2022-08-31

Critical Mass of Women on Biotech Corporate Boards and Its Implication For Firm Performance: A Mixed Method Explanatory Sequential Study

Shesh Sharma
University of San Diego

CRITICAL MASS OF WOMEN ON BIOTECH CORPORATE BOARDS AND ITS IMPLICATION FOR FIRM PERFORMANCE: A MIXED METHOD EXPLANATORY SEQUENTIAL STUDY

by

Sheshadri Sharma

A dissertation submitted for the partial fulfillment
of the requirements for the degree of

Doctor of Philosophy

25 July 2022

Dissertation Committee

Hans P Schmitz, PhD
Fred J. Galloway, PhD
Taylor Peyton, PhD
Vivek Mande, PhD

University of San Diego

University of San Diego
School of Leadership and Education Sciences

CANDIDATE'S NAME: Sheshadri Sharma

TITLE OF DISSERTATION: CRITICAL MASS OF WOMEN ON BIOTECH CORPORATE BOARDS AND ITS IMPLICATION FOR FIRM PERFORMANCE: A MIXED METHOD EXPLANATORY SEQUENTIAL STUDY

APPROVAL July 25, 2022:

_____, Chair
Hans P. Schmitz, PhD

_____, Co-Chair
Fred J. Galloway, DSc

_____, Member
Taylor Peyton, PhD

_____, Member
Vivek Mande, PhD

ABSTRACT

This study examined the influence of demographic, functional, and cognitive diversities on firm performance of North American Biotech companies using a mixed method explanatory sequential approach. One-year cross-sectional data of 100 companies was analyzed followed by purposeful semistructured interviews with eight board members from the dataset. The combined results resolved several ambiguities present in the literature regarding board selection, composition, and the correlation of board diversity with firm performance. This study used the well-known market-based financial metric Tobin's Q to measure firm performance.

The quantitative results showed a dichotomous relationship between gender ratio and Tobin's Q based on a theoretically determined shift in performance at 22% gender ratio. Firm performance or Tobin's Q was negative for gender ratio less than or equal to 22% highlighting that "tokenism" did not enhance performance and positive for gender ratio greater than 22%. The gender interaction effect analysis using the slope dummy variable approach indicated small to midsize firms with low Tobin's Q attracted more women, and vice versa, alluding to an endogenous relationship.

The qualitative results complemented the quantitative findings with respect to rank ordering of the diversity attributes, board selection process, and strategies for a diverse and inclusive board. The preference for different diversity attributes was dependent on the complexity of the business, board size, and the life cycle of a company. The findings led me to conclude that a combination of diversity attributes is required to meet a board's objectives versus a single diversity attribute. Participants suggested that boards prefer all forms of diversity as it gains from different perspectives of members while avoiding the trap of "groupthink." Further,

the board selection process varies according to the board size and is generally through a professional network with the CEO or a board member and in some cases search firms.

The supply deficit of underrepresented groups can be mitigated through succession planning and grooming the next set of executive leaders. Central to this strategy is the willingness of the executive leadership to change the board dynamics and power structure to enable a more diverse and inclusive board.

Keywords: Demographic, cognitive, functional, Tobin's Q, tokenism, groupthink

DEDICATION

"Awake, Arise, Stop not until the goal is reached" – By Swami Vivekananda (from Katha Upanishad, verse 1.3.14), who has been an inspiration all my life.

To my late parents and late sister for instilling the value of education and hard work. They would have been proud of this academic accomplishment. My sincere gratitude to a couple of family members who were not actively involved in my life but still provided a guiding light.

To my yoga gurus who over the years taught me the value of physical & mental discipline, reflecting inwards, and the importance of seeking new knowledge.

There are no words to express my deep-felt gratitude and appreciation for the support of my immediate and extended family members. Their steadfast encouragement and support over the years has enabled me to overcome many challenges and helped me to accomplish my academic and professional goals.

