


Board diversity and value creation for business sustainability



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ABSTRACT

Article History

Received: 25 September 2023

Revised: 22 November 2023

Accepted: 5 February 2024

Published: 29 February 2024

Keywords

Agency theory
Board diversity
Business sustainability
R&D investment
Resource-based-view theory
Value creation.

The primary objective of a firm is not the creation of profit; it is the creation of value for shareholders. Corporations need to be innovative to create value, and this entails the need for corporations to embark on research and development (R&D) endeavors. This study's objective is to determine the impact of Malaysian publicly listed companies' board diversity (qualification, gender, and age) on the intensity of companies' R&D investment. In conjunction with the 2017 Malaysian Code on Corporate Governance's, which took on a new approach that promotes board diversity in corporate governance culture, samples were selected from the Minority Shareholders Watch Group 's Malaysia: List of Top 100 Companies Overall CG & Performance (By Rank) from 2017-2019, which portrayed good corporate governance practices. The agency theory and the resource-based view were integrated to explain the effects of board diversity on R&D investment. Tests and analysis were conducted, and the results indicated that only age diversity had a positive influence on R&D investment. Practitioners could use the findings of this study to choose the ideal board composition for a company looking to gain a competitive edge. Regulators could also use this study to develop good corporate governance procedures for Malaysian publicly traded companies. The findings of this study may not truly portray the overall industries listed in Bursa Malaysia, as the samples used were limited and the data of certain companies was unavailable.

Contribution/ Originality: Two underpinning theories were used in this study, namely the agency theory and the resource-based view. From an Agency theory perspective, there were negative relationships between the board's qualifications, gender diversity, and R&D investment. A resource-based view highlighted that board members are the main ingredient that could steer a firm's performance.

1. INTRODUCTION

Value to corporations can be defined in a variety of ways, including incremental enhancements to existing goods and services, the formation of completely new products and services, and cost reductions. It is also noted that value is future oriented. According to Li and Peng [1] value creation for a firm principally involves the delivery of products and services that impart benefits to customers and stakeholders, making it a very important aspect in the achievement of the firm's long-term strategic success. Firms are required to create value as it provides financial well-being and competitive advantages [2]. Logically, the value creation process demands strong revenue generation, which can be fulfilled through the value sustainability capability of the firms [3].

In an ever-changing business landscape, firms need to be innovative to create value, and this entails the need for the firms to distinguish their products and services from their competitors. This differentiation strategy aims at making products and services unique and completely fulfilling the needs of the customers, thus negating their need to consider other alternatives [4]. The ability to innovate will result in corporations producing products and services that can be distinguished and differentiated from their rivals' products and services. Dirisu, et al. [4] claimed that the identification of significant product-driven differentiators can be very beneficial in a corporation's pursuit of business competitive advantage. This study hopes to contribute to the flourishing number of studies that explore the view of corporate governance under certain circumstances in relation to value creation and R&D investments. Findings from the study could provide insights to shareholders as to the options and structure of board members that could be appointed for corporations that are in innovation-intensive industries.

1.1. Research Motivation

In the quest for success in a fast-changing environment where innovation and continuous evolution threaten the status quo, corporations need to engage themselves in value creation and value protection activities. In this light, R&D enhances a corporation's ability to innovate. Corporations' ability to innovate as well as find and exploit new business opportunities is becoming increasingly important to their competitiveness and growth [5]. An innovative corporation will differentiate itself from its competitors through its products and services by utilizing its strategic capabilities, which will eventually be beneficial in its pursuit of competitive advantage and business sustainability.

The corporation's investment in R&D can be considered a good proxy for value creation. R&D has been the primary source of value creation due to the existing business landscape, in which corporations face competition from their rivals. A lot of companies are investing in and allocating more resources to R&D to create value and improve their performance. Corporations also focus on R&D as one of the ways to improve their competitiveness in the market [6].

This challenge of creating values for competitive advantage for corporations is producing a sea of change in corporate governance [7]. Embracing value creation through innovation and having the right fit of board members are important in ensuring a corporation's success [8]. The continuous arguments on the composition of the board suggest how important a board composition is to a corporation [9]. The strive for the corporation's continuity could be achieved with the alignment of the board's views and decisions by means of investing in R&D [10].

As corporations seek competitive advantage at all levels, they are progressively focusing on the top, examining the composition and characteristics of the board members as a possible origin of differentiation and success. The BOD is considered the brain of a corporation and makes all its strategic decisions. Thus, it is vital that a board consist of members that possess the necessary competencies, qualifications, and experience to ensure the well-being of a corporation [11]. Seen as the guardian of stakeholders' value, the board members need to possess the right kind of characteristics to enable a corporation's transformation. Diversity is considered one of the pivotal characteristics a board should possess. The knowledge provided by a corporation's diverse board could provide fresh insights, which could reduce uncertainty relating to strategic decisions by identifying innovation opportunities [12]. A lot of existing studies have suggested that it pays for corporations to have a diverse board [13].

2. LITERATURE REVIEW

2.1. Value Creation (Research and Development Investment)

A corporation's value creation endeavor through innovation processes can be regarded as a significant measurement of corporate success [14]. Generally, R&D comprises activities and processes that create value for a corporation in its pursuit of competitive advantage [15]. R&D investment is the amount of resources invested by a

corporation towards innovating and introducing new products and services into the market. R&D also allows for the reduction of production costs through the transformation of input into output in a more effective and efficient manner [16]. The fast-changing business environment and increasing business rivalries have necessitated corporations exploring ways through R&D to improve their competitive advantage Ojok and Okema [6].

Guldiken and Darendeli [17] claimed that corporations may allocate substantial R&D investment when they expect uncertainties from the external environment, and these corporations would indulge in research to mitigate such risks. R&D investments provide opportunities for the emergence of superior output. This value-creation process allows corporations to gain a sustainable competitive advantage in the future. This also suggested that the constant monitoring of the board is apparent in deciding the extent of resource allocation in R&D activities.

2.2. Board Qualification Diversity

The diversity of qualifications represents the different knowledge capacities of board members. This diversity could influence the generation of inventive problem-solving techniques to resolve complex corporation issues. Diversity of educational qualifications would also increase and improve the extent of input that increases the formulation of the strategic objectives of a corporation [19]. Meanwhile, a classical study by Fligstein [20] suggested that, owing to the fact that corporations faced many technical, marketing, and legal issues, it is possible that diversity of qualifications could provide solutions to such issues.

2.3. Board Gender Diversity

Every society has its norms and values, but one similar thing that could be found in almost all societies is the notion that men are superior to women. This notion led to the famously coined phrase “man-made world”. These social norms and perceptions could determine social interaction in a gender-diverse structure [21]. Gender diversity in the top management of corporations has become an increasingly debated issue globally. It is noted that the involvement of women in top management globally is very small. This may be due to the belief that women are emotional and less rational when it comes to decision-making [22]. This may primarily cause the reluctance of companies to appoint women to top managerial positions, resulting in a very small number at the upper echelon in emerging economies.

There are arguments that claim that if there were more women on board, the economic crises experienced would have been less serious. Marinova, et al. [23] argued that this might be since women are seen to be more risk-averse than men. They further claimed that a gender-diverse board would bring the global economy back on track. Closer to home, the Malaysian Securities Commission’s Malaysian Code on Corporate Governance released in 2017 requires that large corporations be presented with at least 30% women in their composition [24]. However, the push for equality has since moved to a question of performance as more corporations with women on board are showing greater financial success. Furthermore, Malaysia’s population in 2020 was estimated at 32.7 million, with a growth rate of 0.4 percent, comprising 15.9 million females [24]. This further strengthens the need for having females on board who would be able to give some insights that relate to their gender’s needs and wants.

