ZTOP3*ZNONEXEC		0.006					
		(0.005)					
ZTOP3*ZIND			-0.005				
			(0.005)				
ZTOP3*ZBSIZE				0.003			
				(0.005)			
ZTOP3*ZEDUDIV					-3.13E-04		
					(0.005)		
ZTOP3*ZEDIV						0.008	
						(0.005)	
ZTOP3*ZGDIV							0.010
							(0.006)
ROA	1.304***	1.304***	1.302***	1.302***	1.303***	1.299***	1.302***
	(0.072)	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)	(0.072)
R^2	0.323	0.323	0.322	0.322	0.323	0.321	0.322
Adjusted R^2	0.319	0.319	0.319	0.319	0.319	0.317	0.318
Durbin-Watson	1.927	1.924	1.923	1.924	1.923	1.920	1.920
F-statistic	85.710	85.636	85.517	85.545	85.659	84.901	85.457
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2b with *CEE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *CEE* measures the extent of value creation for each monetary unit of resources invested in physical capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

For the full sample, the β coefficients of ZHERF*NONDUAL, ZHERF*ZNONEXEC, ZHERF*ZBSIZE, ZHERF*ZEDUDIV, ZHERF*ZEDIV, ZHERF*ZGDIV, ZTOP3*NONDUAL, ZTOP3*ZNONEXEC, ZTOP3*ZIND, ZTOP3*ZBSIZE, ZTOP3*ZEDUDIV, ZTOP3*ZEDIV and ZTOP3*ZGDIV are not statistically significant, indicating that a higher level of ownership concentration does not have a moderating effect on the relationships between the board characteristics and the efficiency of value added by a company from its physical capital resources in these specific cases. The negative β coefficient of ZHERF*ZIND is statistically significant at the 5% level for the full sample. Therefore, a higher level of ownership concentration (ZHERF) has a moderating effect on the relationship between ZIND and CEE. This is supported by the findings of Gaur *et al.* (2015), who found a statistically significant moderating effect of a higher level of ownership concentration on the relationship between a large presence of independent directors and return on assets, which is an accounting measure of performance. The study of Waheed and Malik (2019) provided no support for the findings of Gaur *et al.* (2015) when performance was measured as return on assets, but identified a statistically significant moderating effect when return on equity and Tobin's Q were used to measure performance.

When CEE serves as the dependent variable, ZHERF*ZIND is the only interaction term with a statistically significant β coefficient. Further insights regarding the moderating effects are obtained by plotting the two-way interaction effects. As illustrated in Figure 8.3, for low ownership concentration (ZHERF), the mean CEE increases gradually from just below 0.80 to 0.81 as the percentage of the members of the board of directors who are independent increases from a low to a high level. In the case of high ownership concentration, the negative slope of the ZHERF line is virtually parallel to the x-axis just below 0.69 and only decreases very marginally as the percentage of the members of the board of directors who are independent increases from a low to a high level.

Figure 8.3: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the percentage of non-executive members of the board of directors who are independent (ZIND) and the efficiency of value added by a company from its physical capital resources (CEE)



For the full sample, Hypotheses $H_{9.1b}$ and $H_{9.2b}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its physical capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1b}$ is supported when the characteristic of the board of directors is the percentage of non-executive members who are independent and ownership concentration is measured in terms of the Herfindahl index. For the full sample, Hypotheses $H_{9.1b}$ and $H_{9.2b}$ are not supported when the board characteristic considered is the absence of CEO duality, the percentage of non-executive members of the board of directors, the size of the board of directors, the educational-level diversity of the board of directors, the ethnic diversity of the board of directors, or the gender diversity of the board of directors.

8.3.3 ICE – Model 2c

Model 2c relates specifically to the case when ICE serves as the dependent variable for the full sample. Based on revised Model 1c in Section 6.4.1, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2c for company *i* at period *t*:

$$ICE_{it} = \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} ROA_{it} + \varepsilon_{it}$$

The interaction terms were introduced individually to isolate the moderation effects. This resulted in 14 regression models (i.e. i – xiv). The regression results are presented in Tables 8.4(a) and 8.4(b). The adjusted R^2 values indicate that the predictor variables explain a moderate portion of the variance in ICE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

For the full sample, the β coefficients of ZHERF*NONDUAL, ZHERF*ZNONEXEC, ZHERF*IND, ZHERF*ZEDUDIV, ZHERF*ZGDIV, ZTOP3*NONDUAL, ZTOP3*ZNONEXEC, ZTOP3*ZIND, ZTOP3*ZBSIZE, ZTOP3*ZEDIV and ZTOP3*ZGDIV are not statistically significant, indicating that a higher level of ownership concentration does not have a moderating effect on the relationships between the board characteristics and the efficiency of value added by a company from its intellectual capital resources in these specific cases.

Table 8.4(a): Results of regressions introducing interaction terms individually for the full sample with ICE as the dependent variable and HERF as the moderator variable (Model 2c)

	i	*ii*	*iii*	*iv*	*V*	*vi*	*vii*
Intercept	1.816***	1.818***	1.823***	1.818***	1.821***	1.818***	1.827***
	(0.094)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)
ZHERF#	0.053	-0.034	-0.031	-0.044**	-0.029	-0.036**	-0.034
	(0.052)	(0.021)	(0.019)	(0.018)	(0.019)	(0.017)	(0.019)
ZTOP3#	0.053***	0.055***	0.054***	0.059***	0.054***	0.056***	0.058***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
NONDUAL#	0.074	0.073	0.068	0.067	0.071	0.072	0.064
	(0.072)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)
ZNONEXEC#	0.064**	0.063**	0.0635**	0.066***	0.062**	0.064**	0.063**
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
ZIND#	0.021	0.020	0.021	0.019	0.020	0.023	0.021
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
ZBSIZE#	0.018	0.015	0.015	0.013	0.016	0.013	0.014
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029	(0.029)
ZEDUDIV#	0.007	0.008	0.008	0.010	0.009	0.009	0.009
	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)	(0.021)	(0.022)
ZEDIV#	-0.117***	-0.115***	-0.116***	-0.115***	-0.118***	-0.113***	-0.118***
	(0.027)	(0.026824)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
ZGDIV#	0.028	0.027	0.029	0.0278	0.029	0.025	0.029
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
ZHERF*NONDUAL	-0.087						
	(0.052)						
ZHERF*ZNONEXEC		-0.012					
		(0.015)					
ZHERF*ZIND			-0.004				
			(0.013)				
ZHERF*ZBSIZE				-0.033**			
				(0.017)			
ZHERF*ZEDUDIV					0.017		
					(0.016)		
ZHERF*ZEDIV						-0.034**	
						(0.016)	
ZHERF*ZGDIV							-0.018
							(0.015)
ROA	4.898***	4.889***	4.894***	4.879***	4.894***	4.883122***	4.891***
	(0.227)	(0.227)	(0.228)	(0.229)	(0.226)	(0.227789)	(0.228)
R^2	0.432	0.431	0.431	0.431	0.433	0.430	0.431
Adjusted R^2	0.429	0.428	0.428	0.428	0.430	0.427	0.428
Durbin-Watson	1.997	1.996	1.999	1.996	1.999	1.995	1.997
F-statistic	136.922	136.141	136.393	136.187	137.311	135.486	136.163
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2c with *ICE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *ICE* measures the extent of value creation for each monetary unit of resources invested in intellectual capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Table 8.4(b): Results of regressions introducing interaction terms individually for the full sample with ICE as the dependent variable and TOP3 as the moderator variable (Model 2c)

	viii	*ix*	*x*	*xi*	*xii*	*xiii*	*Xiv*
Intercept	1.827***	1.816***	1.818***	1.819***	1.817***	1.824***	1.824***
	(0.093)	(0.093)	(0.092)	(0.093)	(0.093)	(0.093)	(0.093)
ZHERF#	-0.034	-0.033	-0.031	-0.029	-0.031	-0.029	-0.029
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
ZTOP3#	0.058***	0.063***	0.047**	0.052***	0.059***	0.055***	0.060***
	(0.020)	(0.021)	(0.021)	(0.020)	(0.020)	(0.019)	(0.019)
NONDUAL#	0.064	0.074	0.072	0.071	0.078	0.067	0.067
	(0.071)	(0.071)	(0.070)	(0.071)	(0.071)	(0.071)	(0.071)
ZNONEXEC#	0.063**	0.065**	0.064**	0.064**	0.061**	0.065**	0.065**
	(0.0254)	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)
ZIND#	0.021	0.020	0.019	0.020	0.021	0.021	0.021
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
ZBSIZE#	0.014	0.013	0.015	0.013	0.015	0.017	0.018
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
ZEDUDIV#	0.009	0.006	0.011	0.009	0.009	0.009	0.007
	(0.022)	(0.021)	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)
ZEDIV#	-0.118***	-0.115***	-0.116***	-0.116***	-0.120***	-0.119***	-0.118***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
ZGDIV#	0.029	0.027	0.030	0.029	0.029	0.029	0.030
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
ZTOP3*NONDUAL	-0.018						
	(0.015)						
ZTOP3*ZNONEXEC		0.026					
		(0.014)					
ZTOP3*ZIND			-0.022				
			(0.012)				
ZTOP3*ZBSIZE				-0.009			
				(0.016)			
ZTOP3*ZEDUDIV					0.031**		
					(0.015)		
ZTOP3*ZEDIV						-0.002	
						(0.016)	
ZTOP3*ZGDIV							0.007
							(0.015)
ROA	4.891***	4.910***	4.890***	4.896***	4.902***	4.887***	4.893***
	(0.228)	(0.226)	(0.227)	(0.228)	(0.226)	(0.228)	(0.228)
R^2	0.433	0.432	0.431	0.432	0.434	0.431	0.430
Adjusted R^2	0.429	0.429	0.428	0.428	0.431	0.428	0.427
Durbin-Watson	1.998	1.994	1.999	1.997	1.996	1.998	2.000
F-statistic	136.975	136.608	136.309	136.475	137.887	136.216	135.739
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2c with *ICE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *ICE* measures the extent of value creation for each monetary unit of resources invested in intellectual capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

The negative β coefficient of ZHERF*ZBSIZE is statistically significant at the 5% level, indicating a moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the size of the board of directors and the efficiency of value added by a company from its intellectual capital resources. This finding is supported by the studies of Gaur *et al.* (2015) and Waheed and Malik (2019) with regard to the moderating effect of a higher level of ownership concentration on the relationship between the size of the board of directors and performance, using measures of corporate performance rather than the efficiency of value added by a company from its intellectual capital resources. To gain more insight into the moderating effect, an interaction plot is presented in Figure 8.4. The lines for low and high ZHERF both have positive slopes and are almost parallel. This implies that for low ownership concentration, the mean ICE increases from 2.47 to just below 2.55 as the size of the board of directors changes from low to high, while with high ownership concentration, the mean ICE increases marginally less from 2.28 to just below 2.35 as the size of the board of directors changes from low to high.

The negative coefficient of ZHERF*ZEDIV is statistically significant at the 5% level, indicating a moderating effect of ownership concentration (ZHERF) on the relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources. Figure 8.5 indicates that the negative slope of the line for low ZHERF is slightly less steep than the negative slope of the line for high ZHERF and suggests that for low ownership concentration, the mean ICE decreases from just below 2.60 to 2.45 as ethnic diversity moves from a low to a high level, while for high ownership concentration, the mean ICE decreases more rapidly from just above 2.40 to just below 2.20 as ethnic diversity moves from a low to a high level.

ZTOP3*ZEDUDIV has a statistically significant positive β coefficient at the 5% level. A better understanding of this relationship may be gained by examining the plot in Figure 8.6. This plot shows that the line for low ZTOP3 has a negative gradient, with a mean ICE that decreases from just below 2.60 to 2.45 as educational-level diversity moves from a low to a high level, whereas the line for high ZTOP3 has a positive gradient, with a mean ICE that increases from 2.25 to just below 2.40 as educational-level diversity moves from a low to a high level.

Figure 8.4: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the size of the board of directors (ZBSIZE) and the efficiency of value added by a company from its intellectual capital resources (ICE)

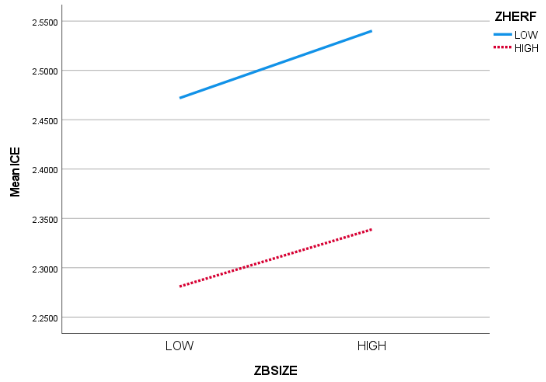
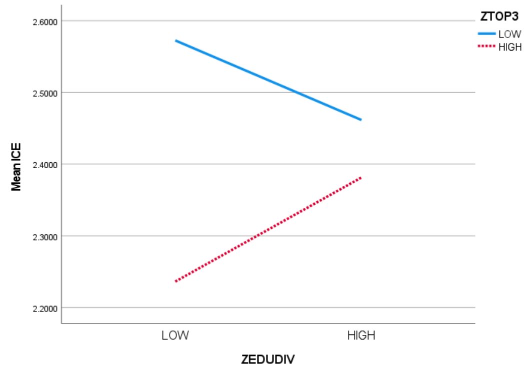


Figure 8.5: Interaction plot for the moderating effect of ownership concentration (ZHERF) on the relationship between ethnic diversity of the board of directors (ZEDIV) and the efficiency of value added by a company from its intellectual capital resources (ICE)

Figure 8.6: Interaction plot for the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between the educational-level diversity of the board of directors (ZEDUDIV) and the efficiency of value added by a company from its intellectual capital resources (ICE)



For the full sample, Hypotheses $H_{9.1c}$ and $H_{9.2c}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its intellectual capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1c}$ is supported when the characteristic of the board of directors is the size of the board of directors or the ethnic diversity of the board of directors and ownership concentration is measured in terms of the Herfindahl index. Hypothesis $H_{9.2c}$ is supported when the characteristic of the board of directors is educational-level diversity and the largest three shareholdings are used to measure ownership concentration. Additionally, for the full sample, these hypotheses are not supported when the board characteristic is absence of CEO duality, the percentage of non-executive members of the board of directors, the percentage of non-executive members of the board of directors who are independent or the gender diversity of the board of directors.

8.3.4 HCE – Model 2d

Model 2d relates specifically to the case when HCE serves as the dependent variable for the full sample. Based on revised Model 1d in Section 6.4.1, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2d for company *i* at period *t*:

$$HCE_{it} = \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} ROA_{it} + \varepsilon_{it}$$

The interaction terms were introduced individually to isolate the moderation effects. This resulted in 14 regression models (i.e. i – xiv). The regression results are presented in Tables 8.5(a) and 8.5(b). The adjusted R^2 values indicate that the predictor variables explain a moderate portion of the variance in HCE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

For the full sample, the β coefficients of ZHERF*NONDUAL, ZHERF*ZNONEXEC, ZHERF*ZIND, ZHERF*ZEDUDIV, ZTOP3*ZNONEXEC, ZTOP3*ZBSIZE, ZTOP3*ZEDUDIV, ZTOP3*ZEDIV and ZTOP3*ZGDIV are not statistically significant, indicating that a higher level of ownership concentration does not have a moderating effect on the relationships between the board characteristics and the efficiency of value added by a company from its human capital resources in these specific cases.

The negative β coefficients of ZHERF*ZBSIZE and ZHERFxZGDIV are statistically significant at the 5% level and the negative β coefficient of ZHERF*ZEDIV is statistically significant at the 1% level, providing evidence of a moderating effect. The finding is supported by the studies of Gaur *et al.* (2015) and Waheed and Malik (2019) regarding the moderating effect of a higher level of ownership concentration on the relationship between the size of the board of directors and performance, using corporate performance measures rather than the efficiency of value added by a company from its human capital resources.

Figure 8.7 indicates that the line for high ZHERF is almost parallel to the x-axis, but has a slight positive slope as the size of the board of directors changes from low to high. For low ownership concentration, the mean HCE increases more rapidly from just above 2.00 to just below 2.05 as the size of the board of directors changes from low to high. Figure 8.8 indicates that the negative slope of the line for low ZHERF is slightly less steep than the negative slope of the line for high ZHERF and suggests that for low ownership concentration, the mean HCE decreases from 2.10 to just below 2.00 as ethnic diversity moves from a low to a high level, while for high ownership concentration, the mean HCE decreases more rapidly from just below 2.00 to 1.75 as ethnic diversity moves from a low to a high level.