ACKNOWLEDGEMENTS

My sincere thanks to my committee co-chair's Hans Schmitz and Fred Galloway for their invaluable guidance and support throughout the doctoral program. It has been an intellectually fulfilling experience to have worked with both Hans and Fred on this dissertation. I also thank Fred for helping me find an external committee member in Taylor Peyton. Thanks to Taylor for introducing me to the concept of intersectionality, a hitherto unexplored area in board diversity studies, and for her guidance in quantitative analysis. A chance meeting with Prof. Vivek Mande at Peet's coffee and his advice to pursue a PhD at USD has led to this academic work. Vivek has been a great mentor and instrumental in pushing the boundaries of my quantitative thinking, which made the dissertation richer.

I would like to thank the administrative staff Beth Garofalo, Adriana Becerra, and V. Dozier for their timely help in various stages of the program. My thanks to several of the faculty members at USD who have enriched my learning during the program. A big shout out to my board members who participated in the interviews and were generous with their time and insights, despite their busy schedules. To several clients/ex-colleagues at Amgen and Kite, too many to name, who over the years have enriched me both professionally and personally.

A sincere appreciation to several friends who in the past two decades have helped me succeed both academically and professionally. Foremost among them is Prof. Shamkanth Navathe, PhD who has mentored and encouraged me ever since my first graduate degree program. My friend and ex-colleague Richard R Jettappa, PhD who groomed me in applied research after my undergraduate studies, which proved to be valuable in my doctoral research. To my friends and ex-roommates from graduate school Madhukar M Rao, PhD, and Jay Sethuraman, PhD for their consistent support and encouragement during my academic journey.

ORDER OF PAGES

ACKNOWLEDGEMENTS I

ORDER OF PAGES II

LIST OF TABLES VII

LIST OF FIGURES VIII

CHAPTER ONE: INTRODUCTION 1

Empirical Evidence About the Effects of Board Diversity 2

The Missing Elements 3

The Study Explained 4

The Role of Corporate Boards 5

Diversity Attributes 5

Firm Performance 6

The Biotech Industry Context 6

Study Approach and Findings 7

Findings Summarized: Gender, Race, and Intersectionality 8

Quantitative Results 8

Qualitative Results 12

Study Contributions 13

Organization of the Study 16

CHAPTER TWO: LITERATURE REVIEW 18

Process for Literature Search 18

Key Findings From the Literature 19

Theoretical Foundations: Diversity, Board Composition, and Corporate Governance 20
Diversity Typology 20
Demographic Diversity 23
Functional Diversity 23
Cognitive Diversity 24
Corporate Governance 25
The Role of Boards 26
Board Composition: Arguments for and Against Diversifying Membership 26
New Regulations and Board Diversity 28
Legislating Board Quotas 28
Empirical Studies Showing the Influence of Board Diversity 29
Positive Correlation Between Board Diversity and Firm Performance 29
Negative Correlation Between Board Diversity and Firm Performance 36
No Correlation Between Board Diversity and Firm Performance 38
Methodological Challenges: Endogeneity and Board Diversity 40
Conclusions: Lessons Learned and Gaps in the Literature 41
Establishing the Case for the Current Study 42
CHAPTER THREE: RESEARCH METHODOLOGY 43
Research Framework 44
Agency Theory 45
Resource Dependence Theory 45
Upper Echelons Theory 46
CMT 47

Intersectionality 48
Initial Hypothesis 50
Research Design 52
Operationalization of Key Concepts 52
Properties of Blau's Index 56
Qualitative Analysis 57
CHAPTER FOUR: QUANTITATIVE APPROACH 58
Steps Involved in Quantitative Analysis 58
Data Collection Process 59
Board Member Data 61
Member Expertise Data 61
Board and Firm Level Data 61
Cross-Check of Board of Directors and Firm Level Data 62
Data Aggregation 62
Empirical Methods 63
Descriptive Statistics 63
Multicollinearity Test 63
OLS Analysis – Method 1 64
OLS Regression With Intersectionality – Method 2 69
OLS Analysis Slope - Dummy Variable Approach – Method 3 70
CHAPTER FIVE: QUALITATIVE APPROACH 76
Explanatory Sequential Design 76
Purpose of the Interviews 77