2.4. Board-Age Diversity

An often-overlooked element of a board is age diversity. Age diversity could be a double-edged sword, bringing advantages to one corporation and disadvantages to another. As time goes by, there are increasing moves towards finding suitable candidates to fill up the seats in the upper echelons of a corporation. It is about striking the right balance that could steer the corporation to better performance, so it is crucial to ensure that the selection pool is diverse Galia and Zenou [25].

Horváth and Spirollari [26] suggested that younger board members are more receptive to risk and are more willing to undertake major changes with the intention of improving the corporation’s performance as compared to

the older board members, who are generally more risk-averse. This could also be associated with the fact that the younger generation has a longer horizon compared to the older board members [27]. It is also argued that with age comes experience. An age-diverse board displays a multitude of values, preferences, and experiences, which could indirectly encourage the employees to freely express differing opinions and approaches to solving issues and problems for the betterment of the corporation [28].

It could also be said that the younger generation is more aware of the current surroundings of the market compared to the older members, thus making their decisions more relevant to the current needs and expectations of the market. However, it could also be expected that dissimilar age groups would produce a broader pool of different information, perspectives, and experiences. Consequently, this will mean that a corporation will have a larger pool of knowledge that could allow it to be more innovative and productive in its operations' processes [29].

2.5. The Agency Theory

Agency theory is a principle that explains the relationship and issues between business principals and their agents [30, 31]. The principal- agent relationship exists when one party has to depend on the other party's actions [32]. According to the gurus of the Agency Theory, Jensen and Meckling [33] the board is permitted to act in the place of and make decisions for and on behalf of the shareholders (principals) and is obligated to comply with the terms of the agency and the rules applying to them. Information asymmetry, which is also known as information failure, could give rise to the principal-agent issue. The agents who are tasked with looking after the corporation possess greater material knowledge related to the business. The principals, however, must depend on the agents for the information. There is a possibility that the information needed might not reach the owners in the same manner [34]. This agency issue mandates a series of checks and balances to be conducted to achieve a congruent goal between the principal and the agent [35].

Corporate governance entails the establishment of a relationship between the principal (shareholders) and the agents (directors) of a corporation, as suggested by the agency theory. A credible and well-functioning corporate governance system is a precondition element for a corporation that aims to create value for its stakeholders in general [36]. It typically starts with funds and resources provided by the principals. The agents then manage and transform these limited resources into valuable outputs. But the agency theory also says that in order for this goal to be reached, a certain set of rules and laws must be put in place to make sure that any agency costs that come up because of the principal-agent relationship are kept to a minimum. This ensures that the interests of the parties related to the relationship will be safeguarded. This would mean that the principals will be rewarded for the contributions that they have provided, and the agents will be compensated for the effective management of resources allocated to them [37].

2.6. The Resource Based View

A resource-based view (RBV) is a model that regards resources as the key ingredient that steers firm performance [38]. RBV is a strategy paradigm used to identify the strategic resources of a corporation towards achieving sustainable competitive advantage [39]. Proponents of RBV claim that it is more practical to exploit the external factors through the exploitation of the internal factors.

In RBV, emphasis is given on the resources possessed by the corporation in its pursuit of performance. However, it is noted that RBV has two vital assumptions: resources must be heterogeneous and immobile [38]. Heterogeneous in RBV assumes that the resources in corporations differ from one another. These resources can be in the form of tangible assets or intangible assets [40]. RBV's key consideration is that the resources are not of the same significance. These resources also do not have the same ability to offer a competitive advantage to the corporation. Based on the RBV theory, corporations would choose the strategy that would best use the resources and capabilities that they already possess in relation to external opportunities. In order to ensure the longevity of

their competitive advantage, corporations must also ensure that their resources and capabilities are valuable, rare, inimitable, and non-substitutable [41]. RBV uses the 'inside-out' perspective in relation to a corporation's resources in making strategic decisions. The board of directors of a corporation seeks to fully utilize the corporation's resources to build or enhance its competitive advantage. These tangible and intangible resources are the main source of assets that are going to be employed by the competent board members in ensuring the corporation's sustained competitive advantage and sustainability [42].

2.7. Hypothesis Development Board Qualification Diversity

The board, which is regarded as the brain of a corporation, typically governs and sets the strategic direction of the corporation. The board plays the key role of leadership in the value creation process by realizing its importance and encouraging innovation and creativity in its business strategy through R&D activities. A lot of researchers argue that R&D investment is a vital component in determining the competitiveness of a corporation. This competitiveness characteristic can be honed through the endeavor of the board of members that possess knowledge and experience. In classical research conducted by John [43] he found that corporation's tendency to invest in R&D activities increased when the board's qualifications were diverse. Chen [44] also supported this by noting that R&D investment is positively associated with the board's diversity of qualifications in his study. This was further strengthened by a more recent study conducted by Olajide and Eunice [45] which showed a significant relationship between board educational diversity and corporations' R&D investment. A lot of studies have claimed that innovation is very important in a corporation's pursuit of competitive advantage. The innovativeness of a corporation can be sharpened by the efforts of board members with knowledge and expertise. There is no guarantee of the result of an R&D effort. An often-complex R&D process and the unpredictability of the business environment add to the complexity of an innovation endeavor. Therefore, it is believed to increase the possibility of a positive outcome, which requires a thorough understanding of the issues and problems at hand. More diversely qualified board members would suggest a better pool of ideas and insights that could result in better decision-making processes. Thus, based on the above arguments, the hypothesis relating to board gender diversity and R&D was developed.

H₁: There is a significant relationship between board qualification diversity and corporations' R&D investment.

2.8. Board Gender Diversity

Gender diversity is an increasingly recognized practice of good governance as it can provide a broader range of perspectives, encourage information gathering, improve the quality of discussions of ideas, and articulate more strategic decisions [46]. The push for governance reforms relating to gender equality has also increased the belief that diversifying the board of directors by including more women will help businesses gain credibility as gender equality becomes more generally recognized as a social norm [47]. In a study conducted by Böhren and Ström [48] they found that there was no significant relationship between board gender diversity and corporations' R&D investment. This was also supported by a study conducted by Vafaei, et al. [49] which reported that they could not conclude that a gender-diverse board could cause corporations to behave more innovatively. In a more recent study by Almor, et al. [50] they found that the presence of women on corporations' boards has a significant negative influence on R&D investments. However, Attah-Boakye, et al. [51] discovered that a gender diverse board member has a significant positive influence on a corporation's innovation and R&D intensity. This discovery was also supported by a study conducted by Gonzales-Bustos, et al. [52] which noted the positive impact gender diversity had on corporations' innovation investment. Due to the above arguments, the hypothesis relating to board gender diversity and R&D investment was developed.

H₂: There is a significant relationship between board gender diversity and a corporation's R&D investment.

2.9. Board-Age Diversity

In relation to Industry Revolution 4.0 and the fast technological advancement that is affecting the business environment, there are concerns that the board is not representative of the customers that they are serving (with regards to the current fads and trends). These concerns have sparked the need to recruit younger board members, including Millennials, putting aside experience in exchange for potential. This could result in the board making judgment calls that are more current and relevant to the current surroundings that the corporations are operating in. People have often expected clashes of opinions between the younger and older board members due to the different perspectives, ideas, and opinions that both offer in relation to relevancy, currency, and the risks faced from decisions made. These clashes could spark more meaningful debates and rigorous discourse. These conflicts could act as a double-edged sword that could initiate and improve the quality of decisions on one side and weaken the ability for them to work together on the other [53]. According to Galia and Zenou [25] board age diversity has been linked to a corporation’s likelihood of implementing product innovation. However, Ojok and Okema [6] discovered in their studies that the R&D investment could not be explained by the board’s age diversity. However, Sharma [54] reported that board age diversity has a significant negative influence on a corporation’s innovation intensity. Thus, the following research objective was developed:

H₁: There is a significant relationship between board age diversity and corporations’ R&D investment.