Table 8.5(a): Results of regressions introducing interaction terms individually for the full sample with HCE as the dependent variable and HERF as the moderator variable (Model 2d)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Intercept	1.453***	1.454***	1.456***	1.452***	1.456***	1.447***	1.454***
	(0.074)	(0.074)	(0.074)	(0.074)	(0.073)	(0.073)	(0.073)
ZHERF#	0.056	-0.014	-0.011	-0.025	-0.013	-0.019	-0.020
	(0.042)	(0.017)	(0.016)	(0.015)	(0.016)	(0.015)	(0.016)
ZTOP3#	0.045***	0.047***	0.046***	0.051***	0.047***	0.049***	0.050***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
NONDUAL#	0.065	0.067	0.065	0.062	0.064	0.070	0.064
	(0.060)	(0.059)	(0.059)	(0.059)	(0.059)	(0.058)	(0.059)
ZNONEXEC#	0.032*	0.032*	0.032*	0.033*	0.030	0.032*	0.030*
	(0.018)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)
ZIND#	0.028**	0.026*	0.026*	0.026*	0.028*	0.027**	0.027**
	(0.014)	(0.013576)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
ZBSIZE#	0.019	0.017	0.018	0.016	0.018	0.015	0.016
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
ZEDUDIV#	0.020	0.020	0.020	0.024	0.019	0.024	0.023
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
ZEDIV#	-0.095*	-0.092***	-0.094***	-0.093***	-0.0948***	-0.090***	-0.095***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
ZGDIV#	0.011	0.011	0.012	0.011	0.012	0.009	0.013
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
ZHERF*NONDUAL	-0.071						
	(0.042)						
ZHERF*ZNONEXEC		-0.011					
		(0.012)					
ZHERF*ZIND			-4.14E-04				
			(0.011)				
ZHERF*ZBSIZE				-0.032**			
				(0.013)			
ZHERF*ZEDUDIV					0.001		
					(0.013)		
ZHERF*ZEDIV						-0.037***	
						(0.013)	
ZHERF*ZGDIV							-0.026**
							(0.012)
ROA	4.135***	4.128***	4.131***	4.120***	4.134***	4.116***	4.130***
	(0.185)	(0.185)	(0.186)	(0.186)	(0.185)	(0.185)	(0.184)
R^2	0.480	0.478	0.479	0.480	0.479	0.480	0.481
Adjusted R^2	0.477	0.475	0.476	0.477	0.476	0.477	0.478
Durbin-Watson	2.008	2.008	2.011	2.011	2.011	2.008	2.012
F-statistic	165.899	164.738	164.929	165.768	165.231	165.883	166.277
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2d with *HCE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *HCE* measures the extent of value creation for each monetary unit of resources invested in human capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Table 8.5(b): Results of regressions introducing interaction terms individually for the full sample with HCE as the dependent variable and TOP3 as the moderator variable (Model 2d)

	viii	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Intercept	1.472***	1.454***	1.448***	1.454***	1.454***	1.458***	1.458***
	(0.075)	(0.074)	(0.073)	(0.074)	(0.074)	(0.074)	(0.074)
ZHERF#	-0.012	-0.013	-0.013	-0.009	-0.011	-0.011	-0.010
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
ZTOP3#	0.145***	0.051***	0.041***	0.042***	0.047***	0.047***	0.049***
	(0.045)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
NONDUAL#	0.047	0.066	0.071	0.065	0.068	0.062	0.063
	(0.061)	(0.059)	(0.058)	(0.059)	(0.059)	(0.059)	(0.059)
ZNONEXEC#	0.031*	0.032*	0.032*	0.032*	0.031*	0.033*	0.033*
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)
ZIND#	0.029**	0.027**	0.026*	0.026*	0.027**	0.027**	0.027**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
ZBSIZE#	0.020	0.017	0.017	0.017	0.018	0.018	0.018
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
ZEDUDIV#	0.018	0.020	0.022	0.021	0.019	0.021	0.020
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
ZEDIV#	-0.095***	-0.094***	-0.095***	-0.093***	-0.095***	-0.095***	-0.096***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
ZGDIV#	0.011	0.012	0.012	0.012	0.012	0.012	0.012
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
ZTOP3*NONDUAL	-0.104**						
	(0.044)						
ZTOP3*ZNONEXEC		0.013					
		(0.011)					
ZTOP3*ZIND			-0.021**				
			(0.009)				
ZTOP3*ZBSIZE				-0.013			
				(0.012)			
ZTOP3*ZEDUDIV					0.015		
					(0.010)		
ZTOP3*ZEDIV						-0.005	
						(0.012)	
ZTOP3*ZGDIV							0.001
							(0.012)
ROA	4.142***	4.142***	4.128***	4.137***	4.148***	4.131***	4.135***
	(0.185)	(0.185)	(0.184)	(0.186)	(0.187)	(0.185)	(0.185)
R^2	0.481	0.479	0.479	0.480	0.480	0.480	0.479
Adjusted R^2	0.478	0.476	0.476	0.477	0.477	0.477	0.476
Durbin-Watson	2.015	2.011	2.013	2.008	2.002	2.013	2.016
F-statistic	166.535	165.200	165.302	165.612	165.738	165.626	165.101
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2d with *HCE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *HCE* measures the extent of value creation for each monetary unit of resources invested in human capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Figure 8.9 indicates that the negative slope of the line for low ZHERF is slightly less steep than the negative slope of the line for high ZHERF and suggests that for low ownership concentration, the mean HCE decreases from just above 2.05 to just above 2.03 as gender diversity moves from a low to a high level, while for high ownership concentration, the mean HCE decreases more rapidly from just below 1.90 to 1.83 as gender diversity moves from a low to a high level.

For ZTOP3*NONDUAL, the negative β coefficient is statistically significant at the 5% level, indicating a moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between absence of CEO duality and the efficiency of value added by a company from its human capital resources. This is not supported by the findings of Gaur *et al.* (2015) and Waheed and Malik (2019), who found no statistically significant moderating effect of a higher level of ownership concentration on the relationship between the absence of CEO duality and return on assets, which is an accounting measure of performance. However, this finding is supported by the study of Waheed and Malik (2019) when return on equity and Tobin's Q were used to measure performance. To gain more insight into the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between HCE and the absence of CEO duality, an interaction plot is presented in Figure 8.10. This figure indicates that the line for low ZTOP3 has a slightly less steep positive slope than the line for high ZTOP3. This implies that for low ownership concentration, the mean HCE increases from 1.85 to 2.05 as there is a shift from CEO duality to absence of CEO duality, while with high ownership concentration, the mean HCE increases slightly more from just below 1.60 to just below 1.90 as there is a shift from CEO duality to absence of CEO duality.

ZTOP3*ZIND has a negative β coefficient that is statistically significant at the 5% level, suggesting a moderating effect of a higher level of ownership concentration on the relationship between the percentage of members of the board of directors who are independent, and the efficiency of value added by a company from its human capital resources. This finding is supported by the work of Gaur *et al.* (2015), who measured performance as the return on assets (an accounting measure) rather than the efficiency of value added by a company from its human capital resources. It is also supported by the study of Waheed and Malik (2019) when performance is measured as return on equity or Tobin's Q, but not when return on assets is used for this purpose. To gain more insight into the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between HCE and the percentage of members of the board of directors who are independent, an interaction plot is presented in Figure 8.11. The figure indicates that the line for low ZTOP3 has a positive slope and the line for high ZTOP3 has a negative slope. This means that for low ownership concentration, the mean HCE increases from 2.03 to just below 2.05 as the percentage of members of the board of directors who are independent moves from a low to a high level, whereas with high ownership concentration, the mean HCE decreases from just below 1.90 to 1.80 as the percentage of members of the board of directors who are independent moves from a low to a high level.

For the full sample, Hypotheses $H_{9.1d}$ and $H_{9.2d}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its human capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1d}$ is supported when the Herfindahl index is used to measure ownership concentration and the characteristic of the board of directors is the size of the board of directors, the ethnic diversity of the board of directors or the gender diversity of the board of directors. For the full sample, Hypothesis $H_{9.2d}$ is supported when the largest three shareholdings are used to measure ownership concentration and the specific board characteristic is absence of CEO duality or the percentage of the non-executive members of the board of directors who are independent. Additionally, for the full sample, these hypotheses are not supported when the board characteristic is the percentage of non-executive members of the board of directors or the educational-level diversity of the board of directors.

Figure 8.7: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the size of the board of directors (ZBSIZE and the efficiency of value added by a company from its human capital resources (HCE)

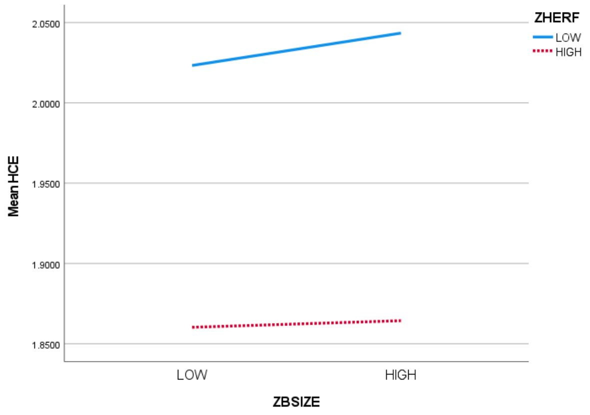


Figure 8.8: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between ethnic diversity of the board of directors (ZEDIV) and the efficiency of value added by a company from its human capital resources (HCE)

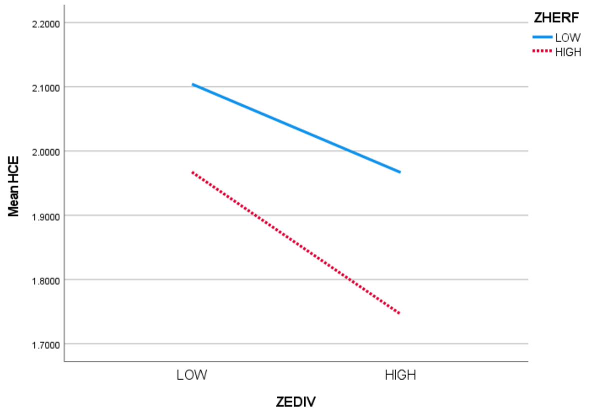


Figure 8.9: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between gender diversity of the board of directors (ZGDIV) and the efficiency of value added by a company from its human capital resources (HCE)

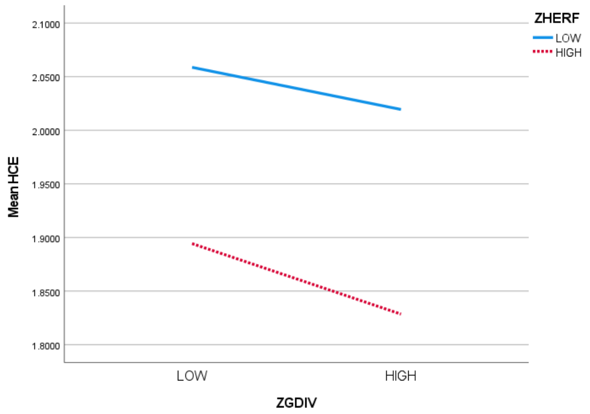


Figure 8.10: Interaction plot for the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between absence of CEO duality (NONDUAL) and the efficiency of value added by a company from its human capital resources (HCE)

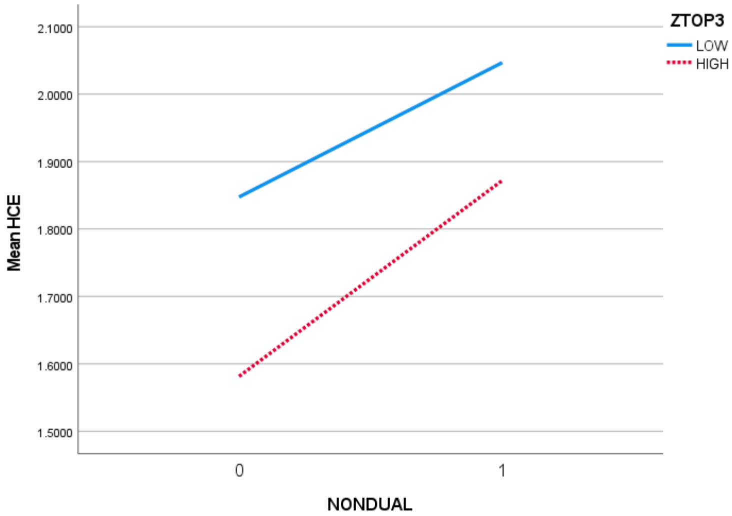
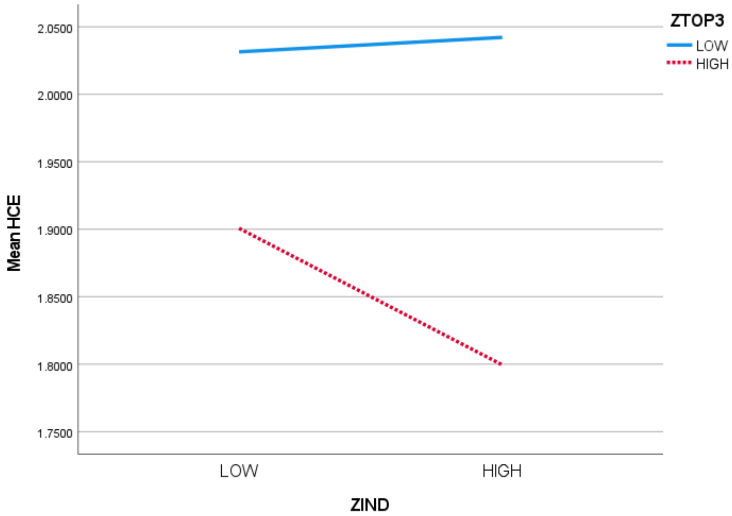


Figure 8.11: Interaction plot for the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between percentage of non-executive members of the board of directors who are independent (ZIND) and the efficiency of value added by a company from its human capital resources (HCE)



8.3.5 SCE – Model 2e

Model 2e relates specifically to the case when SCE serves as the dependent variable for the full sample. Based on revised Model 1e in Section 6.4.1, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2e for company *i* at period *t*:

$$SCE_{it} = \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} ROA_{it} + \varepsilon_{it}$$

The interaction terms were introduced individually to isolate the moderation effects. This resulted in 14 regression models (i.e. i – xiv). The regression results are presented in Tables 8.6(a) and 8.6(b). The adjusted R^2 values indicate that the predictor variables explain a moderate portion of the variance in SCE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. The F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero.

For the full sample, the β coefficients of ZHERF*NONDUAL, ZHERF*ZNONEXEC, ZHERF*ZIND, ZHERF*ZBSIZE, ZHERF*ZEDUDIV, ZTOP3*NONDUAL, ZTOP3*ZIND, ZTOP3*ZBSIZE, ZTOP3*ZEDUDIV, ZTOP3*ZEDIV and ZTOP3*ZGDIV are not statistically significant, indicating that a higher level of ownership concentration does not have a moderating effect on the relationships between the board characteristics and the efficiency of value added by a company from its structural capital resources in these specific cases. The negative β coefficient of ZHERF*ZEDIV and the positive β coefficient of ZTOP3*ZNONEXEC are statistically significant at the 1% level. Additionally, ZHERF*ZGDIV has a statistically significant negative β coefficient at the 5% level, confirming the moderating effect of ownership concentration (ZHERF) on the relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its structural capital resources.

Table 8.6(a): Results of regressions introducing interaction terms individually for the full sample with SCE as the dependent variable and HERF as the moderator variable (Model 2e)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*
Intercept	0.389***	0.390***	0.389***	0.388***	0.390***	0.388***	0.388***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)
ZHERF#	0.012	0.005	0.004	0.003	0.004	0.002	0.003
	(0.010)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
ZTOP3#	0.002	0.003	0.002	0.003	0.002	0.003	0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
NONDUAL#	-0.007	-0.008	-0.007	-0.007	-0.007	-0.007	-0.007
	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)	(0.016)	(0.016)
ZNONEXEC#	0.019**	0.019**	0.019**	0.019**	0.018**	0.019**	0.019**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
ZIND#	-0.009	-0.008	-0.008	-0.009*	-0.009	-0.008	-0.009
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ZBSIZE#	0.007	0.007	0.007	0.006	0.007	0.007	0.006
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ZEDUDIV#	0.005	0.005	0.005	0.005	0.006408	0.005	0.005
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ZEDIV#	-0.012*	-0.012*	-0.012*	-0.012*	-0.012*	-0.011*	-0.013**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ZGDIV#	-0.008	-0.008	-0.008	-0.008	-0.008	-0.009*	-0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ZHERF*NONDUAL	-0.007						
	(0.010)						
ZHERF*ZNONEXEC		-0.001					
		(0.004)					
ZHERF*ZIND			-0.003				
			(0.003)				
ZHERF*ZBSIZE				-0.006			
				(0.004)			
ZHERF*ZEDUDIV					-0.002		
					(0.004)		
ZHERF*ZEDIV						-0.012***	
						(0.004)	
ZHERF*ZGDIV							-0.007**
							(0.004)
ROA	0.701***	0.703***	0.700***	0.700***	0.699***	0.702***	0.704***
	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.061)
R^2	0.219	0.219	0.219	0.220	0.217	0.225	0.223
Adjusted R^2	0.214	0.215	0.215	0.216	0.213	0.221	0.219
Durbin-Watson	1.999	2.000	1.998	1.998	1.996	1.996	1.996
F-statistic	50.317	50.398	50.395	50.812	49.919	52.159	51.690
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2e with *SCE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *SCE* measures the extent of value creation for each monetary unit of resources invested in structural capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Table 8.6(b): Results of regressions introducing interaction terms individually for the full sample with SCE as the dependent variable and TOP3 as the moderator variable (Model 2e)

	viii	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Intercept	0.392***	0.390***	0.387***	0.390***	0.389***	0.390***	0.391***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
ZHERF#	0.005	0.004	0.005	0.005	0.005	0.006	0.006
	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
ZTOP3#	0.012	0.008	-0.001	0.003	0.002	0.003	0.001
	(0.010)	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)
NONDUAL#	-0.010	-0.008	-0.007	-0.007	-0.007	-0.008	-0.006
	(0.017)	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)	(0.017)
ZNONEXEC#	0.019**	0.020***	0.020**	0.018**	0.019**	0.019**	0.019**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
ZIND#	-0.009	-0.009	-0.010*	-0.009	-0.009	-0.008	-0.009*
	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
ZBSIZE#	0.007	0.006	0.007	0.007	0.007	0.006	0.007
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ZEDUDIV#	0.005	0.004	0.006	0.005	0.005	0.005	0.005
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ZEDIV#	-0.012*	-0.011*	-0.012*	-0.012*	-0.012*	-0.013**	-0.013**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
ZGDIV#	-0.008	-0.009*	-0.008	-0.008	-0.008	-0.009	-0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ZTOP3*NONDUAL	-0.011						
	(0.010)						
ZTOP3*ZNONEXEC		0.014***					
		(0.004)					
ZTOP3*ZIND			-0.007				
			(0.004)				
ZTOP3*ZBSIZE				0.003			
				(0.004)			
ZTOP3*ZEDUDIV					0.002		
					(0.003)		
ZTOP3*ZEDIV						-0.001	
						(0.004)	
ZTOP3*ZGDIV							-0.006
							(0.004)
ROA	0.702***	0.708***	0.704***	0.701***	0.701***	0.699***	0.691***
	(0.062)	(0.060)	(0.062)	(0.062)	(0.062)	(0.062)	(0.063)
R^2	0.219	0.228	0.221	0.220	0.219	0.217	0.214
Adjusted R^2	0.214	0.224	0.217	0.215	0.215	0.212	0.210
Durbin-Watson	1.997	2.006	1.994	1.999	1.999	2.000	1.996
F-statistic	50.336	53.060	51.060	50.599	50.369	49.682	49.056
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** and *** denote significance at the 5% and 1% levels, respectively. # means that the variable is standardised. β coefficients are shown before the parentheses. The standard error is in parentheses. The table reports the regression results of Model 2e with *SCE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *SCE* measures the extent of value creation for each monetary unit of resources invested in structural capital resources *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. NONDUAL is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

Plots of the two-way interaction effects were drafted to obtain an enhanced understanding of the moderating effects of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its structural capital resources. Figure 8.12 indicates that the negative slope of the line for low ZHERF is more gradual than the negative slope of the line for high ZHERF and suggests that for low ownership concentration, the mean SCE decreases from 0.47 to just above 0.45 as ethnic diversity moves from a low to a high level, while for high ownership concentration, the mean SCE decreases more rapidly from just above 0.45 to just below 0.43 as ethnic diversity moves from a low to a high level.

Figure 8.13 indicates that the slope of the line for low ZHERF is slightly steeper than the line for high ZHERF and suggests that for low ownership concentration, the mean SCE decreases from 0.465 to just above 0.455 as gender diversity moves from a low to a high level, while for high ownership concentration, the mean SCE decreases more slightly from just above to just below 0.44 as gender diversity moves from a low to a high level.

As illustrated in Figure 8.14, for low ownership concentration (ZHERF), the mean SCE increases from just below 0.45 to 0.47 as the percentage of the non-executive members of the board of directors increases from a low to a high level. In the case of high ownership concentration, the positive slope of the ZHERF line is slightly steeper and increases from 0.41 to just below 0.46 as the percentage of non-executive members of the board of directors increases from a low to a high level.