Research Questions 77
Sample Plan and Interview Protocol 78
Data Collection and Validation 81
Data and Interview Analysis 82
Integration of Results 83
CHAPTER SIX: DISCUSSION OF RESULTS 85
Quantitative Analysis 85
Descriptive Statistics 86
Board Size as a Mediating Factor 88
OLS Regression 88
Validating Critical Mass of Theory 92
Intersectionality Using Standard OLS 96
The Slope Dummy Approach – Analyzing the Gender Interaction Effect 97
Qualitative Analysis 101
Perspectives on Board Diversity 103
Board Recruitment Process 105
The Influence of Board Size (i.e., Large Boards Vs. Small or Midsize Boards) 106
Optimal Gender Composition in a Board 107
Board Independence and Governance 108
Board Inclusion 109
CHAPTER SEVEN: CONCLUSIONS, LIMITATIONS, AND OPPORTUNITIES FOR RESEARCH 112
Conclusions 113

Diversity Attributes – Which Attribute is More Important? 114
Board Selection – What are the Successful Strategies for Board Selection? 116
Impact of a Diverse Board - What is the Optimal Gender Ratio for Positive Performance? 117
Gender Interaction Effect – How does Gender Interaction Influence Firm Performance? . 118
Board Dynamics – What are the Key Enablers for Board independence? 119
Board Inclusion: What are the Successful Strategies for a Diverse and Inclusive Board? . 120
Diversity in Pre-IPO Boards: How Can it Change? 121
Study Limitations 121
Opportunities for Future Research 123
Closing Remarks 125
REFERENCES 127
APPENDIX A Market Perspectives on Diversity 148
APPENDIX B A Case for Studying the Biotech Domain 149
APPENDIX C Board of Directors Demographics Data 150
APPENDIX D Study Contributions 151
APPENDIX E Computing Different Diversity Indices 152
APPENDIX F Example of Diversity Analysis 153
APPENDIX G Qualitative Portion of the Study – Board Member Background 154
APPENDIX H Distribution of Diversity Indices 155
APPENDIX I Impact of Board Size on Diversity Indices 156
APPENDIX J Mapping Blau's Gender Index and Gender Ratio against Tobin's Q (log) 157

LIST OF TABLES

Table 1. Definition and Properties of Diversity Types 54

Table 2. Descriptive Statistics..... 86

Table 3. Comparing Results of Various OLS Models 90

Table 4. Results of OLS With Diversity Index as a Function of Gender Ratio f(GR, GR2)..... 93

Table 5. Coefficients of Regressed Variables..... 93

Table 6. Regression Analysis Using Slope Dummy Variable Approach 98

Table 7. Coefficients of Regressed Slope Dummy Variables..... 98

LIST OF FIGURES

Figure 1. Board Diversity and Firm Performance Construct 5

Figure 2. Study Contributions 14

Figure 3. Literature Review Positioning Matrix 19

Figure 4. Diversity Typology and Operational Definitions 22

Figure 5. The Explanatory Sequential Design 43

Figure 6. Conceptual Framework for Board Diversity and Firm Performance 44

Figure 7. Board of Directors Data Structure 60

Figure 8. The Slope Dummy Variable Graph 73

Figure 9. Framework for Research Questions 77

Figure 10. Interview Plan and Sample Distribution 79

Figure 11. Integration of QUAN-QUAL Studies 84

Figure 12. Cross-Correlation of Gender Ratio Versus Functional Expertise and Cognitive Diversity 87

Figure 13. Group Types Based on Proportional Representation 95

Figure 14. Results of OLS for Gender Diversity Interaction Effect 100

CHAPTER ONE: INTRODUCTION

The growing presence of women and people of color (POC) in top management and corporate boards is a 21st century phenomenon departing from the nearly homogenous boards with mostly White men in the 250-year history of U.S. corporations. Between 2015 and 2020 the number of directors of color from either gender increased by 11% and in 2020 alone the total percentage of non-White board of directors stood at 20% (Spencer Stuart Report, 2020). Globalization is one reason for the increased participation of women, racial, and ethnic minorities in the workforce and representation in senior management positions.