3. THEORETICAL FRAMEWORK

This study aims to investigate the primary factors that influence R&D investment in publicly listed corporations in Malaysia. Three independent variables were used in this study, which were board qualification diversity, board gender diversity, and board age diversity. Several ratios were calculated to determine the relationship of the independent variables with corporations’ R&D investment. This study employed agency theory and the resource-based view to explain the relationship between the independent variables and the dependent variable. Based on the discussion of the theories, a theoretical framework for this study is shown in Figure 1.

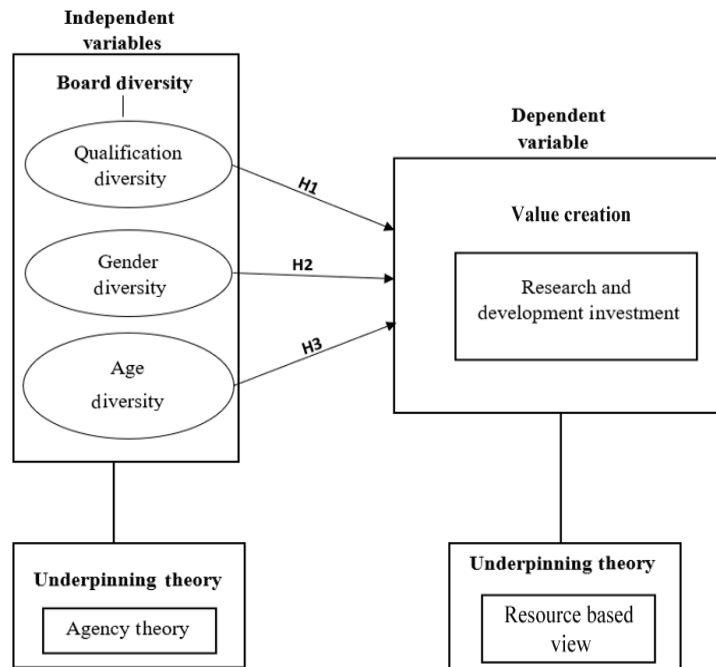


Figure 1. The theoretical framework models.

Based on the framework shown in Figure 1, the relationship between board diversity (measured by board qualification diversity, gender diversity, and age diversity) and value creation (measured by R&D investment) is

present. In this study, we did not include a control variable, such as firm size, that was used in previous studies. The reason for this is that the companies selected for our sample needed to meet specific criteria. They had to have the highest level of adherence to corporate governance best practices in Malaysia and a return on equity of at least three percent for the past three years. Therefore, these requirements are deemed to be the control factor that replaces the need for a control variable. Additionally, the nature and direction of each independent variable are clearly described in the research framework, which will provide the logical basis for developing testable research hypotheses. The agency theory and the resource-based view are used to explain the relationship between board diversity and value creation. In the above framework, three independent variables may impact the R&D investment. The first independent variable is board qualification diversity. This variable is used to determine whether qualification diversity can influence the intensity of a corporation's investment in R&D activities. The second independent variable is board gender diversity. This variable is used to determine whether board gender diversity influences a corporation's R&D investment. The last independent variable is board age diversity. This study attempted to determine the relationship between board age diversity and corporations' R&D potency.

4. RESEARCH METHODOLOGY

This section discusses the methods and techniques applied during the study. The objective of this study is to examine the relationship between board diversity and value creation through the intensity of corporations' R&D investment in the case of Malaysian publicly listed corporations. Secondary data were collected from annual reports. The data were used to calculate ratios. This study used quantitative data analysis for causal research (also known as explanatory study) to study the causes and effects of the relationship between the independent variables and the solitary dependent variable, which can be complicated to understand. This is since it necessitates a high level of comprehension, accuracy, and continuity in terms of how something happens and changes. Thus, establishing a causal relationship with a hundred percent certainty is onerous, and often it can only be assumed or inferred. The collected data was analyzed using SPSS software. A summary of the research design is provided in Figure 2.

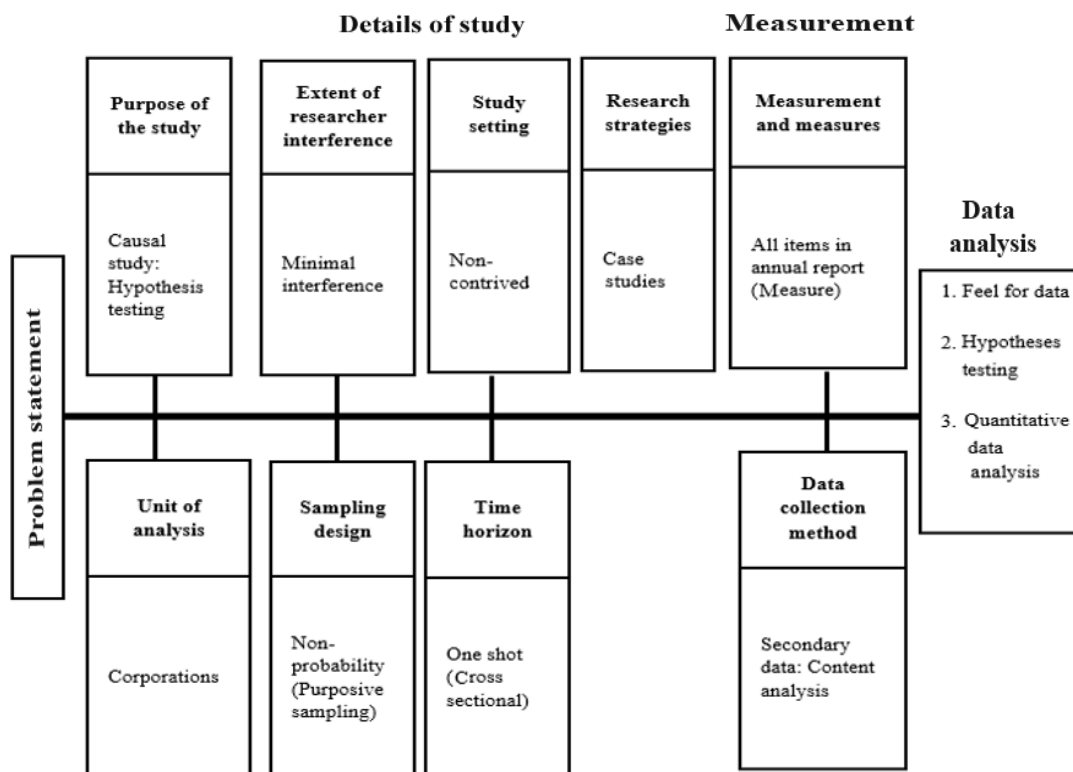


Figure 2. Research design diagram.

4.1. Population and Sampling

In 2017, there were 918 public-listed companies in Malaysia. By employing the purposive sampling technique, this study selected the Minority Shareholders Watch Group's (MSWG) Malaysia: List of Top 100 Companies Overall in CG and Performance (By Rank) from Malaysia: The Association of Southeast Asian Nations (ASEAN) Corporate Governance Report 2017. As a strong proponent of good corporate governance, MSWG leads a few initiatives that promote good management with the aim of increasing shareholders' value. A shared framework for corporate governance in the region is one groundbreaking example of the initiatives by the ASEAN Capital Markets Forum and the Asian Development Bank to assess and benchmark the corporate governance practices of publicly listed companies in ASEAN countries. Due to its global reputation, the scorecard uses the Organization for Economic Co-operation and Development (OECD) Principles as its key standard. It was created using international best practices while considering the complexities of the ASEAN corporate environment.