Figure 8.12: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between ethnic diversity of the board of directors (ZEDIV) and the efficiency of value added by a company from its structural capital resources (SCE)

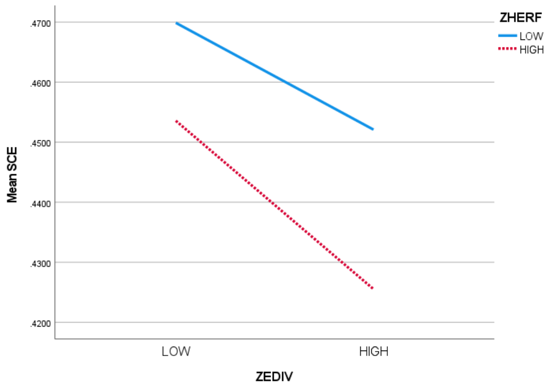


Figure 8.13: Interaction plot for the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between gender diversity of the board of directors (ZGDIV) and the efficiency of value added by a company from its structural capital resources (SCE)

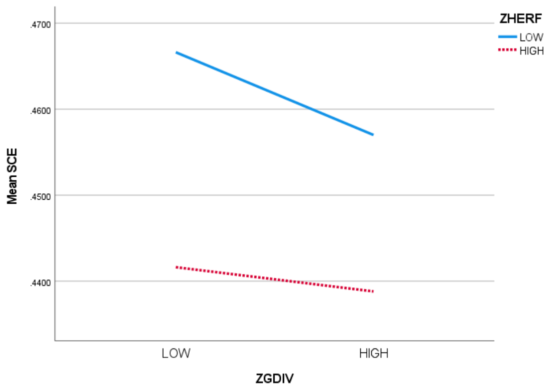
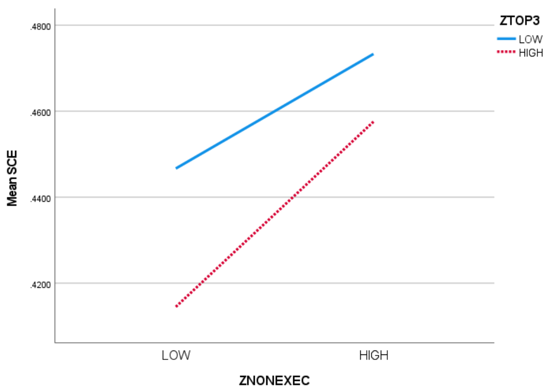


Figure 8.14: Interaction plot for the moderating effect of a higher level of ownership concentration (ZTOP3) on the relationship between percentage of non-executive members of the board of directors (ZNONEXEC) and the efficiency of value added by a company from its structural capital resources (SCE)



For the full sample, Hypotheses $H_{9.1e}$ and $H_{9.2e}$ propose that the relationships between the characteristics of the board of directors and the structural capital efficiency of value added by a company from its structural capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1e}$ is supported when the Herfindahl index is used to measure ownership concentration and when the specific board characteristic is the ethnic diversity of the board of directors or the gender diversity of the board of directors. For the full sample, Hypothesis $H_{9.2e}$ is supported when the characteristic of the board of directors is the percentage of the non-executive members of the board of directors and when the largest three shareholdings are used to measure ownership concentration. Additionally, for the full sample, these hypotheses are not supported when the board characteristic is the absence of CEO duality, the percentage of non-executive members of the board of directors who are independent, the size of the board of directors or the educational-level diversity of the board of directors.

8.3.6 Summary of results of the full sample: Hypothesis H_9

Table 8.7 summarises the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources for the full sample. It is evident that the moderating effects are more prevalent regarding the relationships of board size and diversity than for the relationships of the independence-type variables (NONDUAL, ZNONEXEC and ZIND) with the efficiency of value added by a company from its resources. In addition, the ethnic diversity of the board of directors is the independent variable with the most moderating effects and this occurs when the Herfindahl index serves as the measure of ownership concentration. Furthermore, the moderating effects are more frequent when HCE is the dependent variable than when VAIC, CEE, ICE or SCE is the dependent variable.

The moderating effects of a higher level of ZHERF and ZTOP3 on the relationships between a specific characteristic of the board of directors and specific dependent variable differ, indicating that the measure of ownership concentration (ZHERF or

ZTOP3) plays a role. For example, a higher level of ownership concentration, as measured by ZHERF, has a moderating effect on the relationship between educational-level diversity and VAIC, but ZTOP3 has no moderating effect on this relationship.

Table 8.7: Summary of moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and efficiency of value added by a company from its resources for the full sample

		VAIC (Model 2a)	*CEE (Model 2b)*	*ICE (Model 2c)*	*HCE (Model 2d)*	*SCE (Model 2e)*
i	ZHERF*NONDUAL					
ii	ZHERF*ZNONEXEC					
iii	ZHERF*ZIND					
iv	ZHERF*ZBSIZE					
v	ZHERF*ZEDUDIV					
vi	ZHERF*ZEDIV					
vii	ZHERF*ZGDIV					
viii	ZTOP3*NONDUAL					
ix	ZTOP3*ZNONEXEC					
x	ZTOP3*ZIND					
xi	ZTOP3*ZBSIZE					
xii	ZTOP3*ZEDUDIV					
xiii	ZTOP3*ZEDIV					
xiv	ZTOP3*ZGDIV					

Confirms the moderating effect

Provides no support for the moderating effect

The table provides a summary of the interaction terms and dependent variables for which moderating effects are confirmed or not confirmed. *VAIC*, *CEE*, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in total, physical, intellectual, human and structural capital, respectively. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

8.4 REGRESSION ANALYSIS OF THE TOP INDUSTRIES: HYPOTHESIS H_9

Two of the objectives stated in Section 1.4 of this study were to empirically determine the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources for each of the top industries represented on the Johannesburg Stock Exchange (JSE) and to empirically establish whether there was a moderating effect of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. The aim of the first of these objectives was not to research the fundamental differences between industries, but rather to study the results within industries. Fundamental differences between industries are vast (e.g. labour-intensive industries versus capital-intensive industries and difference in inflation sensitivity between industries). Therefore, no attempt was made to explain the fundamental differences between industries that gave rise to the variations in the results. The purpose of the second of these objectives was to identify whether there were moderating effects. Interaction plots and detailed descriptions of these were not included for the moderating effects in the industry analysis.

Model 2 is specified separately for each of the dependent variables (VAIC, CEE, ICE, HCE and SCE) for the basic materials, consumer services, financials and industrials industries for the period 2002 to 2018. The interaction terms with statistically significant β coefficients provide evidence of moderation effects by the ownership concentration variables on the relationships between specific dependent and independent variables (Da Silva Faia & Vieira, 2018; Dawson, 2014).

8.4.1 VAIC – Model 2f

Model 2f relates specifically to the case when VAIC serves as the dependent variable for the top four industries. Based on revised Model 1f in Section 6.4.2, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2f for company *i* at period *t*:

$$\begin{aligned} VAIC_{it} = \; & \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} \\ & + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} DY_{it} \\ & + \beta_{12} ROA_{it} + \beta_{13} LEV_{it} + \varepsilon_{it} \end{aligned}$$

The interaction terms were introduced individually to isolate the moderation effects. This resulted in 14 regression models (i to xiv). Table 8.8 presents some statistics for the 14 regressions conducted for the top four industries. The adjusted R^2 values indicate that the predictor variables explain a large portion of the variance in VAIC. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero. Table 8.9 presents a summary of the β coefficients of the interaction terms in the 14 regressions conducted for the top four industries, with VAIC as the dependent variable, using Model 2f. Owing to space constraints, the full regression results of the top industries are not provided in this document for any of the dependent variables, but can be obtained from the author on request.

The β coefficients of ZHERF*NONDUAL, ZHERF*ZBSIZE, ZTOP3*ZNONEXEC and ZTOP3*ZEDUDIV are statistically significant at the 1% or 5% level for the basic materials and financials industries, but are not statistically significant for the consumer services and industrials industries. This confirms that a higher level of ZHERF has a moderating effect on the relationships of the absence of CEO duality and the size of the board of directors with the efficiency of value added by the company from its total resources for the basic materials and financials industries. It also supports the presence of a moderating effect of a higher level of ZTOP3 on the relationships of the percentage of non-executive members of the board of directors, and educational-level diversity of the board of directors with the efficiency of value added by a company from its total resources for the basic materials and financials industries.

ZHERF*ZNONEXEC, ZHERF*ZIND, ZHERF*ZEDUDIV, ZHERF*ZEDIV, ZTOP3xZEDIV and ZTOP3*ZGDIV have β coefficients that are statistically significant at the 1% or 5% levels for the basic materials, consumer services and financials industries, but are not statistically significant for the industrials industry. This means that a higher level of ZHERF has a moderating effect on the relationships of the percentage of non-executive members of the board of directors, the percentage of non-executive members of the board of directors who are independent, the educational-level diversity of the board of directors and the ethnic diversity of the board of directors with the efficiency of value added by a company from its total resources for the basic materials, consumer services and financials industries. Additionally, for the basic materials, consumer services and financials industries, a higher level of ownership concentration measured as the shareholding of the largest three shareholders (ZTOP3) has a moderating effect on the relationships of ethnic diversity of the board of directors and gender diversity of the board of directors with the efficiency of value added by a company from its total resources.

The β coefficients of ZHERF*ZGDIV are statistically significant at the 1% level for the basic materials industry, at the 5% level for the consumer services industry, but are not statistically significant for the financials and industrials industries. This confirms the moderating effect of a higher level of ownership concentration, as measured by the Herfindahl index, on the relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its total resources for the basic materials and consumer services industries.

The β coefficient of ZTOP3*NONDUAL is statistically significant at the 1% level for the basic materials and financials industries, at the 5% level for the industrials industry, but is not statistically significant for the consumer services industry. This confirms the moderating effect of a higher level of ownership concentration, as measured by the largest three shareholdings, on the relationship between the absence of CEO duality and the efficiency of value added by a company from its total resources for the basic materials, financials and industrials industries.

For the consumer services and industrials industries, the β coefficient of ZTOP3*ZIND is statistically significant at the 1% level, confirming the moderating effect of a higher level of ZTOP3 on the relationship between the percentage of members of the board of directors who are independent, and the efficiency of value added by a company from its total resources. The β coefficient of ZTOP3*ZIND is not statistically significant for the basic materials and financials industries. ZTOP3*ZBSIZE has a statistically significant β coefficient at the 1% level for the basic materials and financials industries, and at the 5% level for the consumer services and industrials industries. This implies that a higher level of ZTOP3 has a moderating effect on the relationship between the size of the board of directors and the efficiency of value added by a company from its total resources for all top four industries.

Table 8.8: R^2, Adjusted R^2, Durbin-Watson statistic and F-statistic for the regressions introducing the interaction terms individually with VAIC as the dependent variable for the top four industries (Model 2f)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*	*xiii*	*Xiv*
Panel A: Basic materials														
R^2	0.995	0.991	0.999	0.987	0.997	0.999	0.988	1.000	0.995	0.996	0.980	0.994	0.995	0.990
Adjusted R^2	0.995	0.991	0.999	0.987	0.996	0.999	0.987	1.000	0.995	0.996	0.979	0.994	0.995	0.989
Durbin-Watson	2.017	2.053	2.064	2.007	2.050	2.061	2.018	2.033	2.047	2.061	2.047	2.020	2.056	2.016
F-statistic	4577.59	2557.94	23966.53	1743.22	6426.71	17130.02	1779.45	145173.40	4484.67	6079.49	1098.61	3722.14	4757.43	2125.85
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Consumer services														
R^2	0.804	0.817	0.825	0.803	0.810	0.805	0.808	0.806	0.806	0.822	0.795	0.809	0.806	0.796
Adjusted R^2	0.798	0.811	0.820	0.797	0.804	0.799	0.803	0.800	0.800	0.816	0.789	0.803	0.800	0.790
Durbin-Watson	1.832	1.850	1.852	1.835	1.845	1.838	1.820	1.840	1.836	1.856	1.835	1.845	1.830	1.819
F-statistic	135.04	146.73	155.06	134.08	140.20	136.10	138.93	136.48	137.01	151.86	128.05	139.57	136.93	128.32
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel C: Financials														
R^2	0.863	0.882	0.857	0.871	0.827	0.865	0.861	0.914	0.875	0.852	0.869	0.845	0.835	0.833
Adjusted R^2	0.859	0.878	0.853	0.867	0.821	0.861	0.856	0.911	0.871	0.847	0.865	0.840	0.829	0.827
Durbin-Watson	1.864	1.879	1.900	1.877	1.852	1.876	1.884	1.888	1.878	1.872	1.902	1.960	1.914	1.896
F-statistic	183.35	217.30	174.45	196.20	138.77	186.36	179.73	309.98	203.43	166.66	193.01	158.41	146.83	144.27
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel D: Industrials														
R^2	0.778	0.780	0.779	0.782	0.777	0.778	0.773	0.779	0.777	0.762	0.782	0.781	0.779	0.781
Adjusted R^2	0.772	0.774	0.774	0.776	0.771	0.773	0.767	0.773	0.772	0.756	0.776	0.776	0.774	0.776
Durbin-Watson	1.966	1.967	1.970	1.969	1.961	1.974	1.964	1.966	1.968	1.935	1.978	1.966	1.967	1.961
F-statistic	138.35	139.72	139.43	141.27	137.49	138.44	134.32	138.93	137.63	126.20	141.22	140.93	139.47	141.09
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The table presents the R^2, adjusted R^2, Durbin-Watson statistic, F-statistic and probability of the F-statistic for Model 2f with *VAIC* as the dependent variable for the top four industries. *VAIC* measures the extent of value creation for each monetary unit invested in resources. The specific interaction term introduced per model is i) ZHERF*NONDUAL, ii) ZHERF*ZNONEXEC, iii) ZHERF*ZIND, iv) ZHERF*ZBSIZE, v) ZHERF*ZEDUDIV, vi) ZHERF*ZEDIV, vii) ZHERF*ZGDIV, viii) ZTOP3*NONDUAL, ix) ZTOP3*ZNONEXEC, x) ZTOP3*ZIND, xi) ZTOP3*ZBSIZE, xii) ZTOP3*ZEDUDIV, xiii) ZTOP3*ZEDIV and xiv) ZTOP3*ZGDIV. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

Table 8.9: Summary of β coefficients for the regressions introducing the interaction terms individually with VAIC as the dependent variable for the top four industries (Model 2f)

	Interaction term	*Basic materials (n=306)*	*Consumer services (n=442)*	*Financials (n=391)*	*Industrials (n=527)*
i	ZHERF*NONDUAL	0.199*** (0.010)	-0.060 (0.065)	39.017*** (7.281)	-0.039 (0.057)
ii	ZHERF*ZNONEXEC	0.039*** (0.007)	0.041*** (0.011)	0.189*** (0.061)	0.016 (0.015)
iii	ZHERF*ZIND	0.015*** (0.001)	-0.080*** (0.013)	-0.228*** (0.072)	0.009 (0.010)
iv	ZHERF*ZBSIZE	-0.109*** (0.011)	0.013 (0.018)	0.113** (0.05)	0.030 (0.018)
v	ZHERF*ZEDUDIV	-0.027*** (0.005)	-0.028*** (0.009)	0.122** (0.054)	-0.014 (0.018)
vi	ZHERF*ZEDIV	-0.005*** (0.001)	-0.065*** (0.012)	0.215*** (0.063)	0.005 (0.016)
vii	ZHERF*ZGDIV	-0.072*** (0.007)	0.024** (0.011)	-0.070 (0.062)	-0.022 (0.014)
viii	ZTOP3*NONDUAL	0.163*** (0.002)	0.025 (0.052)	-9.806*** (1.823)	-0.295** (0.142)
ix	ZTOP3*ZNONEXEC	0.027*** (0.005)	-0.005 (0.008)	-0.153*** (0.054)	0.012 (0.012)
x	ZTOP3*ZIND	-0.007 (0.004)	-0.029*** (0.008)	-0.055 (0.073)	0.048*** (0.013)
xi	ZTOP3*ZBSIZE	-0.207*** (0.012)	0.033** (0.014)	0.283*** (0.056)	-0.038** (0.018)
xii	ZTOP3*ZEDUDIV	-0.026*** (0.007)	-0.009 (0.009)	0.638*** (0.059)	-0.020 (0.014)
xiii	ZTOP3*ZEDIV	-0.041*** (0.004)	-0.023** (0.010)	0.469*** (0.068)	-0.003 (0.017)
xiv	ZTOP3*ZGDIV	-0.091*** (0.006)	0.020** (0.009)	0.360*** (0.075)	-0.031 (0.017)

Confirms the moderating effect (green cells)

Provides no support for the moderating effect (orange cells)

** and *** denote significance at the 5% and 1% levels, respectively. β coefficients are shown before the parentheses for the interaction terms. The standard error is in parentheses. The table provides a summary of the β coefficients that form part of the regression results of Model 2f with *VAIC* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *VAIC* measures the extent of value creation for each monetary unit invested in resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

It is worth noting that, except for the β coefficient of ZTOP3*ZIND, all of the β coefficients of the interaction terms for the basic materials industry are statistically significant at the 1% level. In contrast, ZTOP3*NONDUAL, ZTOP3*ZIND and ZTOP3*ZBSIZE are the only interaction terms with statistically significant β coefficients at the 1% or 5% levels for the industrials industry. All three of these interaction terms were created using ZTOP3 rather than ZHERF as the moderator variable, suggesting that the measure of ownership concentration influences the results of the industrials industry.

Hypotheses $H_{9.1a}$ and $H_{9.2a}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its total resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1a}$ is supported for ZHERF*NONDUAL and ZHERF*ZBSIZE, while $H_{9.2a}$ is supported for ZTOP3*ZNONEXEC and ZTOP3*ZEDUDIV for the basic materials and financials industries, but not for the consumer services and industrials industries. In addition, Hypothesis $H_{9.1a}$ is supported for ZHERF*ZNONEXEC, ZHERF*ZIND, ZHERF*ZEDUDIV and ZHERF*ZEDIV, and Hypothesis $H_{9.2a}$ is supported for ZTOP3*ZEDIV and ZTOP3*ZGDIV for the basic materials, consumer services and financials industries, but not for the industrials industry. Additionally, Hypotheses $H_{9.1a}$ and $H_{9.2a}$ are supported for ZHERF*ZGDIV for the basic materials and consumer services industries, but not for the financials and industrials industries. Hypothesis $H_{9.2a}$ is also supported for ZTOP3*NONDUAL for the basic materials, financials and industrials industries, but not for the consumer services industry. There is also support for Hypothesis $H_{9.2a}$ with regard to ZTOP3*ZIND for the consumer services and industrials industries, but not for the basic materials and financials industries. Furthermore, this hypothesis is supported for ZTOP3*ZBSIZE for all the top four industries.