Despite such progress, research has shown these populations remain underrepresented in boards and executive ranks (Ely & Thomas, 2020; Sarah & Huang, 2020; see Appendix A). As a result, publicly traded companies are under intense scrutiny by multiple stakeholders cutting across corporate, investors, government, policy makers, and social equity advocates who are collectively pushing for more board diversity. Some notable developments driving the call for more board diversity was the 2008 global financial market meltdown, which resulted in the collapse of big-name financial companies; passing of the post-2008 Securities and Exchange Commission (SEC) regulations supporting board independence; and the emphasis on board diversity as a control mechanism to proactively prevent such future financial crises. Additionally, the ability of many social justice advocates and governments across the globe to pass board quota legislation with a focus on equitable representation in the boardroom have contributed to the call for increased boardroom diversity (Carver, 2002; Erhardt et al., 2003; Gabrielsson & Huse, 2004). Such developments highlight the importance of this topic for improved corporate governance, policy making, and academic research.

Empirical Evidence About the Effects of Board Diversity

In the past 2 decades, researchers from multiple disciplines—ranging from social science and law to business—have analyzed board diversity from various research lenses and contributed significantly to the development of this topic. The results from the extant literature can be grouped into three main categories, namely, studies showing a correlation between diversity and firm performance that was (a) positive, (b) negative, or (c) had no correlation at all. The findings with a positive correlation validate the principle that a diverse board enhances the monitoring, advising, and controlling functions, thereby reducing the agency costs, and diverse boards are likely to be more innovative, bring new perspectives, and expand external relationships (Erhardt et al., 2003; Hambrick, 2007; Hambrick & Mason, 1984).

The factors driving a negative correlation between board diversity and firm performance can be attributed to heterogeneous boards having different leadership styles driven by the sociocultural differences among board members. This heterogeneity leads to conflicts that undermine board effectiveness (Adams & Ferreira, 2004; del Carmen Triana et al., 2014; Kanter, 1977a; Wellalage & Locke, 2013). There have also been arguments against the notion of board diversity. These arguments stemmed from the social identity and similarity/attraction theories, which state members in a unit or team tend to build relations or identify themselves with others who are similar in social category. Williams and O'Reilly (2000) argued that such homogenous groups tend to work more effectively as they can develop a bond based on one's own gender and/or race. On the contrary, researchers have argued that heterogeneous members tend to breed conflicts, form in-groups and out-groups, and prevent effective decision making, thus affecting board performance (Elsass & Graves, 1997; Ely & Thomas, 2020; Richard et al., 2007).

The negative correlations between board diversity and firm performance are also driven by the inadequate methods to treat endogeneity and the reverse causality issue, which is so prevalent in this complex topic. Endogeneity is typically seen when some of the independent variables, which appear to be exogenous, are in reality correlated with the error term. It can also occur when a relevant independent variable might be omitted from the ordinary least square (OLS), or due to reverse causality occurring between the independent variable and the dependent variable (Adams & Ferreira, 2009; Ong, 2019; Schultz et al., 2010).

Finally, the third stream of empirical studies with no correlations between board diversity and firm performance is primarily due to inconsistent use of contextual factors (e.g., governance systems), input parameters (e.g., data sources, size of data, and data time span), and limited understanding of the intervening or board governance processes (Banff & Sur, 2006; Dobbin & Jung, 2011; Ong, 2019; Schultz et al., 2010). Additional factors like generalizing results across industries, smaller sample sizes, and type of data compiled have contributed to mixed results (Hermalin & Weisbach, 2001; Ong, 2019; Rhode & Packel, 2010; Schultz et al., 2010; Wintoki et al., 2012). In tune with these developments, researchers have also tried to define different diversity attributes and proposed various measurement techniques to quantify the diversity attributes (Blau,1977; Harrison & Klein, 2007).