The year 2017 was the sixth year of the implementation of the scorecard methodology, and the framework and the evaluation process of the scorecard were updated to consider heightened investor expectations and changes in corporate governance practices in reaction to the latest guidelines and recommendations of the G20/OECD Principles of Corporate Governance. These updates have reinforced the soundness of the evaluation framework and provided a better understanding of the materiality of good corporate governance.

The scorecard is also being used by corporations to identify gaps between their corporate governance practices and the framework to make necessary improvements. The corporations could assess their level of corporate governance practices, compare them with their peers, and determine their position in the business landscape. Regulators can also benefit from the results of the scorecard to gauge the level of governance compliance in the country.

The scorecard has five sections that cover areas such as the rights of shareholders, equitable treatment of shareholders, the role of stakeholders, disclosure and transparency, and the responsibilities of the board in accordance with the OECD's corporate governance principles. The scorecard is used to assess the conformance based on the disclosures made by the corporations in their annual reports, announcements made to Bursa Malaysia Securities, and other information that is accessible freely to the public. The Top 100 Malaysian listed companies were identified using the scorecard methodology and had to have achieved a return on equity of not less than three percent for the last three years. In line with the 2017 Malaysian Code on Corporate Governance's recommendations on corporate governance, which include the strengthening of board diversity, this list consists of listed corporations that have been ranked as having the best conformance level of corporate governance best practices in Malaysia. Furthermore, this list was also chosen because it was not focused on any specific sector or a limited choice of corporations only.

Initially, the sample size consisted of 100 corporations with 300 corporation-year observations of publicly listed companies in the main market of Bursa Malaysia. The years 2017, 2018, and 2019 were chosen in conjunction with the 2017 Malaysian Code on Corporate Governance, which placed emphasis on corporations. First, due to the stricter and more robust corporate governance requirements provided under the Financial Services Act 2013, corporations from the financial sector were excluded from this study. After excluding those corporations, this study was left with 84 companies. Then this study also had to ensure that the corporations were present in the Top 100 list for the three consecutive years observed. Corporations that were not present were further eliminated.

This study's sample list was further refined when it eliminated any missing or non-available values. In total, 192 corporation-year observations were eliminated due to the missing data required for the analysis, leaving a total of only 36 corporations and 108 corporation-year observations. In any research, if a result could not be generalized, it would have no scientific value, so determining the sample size is of the utmost importance. [Tabachnick and Fidell \[55\]](#) suggested a formula to calculate the minimum sample size as $N > 50 + 8m$ (where m is the number of independent variables). This study had three independent variables; thus, applying the formula, the minimum

number of samples required for this research was 74. The sample selection of the number of corporations is presented in Table 1, and the sample selection of the corporation's R&D investment is presented in Table 2.

Table 1. Sample selection of corporations' value creation (R&D investment).

Sample corporations	Number of corporations	Number of corporations – years
Value creation (Research & development observation)	100	300
Less:		
Corporations in the financial sector	(16)	(48)
Corporations are not listed in the list for the three years observed (2017, 2018, 2019)	(40)	(120)
Number of corporations	44	132
Missing observation	(8)	(24)
Total number of observations	36	108

4.2. Profiles of Corporations Selected

In total, there were 108 corporation-year observations collected for this study. There were 36 Malaysian publicly listed corporations that had fulfilled the criteria of selection, ranging from different sectors of the Malaysian economy. Table 2 shows the distribution of the sectors of the selected sample corporations.

Table 2. Sectors and number of corporations.

Sector	Number of corporations
Energy	2
Consumer products and services	9
Industrial products and services	2
Construction	3
Transportation and logistics	3
Plantation	3
Health care	4
Telecommunication and media	4
Utilities	2
Properties	4
Total	36

4.3. Data Collection Method

This research employed secondary data analysis, also known as second-hand analysis, in which the study's data were primarily derived from the annual reports that had been collected. The secondary data were derived from the Thomson Reuters Eikon database to measure the independent variables and the solitary dependent variable. This database contains the financial and non-financial data that is collected from the selected Publicly Listed Companies in Bursa Malaysia. However, because the data was not available in the data stream database, each of the companies' annual reports had to be downloaded from Bursa Malaysia's website. All data were substantially identical in content to the annual reports published in Bursa Malaysia, thus making the data reliably accurate.

5. RESEARCH FINDINGS AND RESULTS DESCRIPTIVE STATISTICS

Table 3 and Table 4 indicate descriptive statistics for the variables of interest in the present study, which were board gender diversity, age diversity, and corporations' R&D investment. The statistical summary represents the analyzed data from SPSS in the form of mean, range, standard deviation, minimum, maximum, frequency, and percentage. This study includes 108 observations from 36 firms in Malaysia for a three-consecutive year from 2017 to 2019.

Table 3. Summary of descriptive statistics (Continuous variable).

Variables	N	Range	Min.	Max.	Mean.	Std. deviation
Qualification diversity	108	80.56	11.11	91.67	62.73	18.709
Value creation (Research and development investment)	108	5.93	-1.56	4.37	1.779	1.152

Note: This study used Value Creation (Research and development investment) as one of the transformation approaches to non-normality.

From [Table 3](#), the average qualification diversity of all firms is 62.73, and the standard deviation is 18.709. This indicates that most of the firms have around 62% of their board members with a master's degree or advanced level. In terms of the dependent variable, research and development investment, the mean and standard deviation are 1.779 and 1.152, respectively. This finding shows that, on average, the percentage ratio of R&D investment for the total of 36 corporations to their corporation's total sales is 1.779, indicating that the value creation (research and development investment) for overall corporations under study is moderate (Approaching 2).

For gender diversity, in this study, 98.1% (106) of the time involved boards having at least a female member and 1.9% (2) of the time having all male board members. Furthermore, the present study shows that 58.3% (63) of the time, the average age of the board members is below 60 years old, and 41.7% (45%) of the time, the average age of the board members is below 60 years old.

Table 4. Summary of descriptive statistics (Categorical variable).

Variables	Frequency (n=108)	Percentage (%)	Cumulative percentage (%)
Gender diversity board with female board without female	106 2	98.1 1.9	98.1 100.0
Age diversity < 60 years old ≥ 60 years old	63 45	58.3 41.7	58.3 100.0

5.1. Normality Test

The normality test is employed to determine whether the variable distribution has strayed from that of a normal distribution. According to [George and Mallery \[56\]](#) to prove a data set is of normal distribution, the values for skewness and kurtosis should be between -2 and +2. From the skewness and kurtosis values results in [Table 5](#), the qualification diversity and value creation (research and development investment) are considered normal since the values lie between -2 and +2. Based on the SPSS results, the skewness for qualification diversity is -0.800, and the kurtosis value is 0.517. The value of skewness for value creation (research and development investment) is -0.538, and the kurtosis value is 0.139.

Table 5. Skewness and kurtosis values.

Variables	Skewness	Kurtosis
Qualification diversity	-0.800	0.517
Value creation (Research and development investment)	-0.538	0.139

Note: This study used Value creation (Research and development investment) as one of the transformation approaches to non-normality.