It is noteworthy that the moderating effects are most prevalent regarding the basic materials and financials industries. For Model 1f, presented in Section 7.3.1, both HERF and TOP3 have statistically significant relationships with VAIC for these two industries. For the consumer services industry, the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its total resources are less frequent. However, Section 7.3.1 indicates that HERF has a statistically significant relationship with VAIC for the consumer services industry, but not TOP3. The industrials industry is the industry with the least frequent moderating effects and neither HERF nor TOP3 has a statistically significant relationship with VAIC for this industry for Model 1f, presented in Section 7.3.1.

8.4.2 CEE – Model 2g

Model 2g relates specifically to the case when CEE serves as the dependent variable for the top four industries. Based on the revised Model 1g, presented in Section 6.4.2, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2g for company *i* at period *t*:

$$CEE_{it} = \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} DY_{it} + \beta_{12} ROA_{it} + \beta_{13} LEV_{it} + \varepsilon_{it}$$

Table 8.10 presents some statistics for the 14 regressions (i.e. i – xiv) conducted for the top four industries. The adjusted R^2 values indicate that the predictor variables explain a fairly large portion of the variance in CEE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero. Table 8.11 presents a summary of the β coefficients of the interaction terms in the 14 regressions (i.e. i - xiv) conducted for the top four industries, with CEE as the dependent variable, using Model 2g.

The β coefficients of ZHERF*NONDUAL and ZHERF*ZGDIV are statistically significant at the 1% level for the basic materials and consumer services industries, but are not statistically significant for the financials and industrials industries. This confirms that a higher level of ZHERF has a moderating effect on the relationships of the absence of CEO duality and the gender diversity of the board of directors with the efficiency of value added by a company from its physical capital resources for the basic materials and consumer services industries.

Table 8.10: R^2, Adjusted R^2, Durbin-Watson statistic and F-statistic for the regressions introducing the interaction terms individually with CEE as the dependent variable for the top four industries (Model 2g)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Panel A: Basic materials														
R^2	0.965	0.986	0.992	0.985	0.996	0.986	0.992	0.967	0.992	0.999	0.979	0.992	0.989	0.990
Adjusted R^2	0.963	0.985	0.992	0.985	0.996	0.986	0.992	0.965	0.991	0.999	0.978	0.992	0.988	0.990
Durbin-Watson	1.994	2.120	2.119	2.123	2.056	2.125	2.113	2.026	2.083	2.033	2.143	2.087	2.111	2.023
F-statistic	619.56	1591.31	2793.92	1507.10	5416.78	1600.18	2856.28	648.67	2625.13	18450.89	1038.38	2959.25	1988.84	2269.45
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Consumer services														
R^2	0.689	0.679	0.722	0.718	0.651	0.693	0.634	0.664	0.690	0.688	0.690	0.690	0.682	0.683
Adjusted R^2	0.679	0.670	0.714	0.710	0.641	0.683	0.623	0.654	0.681	0.678	0.681	0.681	0.672	0.674
Durbin-Watson	1.823	1.809	1.847	1.826	1.814	1.819	1.831	1.818	1.845	1.834	1.807	1.870	1.832	1.891
F-statistic	72.84	69.74	85.57	84.00	61.55	74.21	57.02	65.01	73.31	72.47	73.28	73.32	70.56	71.02
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel C: Financials														
R^2	0.725	0.737	0.727	0.728	0.735	0.726	0.753	0.740	0.735	0.736	0.734	0.729	0.734	0.763
Adjusted R^2	0.715	0.728	0.717	0.719	0.726	0.717	0.745	0.731	0.726	0.727	0.725	0.720	0.725	0.755
Durbin-Watson	1.995	1.997	1.999	2.008	1.993	2.005	1.997	2.006	1.980	1.986	2.002	2.012	1.970	2.000
F-statistic	76.42	81.21	77.10	77.75	80.63	76.95	88.58	82.68	80.35	80.87	79.92	78.04	80.22	93.30
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel D: Industrials														
R^2	0.675	0.683	0.679	0.694	0.684	0.675	0.676	0.667	0.674	0.671	0.680	0.677	0.676	0.677
Adjusted R^2	0.666	0.675	0.671	0.686	0.676	0.667	0.668	0.658	0.666	0.663	0.672	0.669	0.667	0.669
Durbin-Watson	1.921	1.929	1.902	1.900	1.889	1.914	1.909	1.898	1.922	1.885	1.904	1.918	1.902	1.917
F-statistic	81.79	85.05	83.65	89.31	85.41	81.12	82.36	78.94	81.61	80.45	83.85	82.82	82.16	82.85
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The table presents the R^2, adjusted R^2, Durbin-Watson statistic, F-statistic and probability of the F-statistic for Model 2g with *CEE* as the dependent variable for the top four industries. *CEE* measures the extent of value creation for each monetary unit of resources invested in physical capital resources. The specific interaction term introduced per model is i) ZHERF*NONDUAL, ii) ZHERF*ZNONEXEC, iii) ZHERF*ZIND, iv) ZHERF*ZBSIZE, v) ZHERF*ZEDUDIV, vi) ZHERF*ZEDIV, vii) ZHERF*ZGDIV, viii) ZTOP3*NONDUAL, ix) ZTOP3*ZNONEXEC, x) ZTOP3*ZIND, xi) ZTOP3*ZBSIZE, xii) ZTOP3*ZEDUDIV, xiii) ZTOP3*ZEDIV and xiv) ZTOP3*ZGDIV. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

Table 8.11: Summary of β coefficients for the regressions introducing the interaction terms individually with CEE as the dependent variable for the top four industries (Model 2g)

	Interaction term	*Basic materials (n=306)*	*Consumer services (n=442)*	*Financials (n=391)*	*Industrials (n=527)*
i	ZHERF*NONDUAL	-0.095*** (0.007)	-0.160*** (0.021)	0.249 (0.360)	0.027 (0.046)
ii	ZHERF*ZNONEXEC	-0.005*** (0.001)	-0.002 (0.006)	-0.009*** (0.003)	-0.022** (0.009)
iii	ZHERF*ZIND	-0.010*** (0.002)	-0.040*** (0.006)	-0.009** (0.004)	-0.006 (0.008)
iv	ZHERF*ZBSIZE	0.009*** (0.003)	0.081*** (0.013)	0.005 (0.003)	-0.039*** (0.011)
v	ZHERF*ZEDUDIV	-0.027*** (0.002)	-0.047*** (0.008)	-0.009*** (0.002)	-0.027** (0.012)
vi	ZHERF*ZEDIV	-0.001 (0.001)	0.017 (0.009)	0.007** (0.003)	0.002 (0.008)
vii	ZHERF*ZGDIV	0.009*** (0.001)	0.038*** (0.009)	0.018 (0.004)	-0.015 (0.009)
viii	ZTOP3*NONDUAL	-0.065*** (0.006)	-0.096*** (0.022)	-1.040*** (0.144)	0.177*** (0.064)
ix	ZTOP3*ZNONEXEC	-0.012*** (0.001)	-0.015*** (0.006)	0.024*** (0.005)	0.027*** (0.007)
x	ZTOP3*ZIND	-0.012*** (0.001)	-0.005 (0.004)	-0.033*** (0.006)	0.031*** (0.009)
xi	ZTOP3*ZBSIZE	0.003 (0.004)	0.015 (0.009)	0.010*** (0.004)	-0.008 (0.009)
xii	ZTOP3*ZEDUDIV	-0.014*** (0.002)	-0.044*** (0.006)	0.007** (0.003)	-0.016 (0.010)
xiii	ZTOP3*ZEDIV	-0.013*** (0.001)	-0.002 (0.006)	0.022*** (0.004)	0.028*** (0.010)
xiv	ZTOP3*ZGDIV	-0.020*** (0.001)	0.034*** (0.006)	0.023*** (0.004)	-0.001 (0.010)

Confirms the moderating effect

Provides no support for the moderating effect

** and *** denote significance at the 5% and 1% levels, respectively. β coefficients are shown before the parentheses for the interaction terms. The standard error is in parentheses. The table provides a summary of the β coefficients that form part of the regression results of Model 2g with *CEE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *CEE* measures the extent of value creation for each monetary unit of resources invested in physical capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

ZHERF*ZNONEXEC, ZTOP3*ZIND and ZTOP3*ZEDIV have β coefficients that are statistically significant at the 1% or 5% levels for the basic materials, financials and industrials industries, but are not statistically significant for the consumer services industry. This means that a higher level of ZHERF has a moderating effect on the relationship between the percentage of non-executive members of the board of directors and the efficiency of value added by a company from its physical capital resources for the basic materials, financials and industrials industries. Additionally, for the basic materials, financials and industrials industries, a higher level of ownership concentration measured as the shareholding of the largest three shareholders has a moderating effect on the relationships of the percentage of non-executive members of the board of directors who are independent and the ethnic diversity of the board of directors with the efficiency of value added by a company from its physical capital resources.

The β coefficient of ZHERF*ZIND and ZTOP3*ZEDUDIV is statistically significant at the 1% level for the basic materials and consumer services industries, at the 5% level of significance for the financials industry, but is not statistically significant for the industrials industries. ZTOP3*ZGDIV has a β coefficient that is statistically significant at the 1% level for the basic materials, consumer services and financials industries, but is not statistically significant for the industrials industry. These results confirm the moderating effect of a higher level of ownership concentration, as measured by the Herfindahl index, on the relationship between the percentage of non-executive members of the board of directors who are independent and the efficiency of value added by a company from its physical capital resources for the basic materials, consumer services and financials industries. They also provide support for the moderating effect of a higher level of ownership concentration, as measured by the largest three shareholdings, on the relationship of educational-level diversity and gender diversity of the board of directors with the efficiency of value added by a company from its physical capital resources for the basic materials, consumer services and financials industries.

For the basic materials, consumer services and industrials industries, the β coefficient of ZHERF*ZBSIZE is statistically significant at the 1% level, confirming the moderating effect of a higher level of ZHERF on the relationship between the size of the board of directors and the efficiency of value added by a company from its physical capital resources. The β coefficient of ZHERF*ZBSIZE is not statistically significant for the financials industry.

ZHERF*ZEDUDIV, ZTOP3*ZNONDUAL, and ZTOP3*ZNONEXEC have statistically significant β coefficients at the 1% level for the basic materials, consumer services and financials industries. For the industrials industry, the β coefficient of ZHERF*ZEDUDIV is statistically significant at the 5% level, whereas the β coefficients of ZTOP3*NONDUAL and ZTOP3*ZNONEXEC are statistically significant at the 1% level. Based on these results, a higher level of ZHERF has a moderating effect on the relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its physical capital resources for all the top four industries. In addition, a higher level of ZTOP3 has a moderating effect on the relationship of both the absence of CEO duality and the percentage of non-executive members of the board of directors with the efficiency of value added by a company from its physical capital resources for all the top four industries.

For the financials industry, the β coefficient of ZHERF*ZEDIV is statistically significant at the 5% level and the β coefficient of ZTOP3*ZBSIZE is statistically significant at the 1% level. These results confirm the moderating effect of a higher level of ownership concentration, as measured by the Herfindahl index, on the relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its physical capital resources for the financials industry. It also supports the moderating effect of a higher level of ownership concentration, as measured by the largest three shareholdings, on the relationship between the size of the board of directors and the efficiency of value added by a company from its physical capital resources for the financials industry.

Hypotheses $H_{9.1b}$ and $H_{9.2b}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its physical capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1b}$ is supported for ZHERF*NONDUAL and ZHERF*ZGDIV for the basic materials and consumer services industries, but not for the financials and industrials industries. In addition, Hypothesis $H_{9.1b}$ is supported for ZHERF*ZNONEXEC and Hypothesis $H_{9.2b}$ is supported for ZTOP3*ZIND and ZTOP3*ZEDIV for the basic materials, financials and industrials industries, but not for the consumer services industry. Additionally, Hypothesis $H_{9.1b}$ is supported for ZHERF*ZIND and Hypothesis $H_{9.2b}$ is supported for ZTOP3*ZEDUDIV and ZTOP3*ZGDIV for the basic materials, consumer services and financials industries, but not for the industrials industry. There is also support for Hypothesis $H_{9.1b}$ regarding ZHERF*ZBSIZE for the basic materials, consumer services and industrials industries, but not for the financials industry. The statistical significance of the β coefficient of ZHERF*ZEDUDIV provides support for Hypothesis $H_{9.1b}$, while the β coefficients of ZTOP3*ZNONDUAL and ZTOP3*ZNONEXEC provide support for Hypothesis $H_{9.2b}$ for all the top four industries. Furthermore, Hypothesis $H_{9.1b}$ is supported for ZHERF*ZEDIV and Hypothesis $H_{9.2b}$ is supported for ZTOP3*ZBSIZE for the financials industry, but not for the basic materials, consumer services and industrials industries.

It is worth noting that the moderating effects are most prevalent regarding the basic materials and financials industries, and less frequent in relation to the consumer services and industrials industries. For Model 1g, presented in Section 7.3.2, both HERF and TOP3 have statistically significant relationships with CEE for the basic materials and financials industries. In contrast, neither HERF nor TOP3 has a statistically significant relationship with CEE for the consumer services and industrials industries.

8.4.3 ICE – Model 2h

Model 2h relates specifically to the case when ICE serves as the dependent variable for the top four industries. Based on revised Model 1h in Section 6.4.2, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2h for company *i* at period *t*:

$$\begin{aligned} ICE_{it} = \quad & \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} \\ & + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} DY_{it} \\ & + \beta_{12} ROA_{it} + \beta_{13} LEV_{it} + \varepsilon_{it} \end{aligned}$$

Table 8.12 presents some statistics for the 14 regressions (i.e. i – xiv) conducted for the top four industries. The adjusted R^2 values indicate that the predictor variables explain a fairly large portion of the variance in ICE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero. Table 8.13 provides a summary of the β coefficients of the interaction terms in the 14 regressions (i.e. i – xiv) conducted for the top four industries, with ICE as the dependent variable, using Model 2h.

The β coefficients of ZHERF*NONDUAL, ZTOP3*ZBSIZE, ZTOP3*ZEDIV and ZTOP3*ZGDIV are statistically significant at the 1% level for the basic materials and financials industries, but are not statistically significant for the consumer services and industrials industries. This confirms that a higher level of ZHERF has a moderating effect on the relationship between the absence of CEO duality and the efficiency of value added by a company from its intellectual capital resources for the basic materials and financials industries. It also confirms the moderating effect of a higher level of ZTOP3 on the relationships of the size of the board of directors, the ethnic diversity of the board of directors and the gender diversity of the board of directors with the efficiency of value added by a company from its intellectual capital resources for the basic materials and financials industries.

ZHERF*ZNONEXEC, ZHERF*ZIND and ZHERF*ZGDIV have β coefficients that are statistically significant at the 1% or 5% levels for the basic materials, consumer services and financials industries, but are not statistically significant for the industrials industry. This means that a higher level of ZHERF has a moderating effect on the relationships of the percentage of non-executive members of the board of directors, the percentage of non-executive members of the board of directors who are independent and the gender diversity of the board of directors with the efficiency of value added by a company from its intellectual capital resources for the basic materials, consumer services and financials industries.

Table 8.12: R^2, Adjusted R^2, Durbin-Watson statistic and F-statistic for the regressions introducing the interaction terms individually with ICE as the dependent variable for the top four industries (Model 2h)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Panel A: Basic materials														
R^2	0.956	0.967	0.971	0.974	0.972	0.986	1.000	0.960	0.963	0.972	0.980	0.975	0.974	0.985
Adjusted R^2	0.954	0.966	0.970	0.973	0.970	0.986	1.000	0.958	0.961	0.971	0.979	0.974	0.973	0.984
Durbin-Watson	1.950	1.953	1.950	1.953	1.937	1.946	2.048	1.955	1.944	1.935	2.006	1.950	1.971	2.001
F-statistic	489.63	657.72	764.92	856.24	766.75	1606.57	175477.60	535.39	578.06	781.12	1073.29	867.99	834.60	1481.51
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Consumer services														
R^2	0.869	0.868	0.859	0.832	0.883	0.852	0.888	0.872	0.873	0.867	0.862	0.892	0.849	0.875
Adjusted R^2	0.865	0.864	0.854	0.827	0.880	0.848	0.884	0.868	0.869	0.863	0.858	0.889	0.844	0.871
Durbin-Watson	1.884	1.858	1.857	1.864	1.854	1.830	1.853	1.887	1.876	1.884	1.878	1.855	1.841	1.873
F-statistic	218.89	215.63	200.169	162.77	248.907	190.106	259.97	223.43	225.43	214.17	205.83	272.85	184.91	230.78
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel C: Financials														
R^2	0.795	0.836	0.797	0.789	0.772	0.763	0.839	0.786	0.795	0.793	0.819	0.813	0.765	0.761
Adjusted R^2	0.787	0.830	0.790	0.781	0.764	0.755	0.833	0.778	0.788	0.786	0.813	0.807	0.757	0.752
Durbin-Watson	1.886	1.933	1.892	1.904	1.893	1.898	1.881	1.888	1.892	1.891	1.906	1.971	1.950	1.914
F-statistic	112.13	147.87	113.97	108.22	98.21	93.35	151.03	106.36	112.29	110.97	131.43	126.35	94.23	92.13
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel D: Industrials														
R^2	0.696	0.679	0.695	0.696	0.683	0.700	0.696	0.690	0.700	0.699	0.694	0.699	0.694	0.694
Adjusted R^2	0.688	0.671	0.687	0.688	0.675	0.692	0.688	0.683	0.692	0.691	0.686	0.691	0.686	0.686
Durbin-Watson	1.903	1.890	1.900	1.904	1.910	1.902	1.900	1.877	1.903	1.905	1.901	1.892	1.906	1.898
F-statistic	90.14	83.42	89.81	90.36	84.94	91.97	90.18	87.99	91.87	91.48	89.50	91.65	89.57	89.51
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The table presents the R^2, adjusted R^2, Durbin-Watson statistic, F-statistic and probability of the F-statistic for Model 2h with *ICE* as the dependent variable for the top four industries. *ICE* measures the extent of value creation for each monetary unit of resources invested in intellectual capital resources. The specific interaction term introduced per model is i) ZHERF*NONDUAL, ii) ZHERF*ZNONEXEC, iii) ZHERF*ZIND, iv) ZHERF*ZBSIZE, v) ZHERF*ZEDUDIV, vi) ZHERF*ZEDIV, vii) ZHERF*ZGDIV, viii) ZTOP3*NONDUAL, ix) ZTOP3*ZNONEXEC, x) ZTOP3*ZIND, xi) ZTOP3*ZBSIZE, xii) ZTOP3*ZEDUDIV, xiii) ZTOP3*ZEDIV and xiv) ZTOP3*ZGDIV. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

Table 8.13: Summary of β coefficients for the regressions introducing the interaction terms individually with ICE as the dependent variable for the top four industries (Model 2h)