The Missing Elements

Despite the progress made in board diversity research, gaps are evident from findings in the extant literature. These gaps relate to limited qualitative and mixed method studies, restricting the diversity analysis to mostly demographic diversity with lesser emphasis on functional and cognitive diversities, and a lack of focus on the intersectionality or interactions between the different diversity attributes. There has also been limited evidence in the literature

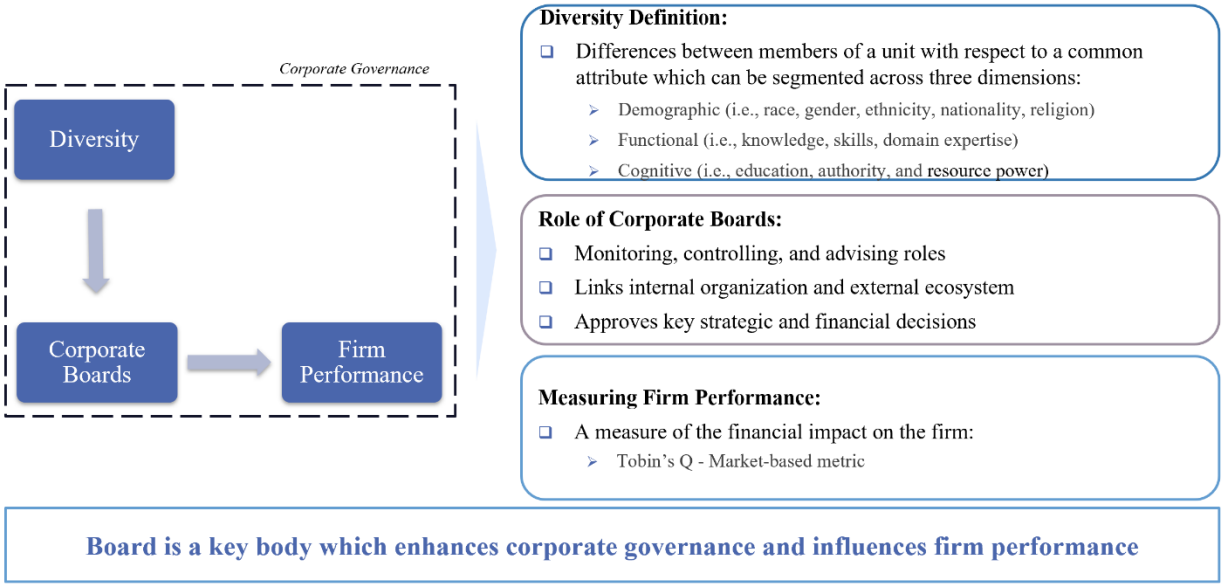
on the overall board governance process, which includes board member selection, assignment of leadership roles within the board, and the decision-making process. From a methodological perspective, the quantitative techniques and the types of datasets used for the analysis has varied across studies. The datasets for the quantitative analysis have varied by sample sizes, nature of data (i.e., panel vs. cross sectional), and the time periods considered for the data (i.e., single year to multi-year). Similarly, a variety of quantitative techniques are used ranging from OLS to two-stage least squares (2SLS) to generalized method of moments (GMM) methods, or hierarchical regressions based on the complexity of the governing equation, and the need to minimize any spurious results due to endogeneity and reverse causality.

The Study Explained

The study of board diversity falls within the corporate governance literature alongside other topics like board structure, board processes, influence of board size, board independence, role of independent directors, and the relevance of board quotas. The goal of the current study was to apply quantitative and qualitative methods to assess the influence of board diversity on firm performance of North American biotech companies (see Figure 1).

Figure 1

Board Diversity and Firm Performance Construct



The Role of Corporate Boards

The board of directors is a group of members with varied backgrounds who function as a team and collectively monitor, control, and advise the managers of a firm. The board is involved in setting strategy and discharging its fiduciary responsibilities to protect shareholders' interests. The board is also responsible for establishing and overseeing the governance system (e.g., CEO compensation and retention policies, and board recruitment or nomination committee policies) (Baysinger & Butler, 1985; Campbell & Mínguez-Vera, 2008; Hillman & Dalziel, 2003; Pfeffer, 1972).