Next, the second normality test conducted in this study is known as the Kolmogorov - Smirnov (K-S) test. If the p-value of the test is more than 0.05 ($\alpha = 0.05$), the data is said to be normally distributed [\[57\]](#). [Table 6](#) presents the result of the Kolmogorov-Smirnov test for the assessment of normality. The results of the test indicated that all variables were considered non-normal due to their respective p-values, as the p-value obtained was less than 0.05, thus this did not fulfil the normality assumption. Nevertheless, due to the large sample size (>30), the data were assumed to be normal based on the central limit theorem. According to [Dalnial, et al. \[58\]](#) when a sample

distribution is greater than 30, the central limit theorem dictates that regardless of the population distribution, the data is deemed to be normal, and this becomes more apparent as the sample count rises.

Table 6. Kolmogorov-Smirnov test of normality.

Variables	Kolmogorov-Smirnov		
	Statistic	Df	Sig.
Qualification diversity	0.111	108	0.002
Value creation (Research and development investment)	0.093	108	0.023

Note: This study used value creation (Research and development investment) as one of the transformation approaches to non-normality.

Next, to proceed with the regression analysis, it is crucial to check the residuals (errors) of the regression line where it is approximately normally distributed. Therefore, the common method used to check this assumption is a Normal P-P plot. From Figure 3, the points lie close to the straight line, suggesting that the residuals (error) of the regression line are approximately normally distributed.

Normal P-P plot of regression standardized residual dependent variable: ln_rnd

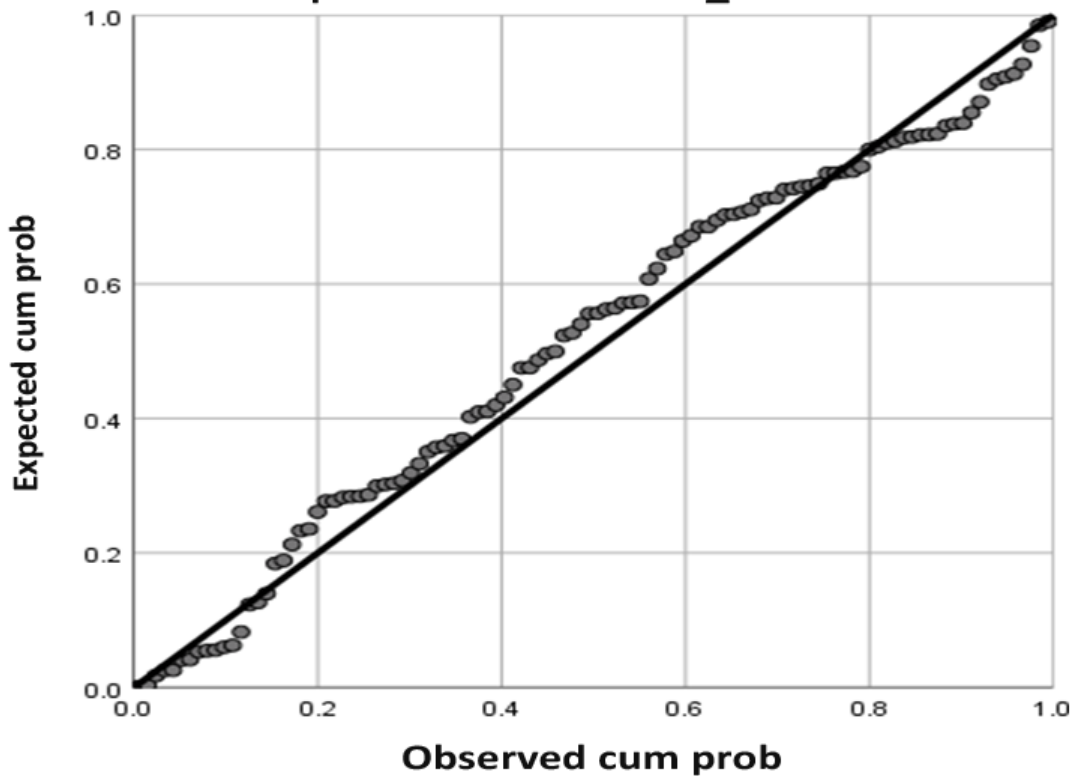


Figure 3. Normal P-P plot.

5.2. Multiple Linear Regression Analysis

Multiple linear regression analysis were performed to ascertain the relationship between board qualification diversity, board gender diversity, and board age diversity and the board’s R&D investment. Table 7, Table 8, and Table 9 present the multiple logistic regression analysis results. The linear regression model can be written as:

$$\text{Value creation (Research and development investment)} = 2.568 - 0.876 \text{ gender diversity} - 0.669 \text{ age diversity} + 0.007 \text{ qualification diversity.}$$

The first table of interest is the Model Summary table. Table 7 provides the R, R², adjusted R², and the standard error of the estimate, which can be used to determine how well a regression model fits the data.

Table 7. Model summary.

R	R square	Adjusted R square	Std. error of the estimate
0.323	0.104	0.078	1.10628

The R column represents the value of the correlation coefficient. R can be one measure of the quality of the prediction of the dependent variable; in this study, value creation (research and development investment). A value of 0.323 in this study indicated a weak level of prediction. The R Square column represents the R² value (also called the coefficient of determination), which is the proportion of variance in the dependent variable that can be explained by the independent variables. From Table 7, the value of 0.104 shows that only 10.4% of the variability of value creation (research and development investment) is explained by board qualification diversity, board gender diversity, and board age diversity.

Table 8. ANOVA.

Analysis	Sum of squares	Df	Mean square	F	P-value
Regression	14.795	3	4.932	4.030	0.009
Residual	127.282	104	1.224		
Total	142.077	107			

Analysis of Variance (ANOVA) is a statistical formula used to compare variances across the means (or average) of different groups. The F-value in the ANOVA table (Table 8) is an indication that the overall regression model is not a good fit for the data. The result shows that the independent variables (board qualification diversity, board gender diversity, and board age diversity) were statistically significant in predicting the dependent variable, value creation (research and development investment), $F(3,104) = 4.030$, $p < 0.05$, suggesting the regression model was a good fit of the data.

Table 9. Coefficient results.

Variables	Unstandardized coefficients		t value	p-value	95.0% confidence interval for B	
	B	Std. error			Lower bound	Upper bound
(Constant)	2.568	0.921	2.790	0.006	0.743	4.394
Qualification diversity	0.007	0.006	1.280	0.204	-0.004	0.019
Gender diversity	-0.876	0.798	-1.098	0.275	-2.459	0.707
Age diversity	-0.669	0.218	-3.075	0.003*	-1.100	-0.237

Note: *Significant at 5% level.
This study used value creation (Research and development investment) as one of the transformation approaches to non-normality.

Based on Table 9, for gender diversity, the result shows that at a 95% confidence level, the null hypothesis cannot be rejected since $p > 0.05$ ($p = 0.275$, $t = -1.098$). Therefore, it can be concluded that there is no significant relationship between gender diversity and value creation (research and development investment). This result indicated that the corporation's investment in R&D was not influenced by gender diversity (male and female). Hence, the result showed that at the 95% confidence level, the null hypothesis cannot be rejected since $p > 0.05$ ($p = 0.275$, $t = -1.098$).

In contrast, based on age diversity, the p-value was significant since $p < 0.05$ ($p = 0.003$, $t = -3.075$), suggesting that there was a significant relationship between age diversity and value creation (research and development investment). From this result, it was observed that the corporation's investment in R&D was influenced by age diversity. A negative regression coefficient for age diversity (-0.669) shows that value creation (research and

development investment) was lower for board members who were below 60 years old than for those who were 60 years old and above. Therefore, the null hypothesis is rejected at the 5% level.