	Interaction term	*Basic materials (n=306)*	*Consumer services (n=442)*	*Financials (n=391)*	*Industrials (n=527)*
i	ZHERF*NONDUAL	0.231*** (0.036)	0.015 (0.034)	27.878*** (7.531)	-0.088 (0.051)
ii	ZHERF*ZNONEXEC	0.020** (0.009)	0.018** (0.008)	0.405*** (0.059)	0.019 (0.011)
iii	ZHERF*ZIND	0.048*** (0.009)	-0.034*** (0.010)	-0.309*** (0.083)	0.003 (0.008)
iv	ZHERF*ZBSIZE	-0.121*** (0.016)	-0.111*** (0.015)	0.072 (0.051)	0.040*** (0.014)
v	ZHERF*ZEDUDIV	0.017 (0.011)	0.031*** (0.007)	0.174*** (0.060)	0.005 (0.013)
vi	ZHERF*ZEDIV	-0.052*** (0.006)	-0.052*** (0.012)	0.185*** (0.071)	-0.026** (0.012)
vii	ZHERF*ZGDIV	-0.119*** (-4.21E-04)	-0.033*** (0.007)	-0.297*** (0.061)	-0.009 (0.011)
viii	ZTOP3*NONDUAL	0.162*** (0.022)	0.022 (0.044)	1.269 (2.365)	-0.269*** (0.098)
ix	ZTOP3*ZNONEXEC	0.025** (0.011)	0.010 (0.006)	-0.029 (0.066)	-0.016 (0.010)
x	ZTOP3*ZIND	0.017 (0.009)	-0.012 (0.006)	-0.013 (0.065)	-0.011 (0.010)
xi	ZTOP3*ZBSIZE	-0.161*** (0.014)	-0.007 (0.009)	0.394*** (0.063)	-0.005 (0.014)
xii	ZTOP3*ZEDUDIV	0.028*** (0.009)	0.033*** (0.006)	0.791*** (0.062)	-0.025** (0.011)
xiii	ZTOP3*ZEDIV	-0.047*** (0.009)	-0.001 (0.008)	0.565*** (0.067)	-0.023 (0.013)
xiv	ZTOP3*ZGDIV	-0.105*** (0.007)	-0.006 (0.006)	0.337*** (0.086)	-0.016 (0.013)

Confirms the moderating effect

Provides no support for the moderating effect

** and *** denote significance at the 5% and 1% levels, respectively. β coefficients are shown before the parentheses for the interaction terms. The standard error is in parentheses. The table provides a summary of the β coefficients that form part of the regression results of Model 2h with *ICE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *ICE* measures the extent of value creation for each monetary unit of resources invested in intellectual capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

The β coefficient of ZHERF*ZBSIZE is statistically significant at the 1% level for the basic materials, consumer services and industrials industries, but is not statistically significant for the financials industry. These results confirm the moderating effect of a higher level of ownership concentration, as measured by the Herfindahl index, on the relationship between the size of the board of directors and the efficiency of value added by a company from its intellectual capital resources for the basic materials, consumer services and industrials industries. ZHERF*ZEDUDIV has a statistically significant β coefficient at the 1% level for the consumer services and financials industries. The β coefficient of ZHERF*ZEDUDIV is not statistically significant for the basic materials and industrials industries. Consequently, a higher level of ownership concentration, as measured by the Herfindahl index, has a moderating effect on the relationship between educational-level diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources for the consumer services and financials industries, but not for the basic materials and industrials industries.

ZHERF*ZEDIV and ZTOP3*ZEDUDIV have statistically significant β coefficients at the 1% level for the basic materials, consumer services and financials industries, and at the 5% level for the industrials industry. Based on these results, a higher level of ZHERF has a moderating effect on the relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources for the top four industries. In addition, a higher level of ZTOP3 has a moderating effect on the relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its intellectual capital resources for all the top four industries.

For the basic materials and industrials industries, the β coefficient of ZTOP3*NONDUAL is statistically significant at the 1% level, confirming the moderating effect of a higher level of ZTOP3 on the relationship between the absence of CEO duality and the efficiency of value added by a company from its intellectual capital resources. The β coefficient of ZTOP3*NONDUAL is not statistically significant for the consumer services and financials industries. The β coefficient of ZTOP3*ZNONEXEC is statistically significant at the 5% level for the basic materials industry, but is not statistically significant for the consumer services, financials and industrials industries. Therefore, a higher level of ZTOP3 has a moderating effect on the relationship between the percentage of non-executive members of the board of directors and the efficiency of value added by a company from its intellectual capital resources for the basic materials industry. The β coefficient of ZTOP3*ZIND is not statistically significant for any of the top four industries.

Interestingly, for the basic materials industry, only the β coefficients of ZHERF*ZEDUDIV and ZTOP3*ZIND are not statistically significant. For the consumer services industry, when ZHERF is used to measure ownership concentration, only ZHERF*NONDUAL does not have a statistically significant β coefficient. In contrast, when ZTOP3 is used to measure ownership concentration, only ZTOP3*ZEDUDIV has a statistically significant β coefficient for the consumer services industry. This highlights the difference in the moderating effects based on the measure of ownership concentration. In comparison with the other industries, the moderating effect of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its intellectual capital resources is less prevalent for the industrials industry.

Hypotheses $H_{9.1c}$ and $H_{9.2c}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its intellectual capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1c}$ is supported for ZHERF*NONDUAL and Hypothesis $H_{9.2c}$ is supported for ZTOP3*ZBSIZE, ZTOP3*ZEDIV and ZTOP3*ZGDIV for the basic materials and financials industries, but not for the consumer services and industrials industries. In addition, Hypothesis $H_{9.1c}$ is supported for ZHERF*ZNONEXEC, ZHERF*ZIND and ZHERF*ZGDIV for the basic materials, consumer services and financials industries, but not for the industrials industry. This hypothesis is also supported for ZHERF*ZBSIZE for the basic materials, consumer services and industrials industries, but not for the financials industry. There is also support for Hypothesis $H_{9.1c}$ regarding ZHERF*ZEDUDIV for the consumer services and financials industries, but not for the basic materials and industrials industries. The statistical significance of the β coefficient of ZHERF*ZEDIV provides support for Hypotheses $H_{9.1c}$ for all the top four industries. Similarly, the statistical significance of the β coefficient of ZTOP3*ZEDUDIV supports Hypothesis $H_{9.2c}$ for all the top four industries. Furthermore, Hypothesis $H_{9.2c}$ is supported for ZTOP3*NONDUAL for the basic materials and industrials industries, but not for the consumer services and financials industries. This hypothesis is also supported for ZTOP3*ZNONEXEC for the basic materials industry, but not for the consumer services, financials and industrials industries. Hypothesis $H_{9.2c}$ is not supported for ZTOP3*ZIND for any of the top four industries.

It is noteworthy that the moderating effects are more prevalent regarding the basic materials, consumer services and financials industries than the industrials industry. For Model 1h, presented in Section 7.3.3, both HERF and TOP3 have statistically significant relationships with ICE for the basic materials, consumer services and financials industries, whereas only TOP3 has a statistically significant relationship with ICE for the industrials industry.

8.4.4 HCE – Model 2i

Model 2i relates specifically to the case when HCE serves as the dependent variable for the top four industries. Based on the revised Model 1i, presented in Section 6.4.2, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2i for company *i* at period *t*:

$$\begin{aligned} HCE_{it} = \; & \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} \\ & + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} DY_{it} \\ & + \beta_{12} ROA_{it} + \beta_{13} LEV_{it} + \varepsilon_{it} \end{aligned}$$

Table 8.14 presents some statistics for the 14 regressions (i.e. i – xiv) conducted for the top four industries. The adjusted R^2 values indicate that the predictor variables explain a fairly large portion of the variance in HCE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero. Table 8.15 provides a summary of the β coefficients of the interaction terms in the 14 regressions conducted for the top four industries, with HCE as the dependent variable, using Model 2i.

The β coefficients of ZHERF*NONDUAL, ZTOP3*ZBSIZE, ZTOP3*ZEDIV and ZTOP3*ZGDIV are statistically significant at the 1% level for the basic materials and financials industries, but are not statistically significant for the consumer services and industrials industries. This confirms that a higher level of ZHERF has a moderating effect on the relationship between the absence of CEO duality and the efficiency of value added by a company from its human capital resources for the basic materials and financials industries. It also confirms the moderating effect of a higher level of ZTOP3 on the relationships of the size of the board of directors, the ethnic diversity of the board of directors and the gender diversity of the board of directors with the efficiency of value added by a company from its human capital resources for the basic materials and financials industries.

ZHERF*ZNONEXEC has β coefficients that are statistically significant at the 5% level for the consumer services industry and at the 1% level for the financials industry, but are not statistically significant for the basic materials and industrials industries. This means that a higher level of ZHERF has a moderating effect on the relationship between the percentage of non-executive members of the board of directors and the efficiency of value added by a company from its human capital resources for the consumer services and financials industries.

The β coefficients of ZHERF*ZIND, ZHERF*ZEDUDIV and ZTOP3*ZEDUDIV are statistically significant at the 1% level for the basic materials, consumer services and financials industries, but are not statistically significant for the industrials industry. These results confirm the moderating effect of a higher level of ownership concentration, as measured by the Herfindahl index, on the relationships of the percentage of non-executive members of the board of directors who are independent and the educational-level diversity of the board of directors with the efficiency of value added by a company from its human capital resources for the basic materials, consumer services and financials industries. The moderating effects of a higher level of ownership concentration, as measured by the largest three shareholdings, on the relationships between educational-level diversity of the board of directors and the efficiency of value added by a company from its human capital resources for the basic materials, consumer services and financials industries are also confirmed.

ZHERF*ZBSIZE has a statistically significant β coefficient at the 1% level for the basic materials, consumer services and industrials industries. The β coefficient of ZHERF*ZBSIZE is not statistically significant for the financials industry. This implies that there is a moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the size of the board of directors and the efficiency of value added by a company from its human capital resources. For all the top four industries, ZHERF*ZEDIV has a statistically significant β coefficient at either the 1% or 5% level, confirming the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its human capital resources.

The β coefficients of ZHERF*ZGDIV are statistically significant at the 1% level for the basic materials and consumer services industries, but are not statistically significant for the financials and industrials industries. Consequently, a higher level of ownership concentration, as measured by ZHERF, has a moderating effect on the relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its human capital resources for the basic materials and consumer services industries.

For the basic materials and industrials industries, the β coefficient of ZTOP3*NONDUAL is statistically significant at the 1% level and 5% level, respectively, confirming the moderating effect of a higher level of ZTOP3 on the relationship between the absence of CEO duality and the efficiency of value added by a company from its human capital resources. The β coefficient of ZTOP3*NONDUAL is not statistically significant for the consumer services and financials industries. The β coefficient of ZTOP3*ZNONEXEC has a statistically significant β coefficient at the 1% level for the basic materials industry, but is not statistically significant for the consumer services, financials and industrials industries. Therefore, a higher level of ZTOP3 has a moderating effect on the relationship between the percentage of non-executive members of the board of directors and the efficiency of value added by a company from its human capital resources for the basic materials industry. For the basic materials and consumer services industries, the β coefficient of ZTOP3*ZIND is statistically significant at the 1% level and 5% level, respectively, confirming the moderating effect of a higher level of ZTOP3 on the relationship between the percentage of non-executive members of the board of directors who are independent and the efficiency of value added by a company from its human capital resources. The β coefficient of ZTOP3*ZIND is not statistically significant for the financials and industrials industries.

These findings, which relate to the situation when HCE is the dependent variable, are similar to the findings presented in Section 8.3.3 with ICE as the dependent variable. This suggests that HCE, which is a subcomponent of ICE, may be the driving force behind ICE. Except for the β coefficient of ZHERF*ZNONEXEC, all of the interaction term β coefficients are statistically significant at the 1% level for the basic materials industry. In contrast, only ZHERF*ZBSIZE, ZHERF*ZEDIV and ZTOP3*NONDUAL have statistically significant β coefficients for the industrials industry. This means that the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its human capital resources are prevalent for the basic materials industry, but less frequent for the industrials industry. For the consumer services industry, when ZHERF is used to measure ownership concentration, the β coefficient of only ZHERF*NONDUAL is not statistically significant, whereas the majority of the interaction terms are not statistically significant when ZTOP is used to measure ownership concentration. This suggests that the measurement of ownership concentration plays a role in the moderation effect.

Table 8.14: R^2, Adjusted R^2, Durbin-Watson statistic and F-statistic for the regressions introducing the interaction terms individually with HCE as the dependent variable for the top four industries (Model 2i)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Panel A: Basic materials														
R^2	0.972	0.986	0.995	0.977	0.998	0.976	0.959	0.980	0.989	0.987	0.984	0.994	0.990	0.969
Adjusted R^2	0.971	0.985	0.995	0.976	0.998	0.975	0.957	0.979	0.989	0.986	0.983	0.994	0.990	0.967
Durbin-Watson	1.993	1.993	2.018	2.009	2.014	2.025	1.979	1.998	1.996	2.005	2.030	1.991	2.000	2.000
F-statistic	780.43	1583.64	4393.50	967.28	10380.90	913.26	525.31	1093.55	2113.08	1706.60	1341.46	3588.92	2241.91	697.75
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Consumer services														
R^2	0.839	0.836	0.827	0.806	0.864	0.828	0.848	0.839	0.843	0.837	0.835	0.859	0.820	0.835
Adjusted R^2	0.834	0.832	0.822	0.800	0.859	0.823	0.843	0.834	0.839	0.832	0.830	0.854	0.815	0.830
Durbin-Watson	1.859	1.837	1.823	1.833	1.845	1.789	1.818	1.857	1.843	1.857	1.849	1.820	1.816	1.852
F-statistic	171.83	168.43	157.33	136.97	208.46	158.99	183.78	172.00	177.15	169.01	166.78	199.81	150.08	166.34
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel C: Financials														
R^2	0.754	0.786	0.749	0.764	0.785	0.750	0.746	0.749	0.748	0.745	0.753	0.860	0.768	0.778
Adjusted R^2	0.746	0.778	0.741	0.756	0.778	0.742	0.737	0.740	0.740	0.737	0.744	0.855	0.760	0.770
Durbin-Watson	1.845	1.838	1.814	1.817	1.789	1.811	1.822	1.834	1.835	1.835	1.800	1.832	1.827	1.837
F-statistic	88.98	106.31	86.68	94.11	106.01	87.21	85.16	86.32	86.23	84.92	88.39	178.13	95.80	101.62
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel D: Industrials														
R^2	0.654	0.638	0.655	0.654	0.641	0.662	0.656	0.652	0.656	0.661	0.654	0.656	0.651	0.654
Adjusted R^2	0.645	0.629	0.646	0.645	0.632	0.654	0.647	0.643	0.650	0.652	0.645	0.647	0.642	0.645
Durbin-Watson	1.861	1.856	1.856	1.862	1.865	1.859	1.856	1.834	1.858	1.862	1.858	1.850	1.865	1.855
F-statistic	74.55	69.53	74.82	74.55	70.58	77.42	75.09	73.83	75.13	76.79	74.43	75.18	73.679	74.61
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The table presents the R^2, adjusted R^2, Durbin-Watson statistic, F-statistic and probability of the F-statistic for Model 2i with *HCE* as the dependent variable for the top four industries. *HCE* measures the extent of value creation for each monetary unit of resources invested in human capital resources. The specific interaction term introduced per model is i) ZHERF*NONDUAL, ii) ZHERF*ZNONEXEC, iii) ZHERF*ZIND, iv) ZHERF*ZBSIZE, v) ZHERF*ZEDUDIV, vi) ZHERF*ZEDIV, vii) ZHERF*ZGDIV, viii) ZTOP3*NONDUAL, ix) ZTOP3*ZNONEXEC, x) ZTOP3*ZIND, xi) ZTOP3*ZBSIZE, xii) ZTOP3*ZEDUDIV, xiii) ZTOP3*ZEDIV and xiv) ZTOP3*ZGDIV. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

Table 8.15: Summary of β coefficients for the regressions introducing the interaction terms individually with HCE as the dependent variable for the top four industries (Model 2i)

	Interaction term	*Basic materials (n=306)*	*Consumer services (n=442)*	*Financials (n=391)*	*Industrials (n=527)*
i	ZHERF*NONDUAL	0.189*** (0.028)	0.007 (0.030)	30.506*** (7.884)	-0.038 (0.040)
ii	ZHERF*ZNONEXEC	0.003 (0.006)	0.016** (0.007)	0.235*** (0.068)	0.015 (0.009)
iii	ZHERF*ZIND	0.032*** (0.004)	-0.028*** (0.009)	-0.335*** (0.068)	0.001 (0.006)
iv	ZHERF*ZBSIZE	-0.100*** (0.007)	-0.084*** (0.013)	0.092 (0.049)	0.033*** (0.010)
v	ZHERF*ZEDUDIV	0.044*** (0.003)	0.030*** (0.007)	0.218*** (0.055)	0.003 (0.010)
vi	ZHERF*ZEDIV	-0.030*** (0.007)	-0.045*** (0.011)	0.187*** (0.065)	-0.025** (0.011)
vii	ZHERF*ZGDIV	-0.087*** (0.007)	-0.024*** (0.006)	-0.092 (0.066)	-0.011 (0.009)
viii	ZTOP3*NONDUAL	0.152*** (0.013)	0.015 (0.037)	3.394 (2.456)	-0.202** (0.080)
ix	ZTOP3*ZNONEXEC	0.030*** (0.005)	0.009 (0.005)	0.013 (0.061)	-0.008 (0.008)
x	ZTOP3*ZIND	-0.016*** (0.004)	-0.011** (0.005)	-0.008 (0.058)	-0.007 (0.007)
xi	ZTOP3*ZBSIZE	-0.108*** (0.007)	-0.004 (0.008)	0.268*** (0.060)	-0.001 (0.012)
xii	ZTOP3*ZEDUDIV	0.036*** (0.005)	0.025*** (0.005)	0.759*** (0.079)	-0.016 (0.009)
xiii	ZTOP3*ZEDIV	-0.026*** (0.006)	-0.003 (0.007)	0.426*** (0.074)	-0.017 (0.011)
xiv	ZTOP3*ZGDIV	-0.087*** (0.010)	-0.003 (0.005)	0.507*** (0.075)	-0.014 (0.010)

Confirms the moderating effect

Provides no support for the moderating effect

** and *** denote significance at the 5% and 1% levels, respectively. β coefficients are shown before the parentheses for the interaction terms. The standard error is in parentheses. The table provides a summary of the β coefficients that form part of the regression results of Model 2i with *HCE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *HCE* measures the extent of value creation for each monetary unit of resources invested in human capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

Hypotheses $H_{9.1d}$ and $H_{9.2d}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its human capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1d}$ is supported for ZHERF*NONDUAL and Hypothesis $H_{9.2d}$ is supported for ZTOP3*ZBSIZE, ZTOP3*ZEDIV and ZTOP3*ZGDIV for the basic materials and financials industries, but not for the consumer services and industrials industries. Hypothesis $H_{9.1d}$ is also supported for ZHERF*ZNONEXEC for the consumer services and financials industries, but not for the basic materials and industrials industries. Additionally, Hypothesis $H_{9.1d}$ is supported for ZHERF*ZIND and ZHERF*ZEDUDIV, while Hypothesis $H_{9.2d}$ is supported for ZTOP3*ZEDUDIV for the basic materials, consumer services and financials industries, but not for the industrials industry. There is also support for Hypothesis $H_{9.1d}$ regarding ZHERF*ZBSIZE for the basic materials, consumer services and industrials industries, but not the financials industry. This hypothesis is further supported for all the top four industries for ZHERF*ZEDIV. The statistical significance of the β coefficients of ZHERF*ZGDIV and ZTOP3*ZIND provide support for Hypotheses $H_{9.1d}$ and $H_{9.2d}$, respectively, for the basic materials and consumer services industries. Furthermore, Hypothesis $H_{9.2d}$ is supported for ZTOP3*NONDUAL for the basic materials and industrials industries, but not for the consumer services and financials industries. This hypothesis is also supported for ZTOP3*ZNONEXEC for the basic materials industry, but not for the consumer services, financials and industrials industries.