Diversity Attributes

Board members bring different diversity attributes—both visible and invisible—to the governance of a firm (Jensen, 1993; Klein, 2002). Board diversity analysis is the study of how these visible attributes (e.g., race, gender, and age) and invisible attributes (e.g., skills, education,

resource network, and expertise) collectively influence firm performance (Milliken & Martins, 1996; Walt & Ingley, 2003).

Firm Performance

Firm performance is a proxy measure for the effective functioning of a board. The literature has suggested the use of both an accounting-based metric like the return on assets (ROA) or return on equity (ROE), or a market-based metric like Tobin's Q. ROA defines the profitability of a company in relation to its total assets and is the ratio of net income to the total assets of a firm. ROE is another profitability measure, which is defined as the ratio of net income to shareholders' equity. Tobin's Q is the ratio between the market value of a physical asset and its replacement value. It is defined as the ratio of the sum of market capitalization and book value of debt to the total book value of assets of a firm (Adams & Ferreira, 2009; Campbell & Mínguez-Vera, 2008; Carter et al., 2003; Dezsö & Ross, 2012; El-Faitouri, 2014).

The Biotech Industry Context

There were multiple reasons for pursuing a biotech-specific study. First, my professional career has been in this domain for over 18 years, so I had good knowledge about the industry dynamics and the changes that had occurred in the workforce demographics. This involvement in the industry motivated me to want to make a valuable contribution to the literature and the field. Second, in terms of industry statistics, the state of California has been home to 1,600 biotech/pharma companies and has employed approximately 60,000 direct employees (California Life Science Association, 2020). The employment numbers for the United States are much higher with over 1 million direct employees who cumulatively contribute around $1.2T worth of economic output (Biotech Innovation Organization, 2020). Third, a review of the literature showed no evidence of such a domain specific mixed method study, which made a compelling

case for pursuing such a study. Finally, the topic of board diversity is important to top management, investors, policy makers, social justice advocates, and academic researchers. There is also a significant academic interest in this topic with researchers from multiple disciplines (e.g., social sciences, business, finance, and management) analyzing the impact of board diversity. Given the acceleration of workforce demographics, the research to assess the impact of such rapid changes on various aspects of an organization was relevant and important to the academic community.

Board diversity and composition trends in the biotech industry have not been much different than other industries. The 2020 biotech industry survey showed, even though companies are approaching gender parity with 45% female employees overall, this near balance shrinks at the higher levels with a total of 30% female executives and 18% female board members. Representation of people of color was slightly lower at 32% overall. Again, this number lessened at the higher levels as 15% of executives and 14% of board members were people of color (Biotech Innovation Organization, 2020; see Appendix B).

Study Approach and Findings

This study was a mixed method explanatory sequential study with a focus on the biotech industry. Because the board is a key decision-making body, it was important both from an academic and corporate governance perspective to understand the fundamental questions of how, why, when, and whether board diversity affects firm performance.

In this section, the quantitative findings of the study are explained first, followed by the qualitative results. The first section gives a brief overview of the computation of different diversity indices and details the quantitative results obtained through the regression analysis of 100 companies. The subsequent section is the qualitative portion of the study, which synthesizes

the findings from the semistructured interviews of eight board of directors selected from the quantitative dataset.

Findings Summarized: Gender, Race, and Intersectionality

The dataset included 100 publicly traded biotech companies with a mix of early stage start-ups, midsize companies, and mature Fortune 100 companies with multibillion dollar annual revenues. The compiled dataset had a total of 909 board members, of which 72% were male and the remaining 28% were female. The distribution of male and female board members of non-White ethnicities accounted for less than 20% of the total board members, which highlighted the diversity gap in this domain. The data also showed that underrepresented directors comprising of women and people of color of either gender held the same education level and executive experience as the White male board members (see Appendix C).