Subsequently, it can be concluded that there was no significant relationship between board qualification diversity and value creation (research and development investment), indicating that the corporation’s investment in R&D was not influenced by board qualification diversity. Therefore, the null hypothesis for qualification diversity cannot be rejected since $p > 0.05$ ($p=0.204, t=1.280$)

Table 10 shows the Pearson correlation matrix between independent variables (board qualification diversity, board gender diversity, and board age diversity) and the dependent variable, value creation (research and development investment).

Table 10. Pearson correlation result.

Variables	Value creation (Research and development investment)
Qualification diversity	$r=0.134, p=0.166$
Gender diversity	$r=-0.080, p=0.411$
Age diversity	$r=-0.278, p=0.004^*$

Note: r is a Pearson correlation; p is a p-value. * Significant at 5% level.
This study used Value creation (Research and development investment) as one of the transformation approaches to non-normality.

Based on the Pearson correlation results in Table 10, there is a significant negative weak correlation between age diversity and value creation (research and development investment). However, it is not necessary to discuss the correlation value for gender diversity and qualification diversity due to the insignificant relationship result.

Finally, the summarized results for hypothesis testing (based on regression analysis) are presented in Table 11.

Table 11. Summary of the hypothesis.

Hypothesis	P-value < 0.05	Conclusion
H1: There is a significant relationship between board qualification diversity and R&D investment.	No	There was no significant relationship between board qualification diversity and R&D investment.
H2: There is a significant relationship between board gender diversity and R&D investment.	No	There was no significant relationship between board gender diversity and R&D investment.
H3: There is a significant relationship between board age diversity and R&D investment.	Yes	There was a significant relationship between board age diversity and R&D investment.

6. DISCUSSION AND CONCLUSION DISCUSSION OF FINDINGS

This study’s main objective is to investigate the impact of board diversity on corporations’ annual R&D investment from the perspective of agency theory and a resource- based view. The assessed board characteristics were board qualification diversity, gender diversity, and age diversity. Globalization and the fast-changing business landscape necessitate corporations to indulge in value-creation activities. Failure to acknowledge such a need could result in corporations being left behind in the chase for competitive advantage, and maybe there is no need to assess which board characteristics could influence a corporation’s R&D investment as R&D has become so pertinent to almost all corporations in their chase for business competitive advantage. After performing the relevant statistical tests and reaching the empirical findings, this chapter answers the research questions.

6.1. The Relationship between Board Qualification Diversity and R&D Investment

In this study, the result concluded that board qualification diversity was not significantly related to corporations’ R&D investment. The findings are inconsistent with the previous findings by Olajide and Eunice [45] which reported a significant relationship between board educational diversity and corporations’ R&D investment. In another classical study by John [43] it was found that a corporation’s tendency to invest in R&D activities increased when the board’s qualifications were diverse. A lot of researchers argue that R&D investment is

a vital component in determining the competitiveness of a corporation. The researcher believed other factors, such as the long-term market and the uncertainties of the business environment, must also be taken into consideration. Having a more diverse board would indicate a better understanding of the problems and issues faced, which could result in better decisions being made. Like all prior research, this study measured qualification diversity by calculating the percentage of board members with a master's degree or advanced level. Although about 80 percent of the observations consisted of boards having more than 50 percent of members fulfilling the measurement criteria, it still did not manage to influence the intensity of the corporations' investment in R&D activities. A study conducted by Wang, et al. [59] highlighted that the alma mater was another consideration that might affect board members' attitudes towards R&D investment. The study also claimed that board members who graduated from Ivy League Institutions were more likely to raise investment in a corporation's R&D efforts. The study further elaborated that this could likely be due to their increased exposure to cutting-edge studies and active relationships with top academics during their studies. Generally, it is desirable for board members to have a high educational level, such as a master's degree or an advanced level. Additionally, the researcher also feels that it is equally significant for corporations to have board members that possess qualifications in disciplines that are directly relevant and pertinent to the corporations' strategic capabilities.

6.2. The Relationship between Board Gender Diversity and R&D Investment

The findings in this study show that the relationship between board gender diversity and corporations' R&D investment was insignificant, indicating that board gender diversity and R&D investment were not dependent on each other. This non-significant association may depict the insufficient influence of board gender diversity and corporations' R&D investment. This finding was consistent with another study conducted by Bohren and Ström [48], which also discovered that there was no significant relationship between board gender diversity and corporations' R&D investment. However, this study's findings contradicted the findings of a recent study conducted by Almor, et al. [50] that reported the presence of women on corporations' boards had a significant negative influence on R&D investments. However, another study conducted by Attah-Boakye, et al. [51] revealed that there was a significant positive association between gender diversity and a corporation's innovativeness.

Women are normally seen to be more risk-averse than men, making them a bit more calculative and refusing to take chances on venturing into uncharted territories, thus resulting in them shunning R&D endeavors. The push for governance reforms relating to gender equality has also increased the belief that diversifying the board of directors by including more women will help businesses gain credibility as gender equality becomes more generally recognized as a social norms [47]. However, the appointment of women to the board may just be symbolic, and the significance of these directors' efforts may not be recognized [60]. Earlier research debated that the consequences of tokenism and the outnumbered status of female directors generally rely on the social context. Due to this minority status, there is a possibility that the female directors could be subjected to social barriers that are caused by gender stereotyping, thus making their opinions on the intensity of R&D investment undervalued [61]. It can also be argued that things could also be the same if the tables were turned and males became the minority on board.

6.3. The Relationship between Board Age Diversity and R&D Investment

The result regarding board age diversity and corporations' R&D investment revealed a significant positive relationship, suggesting that corporations' R&D investment seemed to depend on board age diversity. However, this significant relationship was not strong. These findings contradict a study by Ojok and Okema [6] where they found that the R&D investment could not be explained by the board age diversity. This study's findings also contradict the research done by Sharma [54] which reported that board age diversity had a significant negative influence on a corporation's innovation intensity. In this era, products, services, and the processes that design, produce, and market them can become outdated and irrelevant in an instant. The recent development of corporate

governance practices that promote the opening of the doors of the boardroom to younger members would invite new, fresh, and current ideas that would be more relevant to the community. This could determine the intensity of a corporation's investment in R&D. As discussed earlier, innovation is a risky business. When a corporation commits to an R&D endeavour, they are exposed to all the risks of the development processes. After investing a substantial amount of money and time in R&D, the corporation is exposed to market risk, such as customers who are not willing to pay for the newly invented products and services. However, in the age of disruption, failure to acknowledge the importance of R&D in the pursuit of innovation could be riskier for a corporation [27].

7. LIMITATION OF THE STUDY

There were several limitations identified during this study. Firstly, the limited sample size that was collected and used. This study focused on Malaysian PLCs that were listed on the MSWG's Malaysia: List of Top 100 Companies Overall in CG & Performance (By Rank) from the Malaysia - ASEAN Corporate Governance Report 2017. Then, this study also had to ensure that the corporations were present in the Top 100 list for the three consecutive years observed. This study's sample list was further refined when it eliminated any missing or non-available values, which limited this study to only 108 corporation-year observations. Secondly, as explained earlier, to ensure that all corporations chosen were present in the three years of observations, a lot of corporations had to be dropped. Hence, not all sectors were included in this study. Although this study fulfilled the minimum number of samples as prescribed by Tabachnick and Fidell [55] the generalizability of the results could not be ascertained as the sample did not consist of corporations from all industries that are available in Malaysia. Thirdly, this study did not include other variables that could moderate the effect of the independent variables used on R&D investment, such as fund availability to invest in R&D activities and ownership structure. It would be interesting to see the moderating effect of such factors in determining the relationship between board diversity and R&D investment.

Funding: This study received no specific financial support.