It is worth noting that the moderating effects are more prevalent regarding the basic materials, consumer services and financials industries than for the industrials industry. For Model 1i, presented in Section 7.3.4, both HERF and TOP3 have statistically significant relationships with HCE for the basic materials, consumer services and financials industries, whereas only TOP3 has a statistically significant relationship with HCE for the industrials industry.

8.4.5 SCE – Model 2j

Model 2j relates specifically to the case when SCE serves as the dependent variable for the top four industries. Based on revised Model 1j, presented in Section 6.4.2, and after standardising the continuous ownership concentration and independent variables, the following model specification was adopted for Model 2j for company *i* at period *t*:

$$SCE_{it} = \alpha_0 + \beta_1 ZHERF_{it} + \beta_2 ZTOP3_{it} + \beta_3 NONDUAL_{it} + \beta_4 ZNONEXEC_{it} + \beta_5 ZIND_{it} + \beta_6 ZBSIZE_{it} + \beta_7 ZEDUDIV_{it} + \beta_8 ZEDIV_{it} + \beta_9 ZGDIV_{it} + \beta_{10}(Mod_{it}{*}W_{it}) + \beta_{11} DY_{it} + \beta_{12} ROA_{it} + \beta_{13} LEV_{it} + \varepsilon_{it}$$

Table 8.16 presents some statistics for the 14 regressions (i.e. i – xiv) conducted for the top four industries. The adjusted R^2 values indicate that the predictor variables explain a large portion of the variance in SCE. In all cases, the Durbin-Watson statistic is within the acceptable threshold of 1.5 to 2.5 to satisfy the assumption of no serious autocorrelation. In addition, the F-statistic for each of the regression models is statistically significant ($p<0.001$), indicating that all the β coefficients differ significantly from zero. Table 8.17 provides a summary of the β coefficients of the interaction terms in the 14 regressions conducted for the top four industries, with SCE as the dependent variable, using Model 2j.

The β coefficients of ZHERF*NONDUAL, ZHERF*ZNONEXEC and ZTOP3*NONDUAL are statistically significant at the 1% or 5% level for the basic materials, financials and industrials industries, but are not statistically significant for the consumer services industry. This confirms that a higher level of ZHERF has a moderating effect on the relationship of the absence of CEO duality and the percentage of non-executive members of the board of directors with the efficiency of value added by a company from its structural capital resources for the basic materials, financials and industrials industries. It also confirms the moderating effect of a higher level of ZTOP3 on the relationship between the absence of CEO duality and the efficiency of value added by a company from its structural capital resources for the basic materials, financials and industrials industries.

Table 8.16: R^2, Adjusted R^2, Durbin-Watson statistic and F-statistic for the regressions introducing the interaction terms individually with SCE as the dependent variable for the top four industries (Model 2j)

	i	*ii*	*iii*	*iv*	*v*	*vi*	*Vii*	*viii*	*ix*	*x*	*xi*	*xii*	*xiii*	*xiv*
Panel A: Basic materials														
R^2	0.995	0.918	0.967	0.970	0.923	0.966	0.924	0.950	0.929	0.995	0.953	0.931	0.959	0.932
Adjusted R^2	0.994	0.914	0.966	0.969	0.920	0.964	0.921	0.947	0.925	0.995	0.950	0.928	0.957	0.929
Durbin-Watson	2.028	1.979	2.015	1.977	1.989	1.947	1.957	2.000	1.952	2.037	2.000	1.999	1.936	1.960
F-statistic	4156.27	249.84	663.66	734.09	269.52	631.21	274.59	424.02	292.11	4600.82	451.10	301.59	528.80	309.80
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Consumer services														
R^2	0.806	0.820	0.812	0.825	0.745	0.803	0.857	0.797	0.813	0.823	0.825	0.774	0.801	0.838
Adjusted R^2	0.800	0.815	0.806	0.819	0.737	0.797	0.853	0.790	0.807	0.817	0.820	0.767	0.795	0.833
Durbin-Watson	1.933	1.945	1.932	1.967	1.888	1.951	1.998	1.958	1.957	1.938	1.946	1.929	1.942	2.003
F-statistic	137.04	150.15	141.93	154.82	95.98	134.41	197.32	128.95	142.96	152.78	155.31	112.64	132.25	170.18
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel C: Financials														
R^2	0.644	0.509	0.541	0.596	0.595	0.568	0.645	0.527	0.635	0.616	0.653	0.630	0.663	0.669
Adjusted R^2	0.632	0.492	0.525	0.582	0.581	0.553	0.633	0.511	0.622	0.603	0.641	0.617	0.652	0.658
Durbin-Watson	2.004	1.990	2.006	2.009	2.006	2.010	2.024	2.011	2.015	2.003	2.003	2.005	1.994	2.023
F-statistic	52.47	30.08	34.15	42.77	42.68	38.11	52.75	32.30	50.40	46.55	54.47	49.30	57.11	58.66
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel D: Industrials														
R^2	0.785	0.782	0.785	0.788	0.783	0.783	0.785	0.786	0.783	0.782	0.783	0.786	0.784	0.782
Adjusted R^2	0.779	0.777	0.780	0.782	0.777	0.777	0.780	0.780	0.778	0.776	0.778	0.780	0.778	0.777
Durbin-Watson	1.934	1.953	1.942	1.932	1.948	1.940	1.941	1.938	1.939	1.940	1.940	1.937	1.941	1.940
F-statistic	143.96	141.82	144.44	146.27	142.23	142.22	144.05	144.76	142.42	141.56	142.40	144.61	143.17	141.92
Prob (F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The table presents the R^2, adjusted R^2, Durbin-Watson statistic, F-statistic and probability of the F-statistic for Model 2j with *SCE* as the dependent variable for the top four industries. *SCE* measures the extent of value creation for each monetary unit of resources invested in structural capital resources. The specific interaction term introduced per model is i) ZHERF*NONDUAL, ii) ZHERF*ZNONEXEC, iii) ZHERF*ZIND, iv) ZHERF*ZBSIZE, v) ZHERF*ZEDUDIV, vi) ZHERF*ZEDIV, vii) ZHERF*ZGDIV, viii) ZTOP3*NONDUAL, ix) ZTOP3*ZNONEXEC, x) ZTOP3*ZIND, xi) ZTOP3*ZBSIZE, xii) ZTOP3*ZEDUDIV, xiii) ZTOP3*ZEDIV and xiv) ZTOP3*ZGDIV. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

Table 8.17: Summary of β coefficients for the regressions introducing the interaction terms individually with SCE as the dependent variable for the top four industries (Model 2j)

	Interaction term	*Basic materials (n=306)*	*Consumer services (n=442)*	*Financials (n=391)*	*Industrials (n=527)*
i	ZHERF*NONDUAL	0.063*** (0.001)	0.001 (0.007)	-2.035*** (0.471)	-0.037*** (0.014)
ii	ZHERF*ZNONEXEC	0.011*** (0.002)	0.002 (0.002)	0.034*** (0.006)	0.007*** (0.002)
iii	ZHERF*ZIND	0.012*** (0.002)	-0.009*** (0.001)	0.033*** (0.007)	0.002 (0.002)
iv	ZHERF*ZBSIZE	-0.019*** (0.003)	-0.024*** (0.003)	0.001 (0.006)	0.007** (0.003)
v	ZHERF*ZEDUDIV	-0.004 (0.003)	0.004** (0.002)	0.011** (0.004)	0.004 (0.003)
vi	ZHERF*ZEDIV	-0.011*** (0.002)	-0.009*** (0.002)	0.004 (0.007)	-0.001 (0.003)
vii	ZHERF*ZGDIV	-0.025*** (0.003)	-0.007*** (0.002)	-0.027*** (0.007)	0.004 (0.003)
viii	ZTOP3*NONDUAL	0.040*** (0.003)	0.006 (0.007)	1.053*** (0.143)	-0.052** (0.025)
ix	ZTOP3*ZNONEXEC	0.005 (0.002)	-0.002 (0.001)	0.070*** (0.006)	-0.002 (0.003)
x	ZTOP3*ZIND	0.014*** (2.49E-04)	-0.004*** (0.001)	0.031*** (0.007)	-0.004 (0.002)
xi	ZTOP3*ZBSIZE	-0.039*** (0.004)	-0.009*** (0.002)	0.028*** (0.006)	0.001 (0.003)
xii	ZTOP3*ZEDUDIV	-0.005 (0.003)	0.002 (0.002)	0.020** (0.008)	-0.004 (0.003)
xiii	ZTOP3*ZEDIV	-0.010*** (0.002)	-0.004** (0.002)	0.045*** (0.007)	-0.005 (0.003)
xiv	ZTOP3*ZGDIV	-0.013*** (0.003)	-0.002 (0.002)	-0.067*** (0.007)	-3.66E-04 (0.003)

Confirms the moderating effect

Provides no support for the moderating effect

** and *** denote significance at the 5% and 1% levels, respectively. β coefficients are shown before the parentheses for the interaction terms. The standard error is in parentheses. The table provides a summary of the β coefficients that form part of the regression results of Model 2j with *SCE* as the dependent variable. The estimation method is EGLS regressions, with period SUR weightings and using White (diagonal) standard errors and covariance methods. *SCE* measures the extent of value creation for each monetary unit of resources invested in structural capital resources. *ZHERF* is the Herfindahl index for ownership concentration. *ZTOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *ZNONEXEC* is the percentage of board members who are non-executive. *ZIND* is the percentage of non-executive directors who are independent. *ZBSIZE* is the number of board members. *ZEDUDIV* is Teachman's index for educational-level diversity. *ZEDIV* and *ZGDIV* are Blau's indices for ethnic and gender diversity, respectively. All variables, other than *NONDUAL,* are standardised.

The β coefficients of ZHERF*ZIND, ZHERF*ZGDIV, ZTOP3*ZIND, ZTOP3*ZBSIZE and ZTOP3*ZEDIV are statistically significant at the 1% or 5% level for the basic materials, consumer services and financials industries, but are not statistically significant for the industrials industry. These results confirm the moderating effect of a higher level of ownership concentration, as measured by the Herfindahl index, on the relationships of the percentage of non-executive members of the board of directors who are independent and the gender diversity of the board of directors with the efficiency of value added by a company from its structural capital resources for the basic materials, consumer services and financials industries. The moderating effects of a higher level of ownership concentration, as measured by the largest three shareholdings, on the relationships of the percentage of non-executive members of the board of directors who are independent, the size of the board of directors and the ethnic diversity of the board of directors with the efficiency of value added by a company from its structural capital resources for the basic materials, consumer services and financials industries are also confirmed.

ZHERF*ZBSIZE has a statistically significant β coefficient at the 1% level for the basic materials and consumer services industries and at the 5% level for the industrials industry. The β coefficient of ZHERF*ZBSIZE is not statistically significant for the financials industry. This implies that there is a moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the size of the board of directors and the efficiency of value added by a company from its structural capital resources for the basic materials, consumer services and industrials industries.

For the financial industry, the β coefficients of ZHERF*ZEDUDIV and ZTOP3*ZEDUDIV are statistically significant at the 5% level and the β coefficient of ZTOP3*ZNONEXEC is statistically significant at the 1% level. The β coefficients of ZHERF*ZEDUDIV, ZTOP3*ZEDUDIV and ZTOP3*ZNONEXEC are not statistically significant for the basic materials, consumer services and industrials industries. These results confirm the moderating effect of a higher level of ownership concentration (ZHERF and ZTOP3) on the relationship between the educational-level diversity of the board of directors and the efficiency of value added by a company from its structural capital resources for the financials industry. The moderating effect of a higher level of ownership concentration, as measured by the largest three shareholdings, on the relationship between the percentage of non-executive members of the board of directors and the efficiency of value added by a company from its structural capital resources is also confirmed for the financials industry.

ZHERF*ZEDIV has a statistically significant β coefficient at the 1% level for the basic materials and consumer services industries. The β coefficient of ZHERF*ZEDIV is not statistically significant for the financials and industrials industries. This implies that there is a moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its structural capital resources for the basic materials and consumer services industries. The β coefficient of ZTOP3*ZGDIV is not statistically significant for the consumer services and industrials industries when SCE is the dependent variable. For the basic materials and financials industries, ZTOP3*ZGDIV has a statistically significant β coefficient at the 1% level, confirming the moderating effect of a higher level of ownership concentration (ZHERF) on the relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its structural capital resources.

Hypotheses $H_{9.1e}$ and $H_{9.1e}$ propose that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its structural capital resources are moderated by a higher level of ownership concentration. Hypothesis $H_{9.1e}$ is supported for ZHERF*NONDUAL and ZHERF*ZNONEXEC, while Hypothesis $H_{9.2e}$ is supported for ZTOP3*NONDUAL for the basic materials, financials and industrials industries, but not for the consumer services industry. Hypothesis $H_{9.1e}$ is also supported for ZHERF*ZIND and ZHERF*ZGDIV, while Hypothesis $H_{9.2e}$ is supported for ZTOP3*ZIND, ZTOP3*ZBSIZE and ZTOP3*ZEDIV for the basic materials, consumer services and financials industries, but not for the industrials industry. Additionally, Hypothesis $H_{9.1e}$ is supported for ZHERF*ZBSIZE for the basic materials, consumer services and industrials industry, but not for the financials industry. There is also support for Hypothesis $H_{9.1e}$ regarding ZHERF*ZEDUDIV and Hypothesis $H_{9.2e}$ for ZTOP3*ZNONEXEC and ZTOP3*ZEDUDIV for the financials industry, but not for the basic materials, consumer services and industrials industries. Hypothesis $H_{9.1e}$ is further supported for the basic materials and consumer services industries, but not for the financials and industrials industries, for ZHERF*ZEDIV. Furthermore, Hypothesis

$H_{9.2e}$ is supported for ZTOP3*ZGDIV for the basic materials and financials industries, but not for the consumer services and industrials industries.

The moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its structural capital resources are most prevalent for the basic materials and financials industries and least extensive for the industrials industry. For Model 1j, presented in Section 7.3.5, both HERF and TOP3 have statistically significant relationships with SCE for the basic materials and financials industries. There is also a statistically significant relationship between SCE and both HERF and TOP3 for the industrials industry, but the majority of the moderating effects are associated with the Herfindahl index rather than the largest three shareholdings as a measure of ownership concentration. For the consumer services industry, neither HERF nor TOP3 has a statistically significant relationship with SCE for Model 1j, presented in Section 7.3.5.

8.5 CHAPTER CONCLUSION

This chapter presented the results of the regression analysis for the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources. Ownership concentration was considered as the moderator owing to the potential for a higher level of ownership concentration to reduce or aggravate the agency problem, which impacts on the resources available for the effective management of intellectual capital by the board of directors. Results of the analysis were reported for both the full sample and the top four industries for the period 2002 to 2018. The moderating effects were less frequent per dependent variable for the full sample than within industries. From the industry analysis, it is evident that the moderating effects were least frequent within the industrials industry and most common for the basic materials industry. In addition, because the moderating effect of a higher level of ZHERF and ZTOP3 on the relationship between a specific characteristic of the board of directors and a specific dependent variable differed, the measure used for ownership concentration (the Herfindahl index or the largest three shareholdings) played a role in the moderating effect. Furthermore, the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources appeared to be more prevalent when there was a statistically significant relationship between ownership concentration and the efficiency of value added by a company from its resources.

The final chapter follows with a summary of the main findings and main contributions of this study. It also makes recommendations for further research.

CHAPTER 9
CONCLUSION

9.1 INTRODUCTION

This study acknowledged the various roles of the directors of a company that are performed simultaneously and the underpinning corporate governance theories. These comprise the monitoring and control role (agency theory), the service role (stakeholder theory) and the strategic role (stewardship theory and resource dependence theory). Directors possess characteristics, which can be used in the performance of these roles to create value for a company.

In this study, the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources were investigated initially, for the full sample, and secondly, for the top industries represented on the Johannesburg Stock Exchange for the period 2002 to 2018. Additionally, the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources were studied. A multi-theoretic contingency model was adopted for this purpose with ownership concentration as the moderator (i.e. contingent factor). Ownership concentration was selected as the moderator because it is a corporate governance mechanism with the potential to reduce or aggravate the agency problem, which impacts on the resources available for the effective management of intellectual capital by the board of directors. The multi-theoretic contingency model also acknowledges the multiple roles of the board of directors by applying an integrated approach to agency theory, stewardship theory, resource dependence theory and stakeholder theory.

This chapter presents a summary of the main findings of the study, sets out the limitations of the study, outlines the contributions of the study, describes the practical implications of the study and provides recommendations for further research.

9.2 SUMMARY OF MAIN FINDINGS

The main findings of this study are summarised with reference to each of the nine hypotheses.

9.2.1 Ownership concentration

Hypothesis H_1 posited a relationship between ownership concentration and the efficiency of value added by a company from its resources. For the full sample, this hypothesis was not supported for any of the dependent variables when ownership concentration was measured using the Herfindahl index (HERF). However, when the largest three shareholdings (TOP3) were used to measure ownership concentration, the hypothesis was supported when the dependent variable was the efficiency of value added by a company from its intellectual capital (ICE) or human capital (HCE) resources. The relationship of TOP3 with both ICE and HCE was positive, indicating that a higher level of ownership concentration more closely aligned the interests of a company's management and shareholders in these cases, reducing the agency problem and creating value.