Quantitative Results

As part of the quantitative analysis, descriptive statistics, diversity indices computation, and OLS regression were used to assess the influence of board diversity on firm performance. In the regression model, the independent variables were the three dimensions of diversity (i.e., demographic, functional, and cognitive diversity), board level parameters, and firm level parameters. The dependent variable was the market-based metric Tobin's Q, which denoted firm performance. The diversity indices (e.g., gender, racial and functional diversity) were computed using the well-known Blau's index. The Blau's index is based on the proportional representation of different categories and suitable when there are multiple evenly distributed categories in a population. For example, in the case of gender diversity, the Blau's index is a proportional representation of both the male and female directors (i.e., K = 2 categories). In the case of functional diversity, Blau's is a proportional representation of multiple functional categories. On

the other hand, cognitive diversity was a ratio based on the total number of members with the highest degree versus the total board members (i.e., highest degree equivalent to a PhD, MD, JD, or MD/PhD was assigned a value of 1, otherwise the value was 0).

A second approach to compute the gender diversity as an alternative to Blau's index was developed based on the principle of structural multicollinearity to account for inherent nonlinearities in gender, which was evident in the gender diversity analysis. Based on this principle, the gender diversity index was defined as the combination of a linear term in gender ratio and a quadratic term in gender ratio (i.e., square of gender ratio; Joecks et al., 2013). This proposed index is a function of one category (i.e., gender ratio) unlike Blau's index, defined earlier, which represents two categories (i.e., male and female, K = 2). If the number of categories in Blau's index is reduced to one category (i.e., female or K = 1) then Blau's index is the same as the proposed index, which is the square of the gender ratio. The maximum value for the proposed index is 1 for an all-female board and 0 if there are no women on the board. As per the percentage distribution of gender in the dataset, the proposed index provides a more realistic representation of gender diversity versus Blau's index. In the quantitative analysis section in Chapter 6, I discuss in detail the rational for using the proposed index versus Blau's index.

I applied the OLS analysis to evaluate the significance of different diversity attributes on various board sizes ranging from small boards (i.e., less than or equal to the median board size of nine members) to large board sizes (i.e., greater than the median size of nine members) and a full board. The regression analysis when controlled for board size indicated that gender ratio and gender diversity were significant across all board sizes. However, both the functional and cognitive diversities were more significant for larger board sizes. Alternatively, when both cognitive and functional expertise were mapped against gender ratio, it indicated these diversity

indices were significant for a gender ratio between 10% to 40%. Interestingly, race was not found to be significant across all board sizes or when cross-correlated against gender ratio. This may have been due to the smaller percentage of directors of color in the dataset (i.e., less than 20%). In terms of firm performance, Tobin's Q decreased for large boards due to higher agency costs, whereas Tobin's Q increased for smaller boards due to lower agency costs. These two findings aligned with the concepts outlined in the agency theory.

The next set of OLS analysis considered the board variables, firm variables, proposed gender diversity index, and the other diversity indices to assess the impact of the proposed diversity index on firm performance. The coefficients of the linear and quadratic terms of the gender ratio from the OLS were mathematically transformed, so the results indicated an inflection point at a gender ratio greater than 22%—at which point the firm performance or Tobin's Q shifted from a negative value to a positive value. This was an important finding that aligned with Kanter's (1977a) critical mass theory (CMT). This theory states a diverse board is more likely to add a positive value when the number of diverse members reaches a critical mass of members (e.g., 20% to 40% representation of women in a group). In this study, a gender ratio greater than 22% fell under Kanter's (1977a) definition of the "tilted group" (p. 209)—at which point the group moved from being a token to a minority group. Other researchers who tested Kanter's CMT have established that 30% of the board need to be female members to have a positive impact on firm performance (Joecks et al., 2013; Konrad & Kramer, 2006; Torchia et al., 2011).

The OLS analysis was further extended to test the notion of intersectionality between the three diversity indices. Intersectionality captures more than just differences in race or gender, but also interactions between each of the diversity categories. In the OLS regression, the interaction

between diversity attributes (e.g., race, gender) was taken as the product of different diversity attributes. However, the results from the regression analysis did not provide any meaningful results when intersectionality was considered. This was possibly due to the nature of the dataset or the fact that the product of diversity results in a fourth order polynomial, which translates to a low numerical value of the indices, some of them being close to 0.