Institutional Review Board Statement: The Ethical Committee of the Universiti Teknologi MARA, Malaysia has granted approval for this study on 21 December 2020 (Ref. No. REC/12/2020 (EX/8)).

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.

REFERENCES

- [1] C. Li and M. Peng, "Creating values for customers: A case study of small investment service firm in China," Unpublished Master's Thesis, Halmstad University, 2011.
- [2] Y. Dora, "Development concept of value, value creation and customer value creation," presented at the Inaugural Conference on Management and Sustainability in Asia April 29 - May 1, 2015 The Mitsui Garden Hotel, Hiroshima, JapanAt: The Mitsui Garden Hotel Hiroshima, Japan, 2015.
- [3] K. Trivedi, P. Trivedi, and V. Goswami, "Sustainable marketing strategies: Creating business value by meeting consumer expectation," *International Journal of Management, Economics and Social Sciences*, vol. 7, no. 2, pp. 186-205, 2018.
- [4] J. I. Dirisu, O. Iyiola, and O. Ibidunni, "Product differentiation: A tool of competitive advantage and optimal organizational performance (A study of Unilever Nigeria PLC)," *European Scientific Journal*, vol. 9, no. 34, pp. 258-281, 2013.
- [5] C. Reguia, "Product innovation and the competitive advantage," *European Scientific Journal*, vol. 1, no. 1, pp. 140-157, 2014.

- [6] F. Ojok and S. Okema, "How does board composition affect R&D investments? Quantitative study based on Swedish listed companies," Unpublished Master's Dissertation. Umea University, 2016.
- [7] P. M. Madhani, *Corporate governance: A journey from compliance to competitive advantage. Book chapter in R. K. Jain, P. Gupta, & U. Dhar (Eds.), Enhancing enterprise competitiveness(strategy, operations and finance)*. New Delhi: Allied Publishers, 2007.
- [8] J. Kaczmarek, "The mechanisms of creating value vs financial security of going concern — sustainable management," *Sustainability*, vol. 11, no. 8, pp. 1-24, 2019. <https://doi.org/10.3390/su11082278>
- [9] B. S. Martini, A. Corvino, and A. Rigolini, "Board diversity and structure: What implications for investments in innovation? Empirical evidence from Italian context," *Corporate Ownership & Control*, vol. 10, no. 1, pp. 9-25, 2012.
- [10] M. Damilano, N. Miglietta, E. Battisti, and F. Creta, "Value creation and competitive advantage: Empirical evidence from dividend champions of the S&P 500," *International Journal of Business and Management*, vol. 13, no. 12, pp. 50-60, 2018. <https://doi.org/10.5539/ijbm.v13n12p50>
- [11] P. Dharmadasa, P. Gamage, and S. K. Herath, "Corporate governance, board characteristics and firm performance: Evidence from Sri Lanka," *South Asian Journal of Management*, vol. 21, no. 1, pp. 7-31, 2014.
- [12] N. Kim and E. Kim, "Board capital and exploration: From a resource provisional perspective," *Management Decision*, vol. 53, no. 9, pp. 2156-2174, 2015. <https://doi.org/10.1108/MD-11-2014-0648>
- [13] R. C. Anderson, D. M. Reeb, A. Upadhyay, and W. Zhao, "The economics of director heterogeneity," *Financial Management*, vol. 40, no. 1, pp. 5-38, 2011. <https://doi.org/10.1111/j.1755-053X.2010.01133.x>
- [14] M. Špacek and E. Vacík, "Company value creation through effective innovation process management," *Journal of Innovation Management*, vol. 4, no. 3, pp. 65-78, 2016.
- [15] A. M. De Mello, W. D. De Lima, E. V. Boas, R. Sbragia, and R. Marx, "Innovation capability and competitive advantage: A case study of two Brazilian firms," presented at the PICMET'08-2008 Portland International Conference on Management of Engineering & Technology. IEEE, 2008.
- [16] D. A. Bodner and W. B. Rouse, "Understanding R&D value creation with organizational simulation," *Systems Engineering*, vol. 10, no. 1, pp. 64-82, 2007. <https://doi.org/10.1002/sys.20064>
- [17] O. Guldiken and I. S. Darendeli, "Too much of a good thing: Board monitoring and R&D investments," *Journal of Business Research*, vol. 69, no. 8, pp. 2931-2938, 2016. <https://doi.org/10.1016/j.jbusres.2015.12.062>
- [18] M. F. Adnan, N. Sabli, A. H. Hashim, M. Z. Abdul Rashid, H. P. Halil, and A. Abdullah, *The impact of educational level of board of directors on firms' performance. In Yacob, N. A., Mohamed, M., Hanafiah, M. A. K. (Eds.), Regional conference on science, technology and social sciences*. Singapore: Springer, 2016.
- [19] A. M. Alomari, "The impact of board of directors and CEO educational qualifications and experience on performance: A field study on manufacturing companies listed on the amman stock exchange," Unpublished Master's Dissertation Yarmouk University, 2016.
- [20] N. Fligstein, "The intraorganizational power struggle: Rise of finance personnel to top leadership in large corporations," *American Sociological Review*, vol. 52, no. 1, pp. 44-58, 1987. <https://doi.org/10.2307/2095391>
- [21] L. Zhang, "An institutional approach to gender diversity and firm performance," *Organization Science*, vol. 31, no. 2, pp. 439-457, 2020. <https://doi.org/10.1287/orsc.2019.1297>
- [22] H. H. Mirza, S. Andleeb, and F. Ramzan, "Gender diversity and firm performance: Evidence from Pakistan," *Journal of Social and Development Sciences*, vol. 3, no. 5, pp. 161-166, 2012.
- [23] J. Marinova, J. Plantenga, and C. Remery, "Gender diversity and firm performance: Evidence from Dutch and Danish boardrooms," *The International Journal of Human Resource Management*, vol. 27, no. 15, pp. 1777-1790, 2015. <https://doi.org/10.1080/09585192.2015.1079229>
- [24] Malaysia Department of Statistics, "Press release current population estimates, Malaysia 2020. Department of Statistics Malaysia Official Portal," Retrieved: <https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=OVByWjg5YkQ3MWFZRTN5bDJiaEVhZz09#:~>