Hypothesis H_1 was supported for the basic materials and financials industries for both HERF and TOP3 for all of the dependent variables. In some cases, the relationship between ownership concentration and the efficiency of value added by a company from its resources was positive, supporting the notion of a reduction of agency problems, and in other cases, this relationship was negative, supporting the idea of the aggravation of agency problems for the basic materials and financials industries. For the consumer services industry, Hypothesis H_1 was supported for both HERF and TOP3 when the dependent variable was ICE or HCE and only for HERF when the dependent variable was the efficiency of value added by a company from its total resources (VAIC). These relationships were all positive, meaning that a higher level of ownership concentration more closely aligned the interests of a company's management and shareholders, reducing agency problems and creating value in these cases. For the industrials industry, Hypothesis H_1 was only supported for HERF when the efficiency of value added by a company from its structural capital resources (SCE) was the dependent variable. The relationship between HERF and SCE was negative, indicating the aggravation of the agency problem and a destruction of value. On the other hand, for the industrials industry, Hypothesis H_1 was supported for the relationships of TOP3 with ICE, HCE and SCE, which were positive and suggested that a higher level of ownership concentration more closely aligned the interests of a company's management and shareholders, reducing agency problems and creating value in these cases.

Based on these results, it is evident that the results of the industry analysis provided more insight than the results of the full sample. The statistically significant relationship between ownership concentration and the efficiency of value added by a company from its resources was most prevalent for the basic materials and financials industries, but less frequent for the consumer services and industrials industry. The measure of ownership concentration (HERF or TOP3) also had an impact on whether the relationship between ownership concentration and the efficiency of value added by a company from its resources was statistically significant for the consumer services and industrials industries. Additionally, the measure used for ownership concentration impacted on whether a higher level of ownership concentration reduced or aggravated the agency problem, particularly for the basic materials, financials and industrials industries.

9.2.2 Absence of chief executive officer (CEO) duality

Hypothesis H_2 proposed a relationship between the absence of chief executive officer (CEO) duality (NONDUAL) and the efficiency of value added by a company from its resources. For the full sample, this hypothesis was not supported. However, the industry analysis provided support for this hypothesis for the basic materials and industrials industries when VAIC or SCE was the dependent variable, for the basic materials, financials and industrials industries when ICE or HCE was the dependent variable, and for the basic materials and financials industries when the efficiency of value added by a company from its physical capital resources (CEE) was the dependent variable. In all except one of these cases, there was a positive relationship between NONDUAL and the efficiency of value added by a company from its resources, meaning that the absence of CEO duality more closely aligned the interests of a company's management and shareholders, reducing agency problems and creating value. For the basic materials industry, the relationship between NONDUAL and CEE was negative, indicating support for stewardship theory because the absence of CEO duality was associated with less efficiency of value added by a company from its resources.

9.2.3 Percentage of members of the board of directors who are non-executive

Hypothesis H_3 proposed a relationship between the percentage of members of the board of directors who were non-executive (NONEXEC) and the efficiency of value added by a company from its resources. This hypothesis was supported for all of the dependent variables for the full sample. Except for when the dependent variable was CEE, the relationship between the percentage of members of the board of directors who were non-executive and the efficiency of value added by a company from its resources was positive. This suggested that a greater extent of non-executive members of the board of directors was associated with more efficiency of value added by a company from its resources, supporting the agency theory perspective that the interests of a company's management and shareholders were more closely aligned in these circumstances.

The industry analysis revealed that Hypothesis H_3 was not supported for the industrials industry for any of the dependent variables. It also showed that this hypothesis was supported for the basic materials and financials industries for all the dependent variables. The relationship between the percentage of members of the board of directors who were non-executive and the efficiency of value added by a company from its resources was negative when VAIC, ICE, HCE or SCE was the dependent variable for the basic materials industry and when CEE was the dependent variable for the financials industry, supporting stewardship theory. In contrast, this relationship was positive when CEE was the dependent variable for the basic materials industry and when VAIC, ICE, HCE or SCE was the dependent variable for the financials industry, supporting agency theory. For the consumer services industry, the relationship between the percentage of members of the board of directors who were non-executive and the efficiency of value added by a company from its resources was not supported when VAIC was the dependent variable, but was supported and negative when CEE was the dependent variable. This negative relationship was in line with stewardship theory. In addition, the positive relationship between the percentage of members of the board of directors who were non-executive and the efficiency of value added by a company from its resources was supported when ICE, HCE or SCE was the dependent variable for the consumer services industry, supporting agency theory. Therefore, the direction of the relationships when the dependent variable was CEE was opposite to the direction for the other dependent variables.

9.2.4 Percentage of non-executive members of the board of directors who are independent

Hypothesis H_4 proposed a relationship between the percentage of non-executive members of the board of directors who were independent (IND) and the efficiency of value added by a company from its resources. For the full sample, this hypothesis was only supported when the dependent variable was the efficiency of value added by a company from its human capital resources and the relationship was positive, suggesting that a greater extent of non-executive members of the board of directors who were independent was associated with better efficiency of value added by a company from its resources, supporting agency theory.

The industry analysis provided additional insight. Hypothesis H_4 was supported for all the top four industries when VAIC or ICE was the dependent variable. It was also supported for the consumer services industry when CEE, HCE or SCE was the dependent variable, for the financials industry when HCE or SCE was the dependent variable and for the industrials industry when HCE was the dependent variable. In each of these cases, the relationship between IND and the dependent variable was positive for the basic materials, and industrials industries, but negative for the consumer services and financials industries. The positive relationships supported agency theory, whereas the negative relationships supported stewardship theory. The industry analysis provided more extensive evidence than the full sample analysis did regarding the relationship between the percentage of non-executive members of the board of directors who were independent and the efficiency of value added by a company from its resources. Therefore, not all companies should be seen as equal for the purposes of constituting a board of directors that functions effectively.

9.2.5 Size of the board of directors

Hypothesis H_5 proposed a relationship between the size of the board of directors (BSIZE) and the efficiency of value added by a company from its resources. This hypothesis was not supported for the full sample. Except for when ICE was the dependent variable, Hypothesis H_5 was supported for the basic materials industry. This relationship was positive and supported stakeholder theory and resource dependence theory when the dependent variable was VAIC, HCE or SCE for the basic materials industry. In contrast, it was negative for the basic materials industry when the dependent variable was CEE, supporting agency theory. For the consumer services industry, Hypothesis H_5 was only supported when VAIC or CEE was the dependent variable. The relationship of the size of the board of directors with VAIC and CEE was positive, supporting stakeholder theory and resource dependence theory for the consumer services industry. In the case of the financials industry, the relationship between the size of the board of directors and the efficiency of value added by a company from its resources was only supported when SCE served as the dependent variable. This relationship was negative indicating that a larger board size was associated with decreased efficiency of value added by a company from its structural capital resources, which supported agency theory. For the industrials industry, Hypothesis H_5 was supported, except when CEE was the dependent variable, and the relationship between board size and the efficiency of value added by a company from its resources was positive, supporting stakeholder theory and resource dependence theory. Although there was no support for the relationship between the size of the board of directors and the efficiency of value added by a company from its resources for the full sample, there were differences between industries and support for this relationship was shown for specific industry and dependent variable combinations.

9.2.6 Educational-level diversity of the board of directors

Hypothesis H_6 proposed a positive relationship between the educational-level diversity of the board of directors (EDUDIV) and the efficiency of value added by a company from its resources. This hypothesis was not supported for any of the dependent variables for the full sample. It was also not supported for any of the dependent variables for the industrials industry. For the basic materials industry, Hypothesis H_6 was supported when the dependent variable was VAIC, ICE or HCE, for the consumer services industry, this hypothesis was supported when the dependent variable was ICE, HCE or SCE, and for the financials industry, this hypothesis was supported when CEE was the dependent variable, in line with agency theory, stakeholder theory and resource dependence theory.

The industry analysis revealed some instances of a statistically significant, but weak negative relationship between educational-level diversity and the efficiency of value added by a company from its resources. No support was provided for this finding based on the theories considered in this study. Therefore, this provides an opportunity for further research.

9.2.7 Ethnic diversity of the board of directors

Hypothesis H_7 proposed a positive relationship between the ethnic diversity of the board of directors (EDIV) and the efficiency of value added by a company from its resources. This hypothesis was not supported for any of the dependent variables for the full sample. It was also not supported when the dependent variable was VAIC, ICE or HCE for the top four industries. When CEE served as the dependent variable, Hypothesis H_7 was supported for the basic materials, consumer services and industrials industries, supporting agency theory, stakeholder theory and resource dependence theory. In addition, when SCE was the dependent variable, this hypothesis was supported for the consumer services and financials industries, supporting the agency theory, stakeholder theory and resource dependence theory perspectives.

In many cases, for the full sample and the top four industries, there was a statistically significant, but weak negative relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its resources. No support was provided for this finding based on the theories considered in this study. Therefore, this provides an opportunity for further research. Additionally, there were situations of a statistically significant, but moderate negative relationship between the ethnic diversity of the board of directors and the efficiency of value added by a company from its resources. The negative relationship may be explained by the higher level of ethnic diversity resulting in conflict that may impede strategic decision-making. Alternatively, this may be justified by a scarcity of directors with appropriate skills and experience and poor enforcement of corporate regulations, despite the existence of broad-based black economic empowerment (BBBEE) regulations, which aim to advance economic transformation and enhance the participation of black individuals, who were previously disadvantaged, in the South African economy (Ntim *et al.*, 2015).

9.2.8 Gender diversity of the board of directors

Hypothesis H_8 proposed a positive relationship between the gender diversity of the board of directors (GDIV) and the efficiency of value added by a company from its resources, supporting the perspectives of agency theory, stakeholder theory and resource dependence theory. This hypothesis was not supported for any of the dependent variables for the full sample. It was also not supported for any of the dependent variables for the basic materials and industrials industries. For the consumer services industry, Hypothesis H_8 was supported when VAIC or CEE was the dependent variable and for the financials industry, this hypothesis was supported for all of the dependent variables.

For the basic materials, consumer services and industrials industries, there were cases of a statistically significant, but weak negative relationship between the gender diversity of the board of directors and the efficiency of value added by a company from its resources. This did not support any of the theories considered in the study, providing an opportunity for further research.

9.2.9 Moderating effect of a higher level of ownership concentration

Hypothesis H_{9}, proposed that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources were moderated by a higher level of ownership concentration. The moderating effects of a higher level of ownership concentration on the relationships between the specific characteristics of the board of directors and specific dependent variables differed depending on whether ownership concentration was measured using the Herfindahl index (HERF) or the largest three shareholdings (TOP3). This suggested that the measure of ownership concentration played an important role in the moderating effect.

The moderating effects were less frequent per dependent variable for the full sample than within industries. From the industry analysis, it was evident that the moderating effects were least frequent within the industrials industry and most common for the basic materials industry. Additionally, the industry analysis showed that the moderating effects of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources were more prevalent when there was a statistically significant relationship between ownership concentration and the efficiency of value added by a company from its resources. Furthermore, for the full sample, the moderating effects of a higher level of ownership concentration were more frequent when HCE was the dependent variable than when VAIC, CEE, ICE or SCE was the dependent variable.

9.3 LIMITATIONS OF THE STUDY

This study had some limitations and the findings should be interpreted within these confines. For example, the sample only included companies listed, or previously listed, on the Johannesburg Stock Exchange (JSE) in South Africa. In addition, only companies that formed part of the top four industries (i.e. basic materials, consumer services, financials and industrials) were considered for the industry analysis. Therefore, care should be taken not to generalise the results beyond the population from which the sample was drawn. A further limitation arises owing to the global financial crisis that occurred during the 2008 to 2010 years, which form part of the study period. The limitation arises because this study did not include a control variable in the regressions to capture the influence of the financial crisis. These limitations may be addressed by further research.

9.4 MAIN CONTRIBUTIONS OF THE STUDY

This study makes a number of key contributions. Firstly, the moderating effect of ownership concentration on the relationships between board characteristics and efficiency of value added by a company from its resources was examined. A multi-theoretic contingency framework was used to examine these relationships The study acknowledged the importance of intellectual capital in creating value for a company and used the efficiency of value added by a company from its resources for this purpose. This is a unique analysis of the relevance of VAIC, which is the primary measure of value added by a company from its resources. The study also provides a comprehensive assessment of the value-relevance of corporate governance in South Africa.

In the current study, a higher level of ownership concentration was treated not only as a corporate governance mechanism to reduce the principal-agent agency problem, but also as a corporate governance mechanism that has the potential to aggravate the principal-agent agency problem. In addition, previous studies investigating the moderating effects of ownership concentration on the relationships between the characteristics of the board of directors and performance measured ownership concentration using only one measure. The current study used both the shareholding of the largest three shareholders and the Herfindahl index for this purpose and showed that different results were obtained depending on the measure used. Therefore, this study contributes by identifying the importance of the measure of ownership concentration used when making decisions regarding the most effective composition of the board of directors.

Another key contribution of this study is that the relationships of ownership concentration and the characteristics of the board of directors with the efficiency of value added by a company from its resources differed according to industry. The moderating effect of a higher level of ownership concentration on the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources also varied by industry. Consequently, companies should not all be treated equally when determining the composition of the board of directors that will function most effectively because the industry in which a company operates plays an important role.

9.5 PRACTICAL IMPLICATIONS

In South Africa, corporate governance guidance has generally been formulated in the light of agency theory, without considering other theoretic perspectives. In addition, the integration of various theoretic views has, to a large extent, been neglected. This study acknowledged the multiple roles of the directors of a company and also that these roles are performed simultaneously, requiring a multi-theoretic approach to corporate governance. As a result, policy setters should adopt an integrated approach, incorporating multiple theoretic perspectives to formulate effective corporate governance regulations.

The study showed that the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources were not the same for all industries. Therefore, corporate governance guidance should not take a one-size-fits-all approach. Consequently, policy setters should carefully consider the different dynamics within industries when drafting corporate governance guidance.

Shareholders are responsible for appointing the board of directors in South Africa. This study identified specific characteristics that may be desirable to establish a board of directors that functions effectively and creates value for the company and its stakeholders. Although the relationships between the characteristics of the board of directors and the efficiency of value added by a company may be important, a better understanding of these relationships may be obtained by considering the role of a higher level of ownership concentration in moderating these relationships.

Ownership concentration may be measured in more than one way. Different measures have different purposes and lead to different results. Therefore, consideration must be given to the problem being solved before making decisions based on a specific ownership concentration measure.

9.6 RECOMMENDATIONS FOR FURTHER RESEARCH

A statistically significant, but weak negative relationship was found between the diversity measures and the efficiency of value added by a company from its resources in some cases. For the full sample, this only applied to the ethnic diversity of the board of directors, whereas it applied to the educational-level diversity, ethnic diversity and gender diversity of the board of directors for the top four industries. This finding did not support any of the underpinning theories considered in this study. Consequently, research could be conducted to further investigate these relationships.

This study found the percentage of members of the board of directors who were independent to be a statistically significant predictor of the efficiency of value added by a company from its human capital resources. However, the study was unable to prove the robustness of this result. Therefore, it is recommended that further research be conducted to confirm the robustness of this result.

The multi-theoretic contingency framework in the current study treated ownership concentration as a corporate governance mechanism that not only has the potential to reduce agency problems and agency costs, but also the prospect of aggravating agency problems and increasing agency costs. This framework was studied in the South African environment for a sample of companies listed on the JSE and for companies forming part of the top four industries on the JSE. Additional research may be conducted using this framework in a different context or for other industries.

This study examined whether a higher level of ownership concentration moderated the relationships between the characteristics of the board of directors and the efficiency of value added by a company from its resources for the top four industries on the JSE. There were indications that the moderating effects were different between industries; however, the dynamics behind these effects were not investigated. This provides an opportunity for further research.

Further research can also be performed to respond to the limitations identified in Section 9.3. For example, consideration may be given to the influence of the global financial crisis on the relationships examined in this study.

Wintoki *et al.* (2012) recognise that endogeneity may be a problem in studies examining the relationships between corporate governance factors and performance. Although consideration was given to this matter in the current study, the available data did not lend itself to research methods that could resolve this issue. Further research may be conducted to explore the potential endogeneity problem.

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APPENDICES

APPENDIX 1: LIST OF COMPANIES INCLUDED IN THE SAMPLE

	Company name	***Ticker symbol***	***Industry***
1	Absa Group Ltd	ABG	Financials
2	Adcorp Holdings Ltd	ADR	Industrials
3	ADvTECH Ltd	ADH	Consumer services
4	AECI Ltd	AFE	Basic materials
5	African & Overseas Enterprises Ltd	AOO	Consumer services
6	African Media Entertainment Ltd	AME	Consumer services
7	African Oxygen Ltd	AFX	Basic materials
8	African Phoenix Investments Ltd	AXL	Financials
9	Allied Electronics Corporation Ltd	AEL	Technology
10	Alviva Holdings Ltd	AVV	Technology
11	Anglo American Platinum Ltd	AMS	Basic materials
12	ArcelorMittal South Africa Ltd	ACL	Basic materials
13	Argent Industrial Ltd	ART	Industrials
14	Aspen Pharmacare Holdings Ltd	APN	Health care
15	Assore Ltd	ASR	Basic materials
16	Astral Foods Ltd	ARL	Consumer goods
17	Aveng Ltd	AEG	Industrials
18	AVI Ltd	AVI	Consumer goods
19	Barloworld Ltd	BAW	Industrials
20	Basil Read Holdings Ltd	BSR	Industrials
21	Bell Equipment Ltd	BEL	Industrials
22	Bowler Metcalf Ltd	BCF	Industrials
23	Brimstone Investment Corporation Ltd	BRT	Financials
24	Buildmax Ltd	BDM	Basic materials
25	Capitec Bank Holdings Ltd	CPI	Financials
26	Cargo Carriers Ltd	CRG	Industrials
27	Cashbuild Ltd	CSB	Consumer services
28	Caxton and CTP Publishers and Printers Ltd	CAT	Consumer services
29	City Lodge Hotels Ltd	CLH	Consumer services
30	Clicks Group Ltd	CLS	Consumer services
31	Cognition Holdings Ltd	CGN	Technology
32	Comair Limited	COM	Consumer services
33	Combined Motor Holdings Ltd	CMH	Consumer services
34	Conduit Capital Ltd	CND	Financials
35	Crookes Brothers Ltd	CKS	Consumer goods
36	Cullinan Holdings Ltd	CUL	Consumer services
37	Datatec Ltd	DTC	Technology

	Company name	Ticker symbol	Industry
38	Delta EMD Ltd	DTA	Basic materials
39	Discovery Ltd	DSY	Financials
40	Distribution And Warehousing Network Ltd	DAW	Industrials
41	ELB Group Ltd	ELR	Industrials
42	eMedia Holdings Ltd	EMH	Consumer services
43	Exxaro Resources Ltd	EXX	Basic materials
44	Famous Brands Ltd	FBR	Consumer services
45	Firstrand Ltd	FSR	Financials
46	Grindrod Ltd	GND	Industrials
47	Group Five Ltd	GRF	Industrials
48	Hosken Consolidated Investments Ltd	HCI	Financials
49	Howden Africa Holdings Ltd	HWN	Industrials
50	Hudaco Industries Ltd	HDC	Industrials
51	Impala Platinum Holdings Ltd	IMP	Basic materials
52	Imperial Logistics Ltd	IPL	Industrials
53	Indequity Group Ltd	IDQ	Financials
54	Investec Ltd	INL	Financials
55	Invicta Holdings Ltd	IVT	Industrials
56	Italtile Ltd	ITE	Consumer services
57	Jasco Electronics Holdings Ltd	JSC	Technology
58	KAP Industrial Holdings Ltd	KAP	Industrials
59	Liberty Holdings Ltd	LBH	Financials
60	Massmart Holdings Ltd	MSM	Consumer services
61	Merafe Resources Ltd	MRF	Basic materials
62	Metair Investments Ltd	MTA	Consumer goods
63	Metrofile Holdings Ltd	MFL	Industrials
64	Momentum Metropolitan Holdings Ltd	MTM	Financials
65	Mr Price Group Ltd	MRP	Consumer services
66	MTN Group Ltd	MTN	Telecommunications
67	Murray & Roberts Holdings Ltd	MUR	Industrials
68	Mustek Ltd	MST	Technology
69	Nampak Ltd	NPK	Industrials
70	Nedbank Group Ltd	NED	Financials
71	Netcare Ltd	NTC	Health care
72	Nictus Ltd	NCS	Consumer services
73	Northam Platinum Ltd	NHM	Basic materials
74	Nu-World Holdings Ltd	NWL	Consumer goods
75	Oceana Group Ltd	OCE	Consumer goods
76	Octodec Investments Ltd	OCT	Financials
77	Omnia Holdings Ltd	OMN	Basic materials

	Company name	Ticker symbol	Industry
78	OneLogix Group Ltd	OLG	Industrials
79	Peregrine Holdings Ltd	PGR	Financials
80	Phumelela Gaming and Leisure Ltd	PHM	Consumer services
81	Pick n Pay Stores Ltd	PIK	Consumer services
82	PPC Ltd	PPC	Industrials
83	Primeserv Group Ltd	PMV	Industrials
84	PSG Group Ltd	PSG	Financials
85	Purple Group Ltd	PPE	Financials
86	RCL Foods Limited	RCL	Consumer goods
87	Remgro Ltd	REM	Industrials
88	Reunert Ltd	RLO	Industrials
89	Rex Trueform Group Ltd	RTO	Consumer services
90	RMB Holdings Ltd	RMH	Financials
91	Sanlam Ltd	SLM	Financials
92	Santam Ltd	SNT	Financials
93	Sappi Ltd	SAP	Basic materials
94	Sasol Ltd	SOL	Basic materials
95	Shoprite Holdings Ltd	SHP	Consumer services
96	Sovereign Food Investments Ltd	SOV	Consumer goods
97	Spanjaard Ltd	SPA	Basic materials
98	Spur Corporation Ltd	SUR	Consumer services
99	Standard Bank Group Ltd	SBK	Financials
100	Stellar Capital Partners Ltd	SCP	Financials
101	Sun International Ltd	SUI	Consumer services
102	Super Group Ltd	SPG	Industrials
103	The Bidvest Group Ltd	BVT	Industrials
104	The Foschini Group Ltd	TFG	Consumer services
105	Tiger Brands Ltd	TBS	Consumer goods
106	Tongaat Hulett Ltd	TON	Consumer goods
107	Tradehold Ltd	TDH	Financials
108	Trans Hex Group Ltd	TSX	Basic materials
109	Transpaco Ltd	TPC	Industrials
110	Trencor Ltd	TRE	Industrials
111	Truworths International Ltd	TRU	Consumer services
112	Tsogo Sun Gaming Ltd	TSG	Consumer services
113	Unicorn Capital Partners Ltd	UCP	Basic materials
114	Value Group Ltd	VLE	Industrials
115	Wilson Bayly Holmes - Ovcon Ltd	WBO	Industrials
116	Woolworths Holdings Ltd	WHL	Consumer services
117	York Timber Holdings Ltd	YRK	Basic materials

APPENDIX 2: BACKWARD ELIMINATION OF INDEPENDENT VARIABLES WITH VAIC AS THE DEPENDENT VARIABLE FOR THE FULL SAMPLE

Variables	Probabilities for t-statistic					Correlations		
	Step 1	***Step 2***	***Step 3***	***Step 4***	***Step 5***	***Zero-order***	***Partial***	***Part***
Intercept	0.000***	0.000***	0.000***	0.000***	0.000***			
HERF	0.208	0.201	0.192	0.147	0.148	-0.097	-0.050	-0.041
TOP3	0.200	0.195	0.197	0.184	0.175	-0.115	0.008	0.006
NONDUAL	0.796					-0.001	-0.019	-0.016
NONEXEC	0.096*	0.092*	0.093*	0.084*	0.111	0.018	0.092	0.075
IND	0.649	0.634				-0.011	-0.018	-0.015
BSIZE	0.168	0.171	0.179	0.179	0.254	0.049	0.100	0.081
EDUDIV	0.159	0.169	0.179	0.208		-0.009	-0.009	-0.007
EDIV	0.000***	0.000***	0.000***	0.000***	0.000***	-0.064	-0.157	-0.129
GDIV	0.398	0.422	0.394			0.027	0.059	0.048
ROA	0.000***	0.000***	0.000***	0.000***	0.000***	0.558	0.565	0.557
Adjusted R^2	0.477032	0.477791	0.477810	0.478186	0.477535			

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

The table displays the probabilities for the t-statistics and adjusted R^2 for each step of the backward elimination of the independent variables, with VAIC as the dependent variable for the full sample. The correlation coefficients of the zero-order, partial and part correlations are also shown. *VAIC* measures the extent of value creation for each monetary unit invested in resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's indices for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

APPENDIX 3: ZERO-ORDER, PARTIAL AND PART CORRELATIONS WITH CEE, ICE, HCE and SCE AS THE DEPENDENT VARIABLES FOR THE FULL SAMPLE

Variables	CEE			ICE			HCE			SCE		
	Zero-order	***Partial***	***Part***	***Zero-order***	***Partial***	***Part***	***Zero-order***	***Partial***	***Part***	***Zero-order***	***Partial***	***Part***
HERF	-0.129	-0.089	-0.081	-0.055	-0.016	-0.013	-0.050	-0.020	-0.017	-0.025	0.009	0.008
TOP3	-0.126	-0.025	-0.022	-0.074	0.028	0.023	-0.070	0.035	0.029	-0.053	-0.002	-0.002
NONDUAL	-0.076	-0.093	-0.085	0.048	0.039	0.033	0.050	0.051	0.042	0.049	0.028	0.025
NONEXEC	-0.107	-0.141	-0.130	0.064	0.144	0.122	0.038	0.128	0.107	0.126	0.180	0.169
IND	0.009	-0.044	-0.040	-0.005	0.002	0.002	-0.015	-0.007	-0.005	-0.057	-0.046	-0.043
BSIZE	-0.003	-0.022	-0.020	0.058	0.099	0.084	0.026	0.073	0.060	0.080	0.100	0.093
EDUDIV	0.008	-0.009	-0.008	0.020	0.031	0.026	0.005	0.041	0.034	0.010	-0.011	-0.010
EDIV	0.102	0.141	0.129	-0.085	-0.197	-0.169	-0.107	-0.207	-0.175	-0.050	-0.124	-0.115
GDIV	0.078	0.039	0.035	-0.009	0.017	0.014	-0.022	0.017	0.014	-0.036	-0.033	-0.030
ROA	0.345	0.328	0.316	0.499	0.518	0.509	0.523	0.541	0.532	0.314	0.335	0.328

The table displays the zero-order, partial and part correlation coefficients, with CEE, ICE, HCE and SCE as the dependent variables, for the full sample.

CEE, *ICE*, *HCE* and *SCE* measure the extent of value creation for each monetary unit of resources invested in physical, intellectual, human and structural capital, respectively. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

APPENDIX 4: ZERO-ORDER, PARTIAL AND PART CORRELATIONS WITH VAIC AS THE DEPENDENT VARIABLE FOR THE TOP FOUR INDUSTRIES

Variables	Basic materials			Consumer services			Financials			Industrials		
	Zero-order	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*
HERF	-0.009	-0.034	-0.021	-0.132	0.140	0.089	-0.159	-0.141	-0.117	-0.062	0.084	0.056
TOP3	-0.018	0.082	0.051	-0.148	0.010	0.006	-0.165	-0.083	-0.068	-0.145	0.018	0.012
NONDUAL	0.077	0.089	0.055	0.004	-0.039	-0.024	-0.009	0.004	0.003	-0.028	0.138	0.092
NONEXEC	-0.088	-0.064	-0.040	0.245	0.068	0.043	-0.060	0.109	0.089	0.000	0.064	0.043
IND	-0.003	0.101	0.063	-0.097	-0.106	-0.066	0.036	-0.108	-0.089	-0.013	0.167	0.112
BSIZE	0.126	0.056	0.034	0.215	0.211	0.135	-0.122	0.002	0.002	0.001	0.116	0.077
EDUDIV	0.107	0.010	0.006	-0.010	-0.073	-0.046	-0.109	-0.025	-0.020	-0.122	-0.025	-0.017
EDIV	-0.198	-0.045	-0.028	0.171	-0.028	-0.018	-0.240	-0.343	-0.299	-0.214	-0.310	-0.216
GDIV	-0.089	-0.138	-0.086	0.091	0.159	0.101	0.130	0.310	0.267	-0.156	0.042	0.028
DY	0.279	-0.027	-0.017	-0.318	-0.163	-0.103	-0.076	-0.028	-0.023	0.184	0.058	0.038
ROA	0.763	0.724	0.650	0.679	0.705	0.620	0.370	0.372	0.328	0.428	0.578	0.470
LEV	-0.077	0.117	0.073	0.072	0.335	0.222	-0.020	0.055	0.045	0.499	0.629	0.536

The table displays the zero-order, partial and part correlation coefficients, with VAIC as the dependent variable, for the top four industries.

VAIC measures the extent of value creation for each monetary unit invested in resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

APPENDIX 5: ZERO-ORDER, PARTIAL AND PART CORRELATIONS WITH CEE AS THE DEPENDENT VARIABLE FOR THE TOP FOUR INDUSTRIES

Variables	Basic materials			Consumer services			Financials			Industrials		
	Zero-order	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*
HERF	-0.092	0.042	0.026	-0.138	-0.071	-0.049	-0.147	-0.106	-0.088	-0.049	0.092	0.071
TOP3	-0.147	-0.121	-0.075	-0.044	-0.043	-0.030	-0.073	0.073	0.061	-0.134	-0.092	-0.071
NONDUAL	-0.119	-0.160	-0.100	0.001	-0.050	-0.035	-0.004	0.027	0.022	-0.111	-0.090	-0.069
NONEXEC	-0.124	0.005	0.003	0.111	-0.088	-0.061	-0.149	-0.302	-0.263	0.123	-0.024	-0.018
IND	-0.088	0.012	0.007	0.047	-0.142	-0.100	0.126	0.005	0.004	-0.032	-0.043	-0.033
BSIZE	0.041	-0.071	-0.044	0.302	0.204	0.145	0.164	-0.013	-0.011	0.004	-0.023	-0.018
EDUDIV	0.153	-0.018	-0.011	0.022	-0.072	-0.051	0.103	0.063	0.052	0.022	-0.007	-0.005
EDIV	-0.258	0.015	0.009	0.202	0.122	0.086	0.041	-0.027	-0.022	0.215	0.236	0.186
GDIV	-0.274	-0.192	-0.120	0.272	0.272	0.197	0.152	0.074	0.061	0.111	0.041	0.031
DY	0.075	-0.013	-0.008	-0.195	-0.071	-0.050	-0.051	-0.055	-0.045	-0.028	-0.070	-0.053
ROA	0.389	0.612	0.475	0.045	0.201	0.142	0.332	0.365	0.325	0.242	0.347	0.283
LEV	0.532	0.670	0.554	0.577	0.609	0.534	0.306	0.348	0.307	0.498	0.543	0.494

The table displays the zero-order, partial and part correlation coefficients, with CEE as the dependent variable, for the top four industries.

CEE measures the extent of value creation for each monetary unit of resources invested in physical capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

APPENDIX 6: ZERO-ORDER, PARTIAL AND PART CORRELATIONS WITH ICE AS THE DEPENDENT VARIABLE FOR THE TOP FOUR INDUSTRIES

Variables	Basic materials			Consumer services			Financials			Industrials		
	Zero-order	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*
HERF	0.028	-0.060	-0.038	-0.131	0.093	0.061	-0.134	-0.104	-0.086	-0.009	-0.022	-0.017
TOP3	0.043	0.158	0.101	-0.188	0.026	0.017	-0.179	-0.129	-0.107	-0.061	0.101	0.078
NONDUAL	0.146	0.186	0.119	0.011	-0.007	-0.004	0.059	0.067	0.055	0.002	0.103	0.080
NONEXEC	-0.062	-0.081	-0.051	0.224	0.135	0.089	-0.018	0.175	0.145	-0.124	0.020	0.016
IND	-0.008	0.040	0.025	-0.149	-0.076	-0.049	0.035	-0.111	-0.092	-0.003	0.144	0.112
BSIZE	0.105	0.022	0.014	0.023	-0.018	-0.012	-0.143	0.022	0.018	0.028	0.135	0.105
EDUDIV	0.067	0.045	0.028	0.027	0.043	0.028	-0.137	-0.053	-0.043	-0.126	-0.001	-0.001
EDIV	-0.132	-0.036	-0.023	0.075	-0.062	-0.041	-0.260	-0.367	-0.323	-0.295	-0.317	-0.256
GDIV	0.008	-0.027	-0.017	-0.111	-0.086	-0.056	0.101	0.311	0.268	-0.236	-0.038	-0.029
DY	0.315	0.011	0.007	-0.225	-0.112	-0.073	-0.068	-0.023	-0.019	0.222	0.078	0.060
ROA	0.753	0.686	0.593	0.723	0.650	0.557	0.348	0.334	0.290	0.505	0.548	0.502
LEV	-0.272	-0.134	-0.085	-0.346	-0.195	-0.129	-0.063	0.000	0.000	0.098	0.209	0.164

The table displays the zero-order, partial and part correlation coefficients, with ICE as the dependent variable, for the top four industries.

ICE measures the extent of value creation for each monetary unit of resources invested in intellectual capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

APPENDIX 7: ZERO-ORDER, PARTIAL AND PART CORRELATIONS WITH HCE AS THE DEPENDENT VARIABLE FOR THE TOP FOUR INDUSTRIES

Variables	Basic materials			Consumer services			Financials			Industrials		
	Zero-order	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*
HERF	0.030	-0.089	-0.053	-0.110	0.107	0.072	-0.140	-0.129	-0.103	-0.011	-0.004	-0.003
TOP3	0.060	0.204	0.124	-0.174	0.027	0.018	-0.181	-0.116	-0.093	-0.068	0.083	0.065
NONDUAL	0.179	0.263	0.161	-0.003	-0.021	-0.014	0.060	0.093	0.074	0.009	0.112	0.088
NONEXEC	-0.070	-0.145	-0.087	0.211	0.141	0.094	-0.064	0.145	0.116	-0.117	0.025	0.020
IND	-0.021	0.006	0.004	-0.156	-0.072	-0.048	0.023	-0.129	-0.103	0.013	0.163	0.130
BSIZE	0.125	0.051	0.030	0.003	-0.026	-0.017	-0.185	-0.001	0.000	0.028	0.131	0.103
EDUDIV	0.088	0.070	0.042	0.015	0.044	0.029	-0.163	-0.019	-0.015	-0.117	0.009	0.007
EDIV	-0.122	-0.026	-0.015	0.053	-0.082	-0.054	-0.319	-0.402	-0.348	-0.304	-0.331	-0.274
GDIV	0.010	-0.014	-0.008	-0.114	-0.083	-0.055	0.059	0.299	0.248	-0.234	-0.026	-0.021
DY	0.327	0.038	0.023	-0.210	-0.102	-0.068	-0.072	-0.009	-0.007	0.221	0.081	0.064
ROA	0.771	0.709	0.596	0.710	0.641	0.552	0.363	0.374	0.319	0.466	0.511	0.466
LEV	-0.270	-0.132	-0.079	-0.345	-0.193	-0.130	-0.076	0.017	0.014	0.112	0.220	0.177

The table displays the zero-order, partial and part correlation coefficients, with HCE as the dependent variable, for the top four industries.

HCE measures the extent of value creation for each monetary unit of resources invested in human capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.

APPENDIX 8: ZERO-ORDER, PARTIAL AND PART CORRELATIONS WITH SCE AS THE DEPENDENT VARIABLE FOR THE TOP FOUR INDUSTRIES

Variables	Basic materials			Consumer services			Financials			Industrials		
	Zero-order	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*	*Zero-order*	*Partial*	*Part*
HERF	0.004	-0.034	-0.028	-0.208	0.010	0.006	0.028	0.030	0.029	-0.006	-0.098	-0.071
TOP3	0.006	0.062	0.051	-0.222	0.035	0.023	-0.005	-0.062	-0.061	-0.031	0.166	0.121
NONDUAL	0.086	0.085	0.069	0.067	0.048	0.032	0.008	-0.026	-0.025	-0.022	0.060	0.043
NONEXEC	-0.035	-0.025	-0.020	0.270	0.140	0.093	0.139	0.163	0.162	-0.141	-0.001	-0.001
IND	-0.023	0.010	0.008	-0.121	-0.083	-0.055	-0.055	-0.040	-0.039	-0.064	0.049	0.035
BSIZE	0.098	0.057	0.047	0.096	0.022	0.014	0.004	0.001	0.001	0.027	0.142	0.103
EDUDIV	0.042	0.010	0.008	0.075	0.038	0.025	-0.024	-0.094	-0.092	-0.152	-0.041	-0.030
EDIV	-0.145	-0.067	-0.054	0.140	0.008	0.005	0.059	0.044	0.043	-0.245	-0.231	-0.170
GDIV	-0.020	-0.033	-0.027	-0.102	-0.124	-0.083	0.023	0.033	0.032	-0.231	-0.081	-0.058
DY	0.292	0.072	0.059	-0.233	-0.063	-0.042	-0.042	-0.069	-0.067	0.211	0.058	0.042
ROA	0.563	0.454	0.415	0.720	0.634	0.541	-0.041	-0.056	-0.055	0.618	0.644	0.605
LEV	-0.175	-0.057	-0.047	-0.317	-0.150	-0.100	-0.005	-0.022	-0.021	0.035	0.144	0.105

The table displays the zero-order, partial and part correlation coefficients, with SCE as the dependent variable, for the top four industries.

SCE measures the extent of value creation for each monetary unit of resources invested in structural capital resources. *HERF* is the Herfindahl index for ownership concentration. *TOP3* is the percentage shareholding held by the largest three shareholders. *NONDUAL* is a dummy variable with a value of 1 if the CEO is not the chairperson of the board of directors and a value of 0 otherwise. *NONEXEC* is the percentage of board members who are non-executive. *IND* is the percentage of non-executive directors who are independent. *BSIZE* is the number of board members. *EDUDIV* is Teachman's index for educational-level diversity. *EDIV* and *GDIV* are Blau's index for ethnic and gender diversity, respectively. *ROA* is the ratio of operating profit to total assets at year-end.