- :text=Malaysia's%20population%20in%202020%20is,rate%20of%200.4%20per%20cent.&text=The%20growth%20rate%20of%20Citizens,to%2029.7%20million%20in%202020. 2020.
- [25] F. Galia and E. Zenou, "Does board diversity influence innovation? The impact of gender and age diversity on innovation types," presented at the XXII Conference Internationale de Management Strategic, 2013.
- [26] R. Horváth and P. Spirollari, "Do the board of directors' characteristics influence firm's performance? The US evidence," *Prague Economic Papers*, vol. 4, no. 2, pp. 470-486, 2012. <https://doi.org/10.18267/j.pep.435>
- [27] Woschkowiak, "Board diversity and firm financial performance: Gender, nationality and age diversity in European boardrooms," Unpublished Master's Thesis. Radboud University Nijmegen, 2018.
- [28] R.-G. Moscu, "The impact of gender and age diversity on company performance," *Knowledge Horizons. Economics*, vol. 5, no. 4, pp. 215-219, 2013.
- [29] S. A. Boehm, M. K. Baumgaertner, and D. J. G. Dwertmann, *Age diversity and its performance implications. In Boppel, M, Boehm, S & Kunisch, S (Eds.), From grey to silver – Managing the demographic change successfully*. Berlin, Heidelberg: Springer, 2015.
- [30] S. K. Johl, S. Kaur, and B. J. Cooper, "Board characteristics and firm performance: Evidence from Malaysian public listed firms," *Journal of Economics, Business and Management*, vol. 3, no. 2, pp. 239-243, 2015. <https://doi.org/10.7763/JOEBM.2015.V3.187>
- [31] J. Bendickson, J. Muldoon, E. W. Liguori, and P. E. Davis, "Agency theory: Background and epistemology," *Journal of Management History*, vol. 22, no. 4, pp. 437-449, 2016. <https://doi.org/10.1108/JMH-06-2016-0028>
- [32] A. Chrisidu-Budnik and J. Przadańska, "The agency theory approach to the public procurement system," *Wroclaw Review of Law, Administration & Economics*, vol. 7, no. 1, pp. 154-165, 2017. <https://doi.org/10.1515/wrlae-2015-0059>
- [33] M. Jensen and W. H. Meckling, "Theory of the firm: Managerial behavior, agency costs and ownership structure," *Journal of Financial Economics*, vol. 3, no. 4, pp. 305-360, 1976.
- [34] B. Panda and N. M. Leepsa, "Agency theory: Review of theory and evidence on problems and perspectives," *Indian Journal of Corporate Governance*, vol. 10, no. 1, pp. 74-95, 2017. <https://doi.org/10.1177/0974686217701467>
- [35] G. S. Balago, "A conceptual review of agency models of performance evaluation," *International Journal of Finance and Accounting*, vol. 3, no. 4, pp. 244-252, 2014.
- [36] J. G. Vargas-Hernández and C. M. Teodoro, "Corporate governance and agency theory: Megacable case," *Corporate Governance and Sustainability Review*, vol. 2, no. 1, pp. 59-69, 2018. <https://doi.org/10.22495/cgsrv2i1p5>
- [37] OECD, "Corporate governance, value creation and growth," Retrieved: <https://www.oecd.org/corporate/ca/corporategovernanceprinciples/50242938.pdf>. 2012.
- [38] J. Barney, "Firm resources and sustained competitive advantage," *Journal of Management*, vol. 17, no. 1, pp. 99-120, 1991. <https://doi.org/10.1177/014920639101700108>
- [39] B. Wernerfelt, "On the role of the RBV in marketing," *Journal of the Academy of Marketing Science*, vol. 42, pp. 22-23, 2014. <https://doi.org/10.1007/s11747-013-0335-8>
- [40] P. M. Madhani, "Resource based view (RBV) of competitive advantage: Importance, issues and implications," *KHOJ Journal of Indian Management Research and Practices*, vol. 1, no. 2, pp. 2-12, 2009.
- [41] K. Almarri and P. Gardiner, "Application of resource-based view to project management research: Supporters and opponents," *Procedia-Social and Behavioral Sciences*, vol. 119, pp. 437-445, 2014. <https://doi.org/10.1016/j.sbspro.2014.03.049>
- [42] R. Eview, E. Xtension, S. Uggestions, and J. Hulland, "Review: The resource-based view and information systems research: Review, extension, and suggestions for future research," *MIS Quarterly*, vol. 28, no. 1, pp. 1-36, 2004.
- [43] F. John, "Board diversity and R&D investment," *Business*, vol. 21, pp. 507-511, 1992.
- [44] H.-L. Chen, "Board characteristics and R&D investment: Evidence from Taiwan's electronics industry," *Advances in Management and Applied Economics*, vol. 2, no. 4, pp. 161-170, 2012.

- [45] S. Olajide and A. Eunice, "Corporate board educational qualification diversity and performance of quoted companies in Nigeria: A methodological shift," *The International Journal of Business & Management*, pp. 1-10, 2019. <https://doi.org/10.24940/theijbm/2019/v7/i6/BM1906-030>
- [46] J. Sarkar and E. Selarka, "Women on board and performance of family firms: Evidence from India," *Emerging Markets Review*, vol. 46, p. 100770, 2021.
- [47] T. Nguyen, S. Locke, and K. Reddy, "Does boardroom gender diversity matter? Evidence from a transitional economy," *International Review of Economics & Finance*, vol. 37, pp. 184-202, 2015. <https://doi.org/10.1016/j.iref.2014.11.022>
- [48] Ø. Bøhren and R. Ø. Strøm, "Governance and politics: Regulating independence and diversity in the board room," *Journal of Business Finance & Accounting*, vol. 37, no. 9-10, pp. 1281-1308, 2010. <https://doi.org/10.1111/j.1468-5957.2010.02222.x>
- [49] A. Vafaei, D. Henry, K. Ahmed, and M. Alipour, "Board diversity: Female director participation and corporate innovation," *International Journal of Accounting & Information Management*, vol. 29, no. 2, pp. 247-279, 2021. <https://doi.org/10.1108/IJAIM-06-2020-0080>
- [50] T. Almor, O. Bazel-Shoham, and S. M. Lee, "The dual effect of board gender diversity on R&D investments," *Long Range Planning*, vol. 55, no. 2, p. 101884, 2022. <https://doi.org/10.1016/j.lrp.2019.05.004>
- [51] R. Attah-Boakye, K. Adams, D. Kimani, and S. Ullah, "The impact of board gender diversity and national culture on corporate innovation: A multi-country analysis of multinational corporations operating in emerging economies," *Technological Forecasting and Social Change*, vol. 161, pp. 1-11, 2020. <https://doi.org/10.1016/j.techfore.2020.120247>
- [52] J. P. Gonzales-Bustos, A. B. Hernández-Lara, and X. Li, "Board effects on innovation in family and non-family business," *Heliyon*, vol. 6, no. 9, p. e04980, 2020. <https://doi.org/10.1016/j.heliyon.2020.e04980>
- [53] S. A. Boehm and D. J. Dwertmann, "Forging a single-edged sword: Facilitating positive age and disability diversity effects in the workplace through leadership, positive climates, and HR practices," *Work, Aging and Retirement*, vol. 1, no. 1, pp. 41-63, 2015. <https://doi.org/10.1093/workar/wau008>
- [54] Z. Sharma, "Board composition and innovation," *Applied Finance Letters*, vol. 5, no. 2, pp. 12-27, 2016. <https://doi.org/10.24135/afl.v5i2.46>
- [55] B. G. Tabachnick and L. S. Fidell, "Review of using multivariate statistics," *Contemporary Psychology. A Journal of Reviews*, vol. 28, no. 8, pp. 642-642, 2007.
- [56] D. George and M. Mallery, *SPSS for windows step by step: A simple guide and reference, 17.0 update*, 10th ed. Boston: Pearson, 2010.
- [57] A. Field, *Discovering statistics using IBM SPSS statistics*, 4th ed. Los Angeles, London, New Delhi: Sage, 2013.
- [58] H. Dalnial, A. Kamaluddin, Z. M. Sanusi, and K. S. Khairuddin, "Detecting fraudulent financial reporting through financial statement analysis," *Journal of Advanced Management Science*, vol. 2, no. 1, pp. 17-22, 2014.
- [59] C. Wang, J. Yang, Z. Cheng, and C. Ni, "Postgraduate education of board members and R&D investment—Evidence from China," *Sustainability*, vol. 11, no. 22, pp. 1-17, 2019. <https://doi.org/10.3390/su11226524>
- [60] A. AlHares, "Corporate governance mechanisms and R&D intensity in OECD countries," *Corporate Governance: The International Journal of Business in Society*, vol. 20, no. 5, pp. 863-885, 2020. <https://doi.org/10.1108/CG-11-2019-0349>
- [61] B. Elstad and G. Ladegard, "Women on corporate boards: Key influencers or tokens?," *Journal of Management & Governance*, vol. 16, pp. 595-615, 2012. <https://doi.org/10.1007/s10997-010-9165-y>

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