As an alternative to intersectionality analysis, the slope dummy variable method was used to analyze the interaction between gender ratio and other independent variables. In this analysis, the qualitative attributes of gender ratio were represented by a dummy variable satisfying two different conditions (i.e., 1 if > 0.22 or 22% gender ratio and 0 if < = 0.22 or 22% gender ratio). The gender interaction effect was computed as the product of the gender ratio and the dummy variable subject to the two qualitative conditions of gender ratio when the firm performance was either negative or positive. The results from the dummy variable approach demonstrated similar conclusions as the OLS regression. The coefficients of the gender diversity from the slope dummy variable analysis were plotted against Tobin's Q, so the results clearly showed two segments with an inflection at a 22% gender ratio. The area under the first segment captured 25 firms whose gender ratio was less than 0.22 but not statistically significant. The area under the second segment captured the remaining 75 firms with a gender ratio greater than 0.22 and mostly low Tobin's Q but these were statistically significant. The firms with low Tobin's Q and higher gender ratio could be classified as small and midsize firms with an average board size of nine members. It could be inferred from this finding that small and midsize firms tended to attract more women and vice versa. In effect, such a symbiotic relationship between smaller firms and high gender ratio points to the existence of an endogenous relationship between female board members and firms with low Tobin's Q.

Qualitative Results

The qualitative portion of the analysis entailed conducting semistructured purposeful interviews for an average of 56 minutes with eight board members selected from the dataset. The purpose of the qualitative part of the study was to incorporate different perspectives of the board members with regard to board selection, board diversity, and board governance. An additional focus of the qualitative part of the study was to validate key findings from the quantitative part of the study (e.g., the importance of different diversity parameters, board selection process) and to validate the concept of critical mass of women required for positive performance. Finally, the goal of the interview was also to understand the reasons for underrepresentation of certain racial minorities and to capture successful board diversity strategies to make the boards not only diverse but also inclusive. The insights from the qualitative study did not address any unconscious bias the board members may have had while commenting on diversity issues.

A synthesis of qualitative findings showed board members value all forms of diversity with functional diversity topping the list followed by gender diversity. I found that boards do not make a deliberate attempt to diversify the board, but the inclusion of diverse members happens as and when a slot arises, or if an existing member leaves the board. Most members opined that the selection of a board member was primarily due to their functional experience and how their experiences supported the CEO's or firm's business objectives; race and gender complement the selection process. In the case of small and midsize firms, board member selection was largely based on a personal relationship with a CEO or a board member or based on a potential member's recognition in the industry. In the case of larger boards, it was different. The recruitment mechanism was more structured, bureaucratic, and generally conducted through an executive search firm.

The interviewees also provided insights on the differences in the functioning of small and large boards. Some female board members suggested they prefer small boards because of the flexibility it offers from a work–life balance perspective and the opportunity for a variety of work. Interviewees also indicated that it was much easier in small boards to build coalitions with other board members and the CEO. Most interviewees suggested large boards tended to be more bureaucratic with multiple committees and subcommittees, which reduced the interaction time with the CEO. The discussions in large boards were also more scripted and rehearsed versus free-flowing discussions in small boards. It was suggested that for a large board to be more productive the CEO should be a strong leader and a good facilitator to mediate between various committees and subcommittees. It was also noted the qualifications and requirements to get appointed to large boards were much different and stringent compared to small boards. Likewise, the compensation structure of a large board was much different (i.e., tend to pay higher) than that of a small board, which was mostly tied to stock options. The board members did confirm the existence of some degree of endogeneity in the selection of new board members, especially in smaller firms. In terms of the optimal size of a board for effective governance, interviewees suggested the board size should be between nine to 11 members.

The board members also concurred on the findings related to supply deficit of directors belonging to certain ethnicities (e.g., African Americans). It was suggested that firm leaders should make concerted efforts to diversify the senior management, develop a robust succession planning process, and groom the next set of leaders to mitigate the supply deficit.

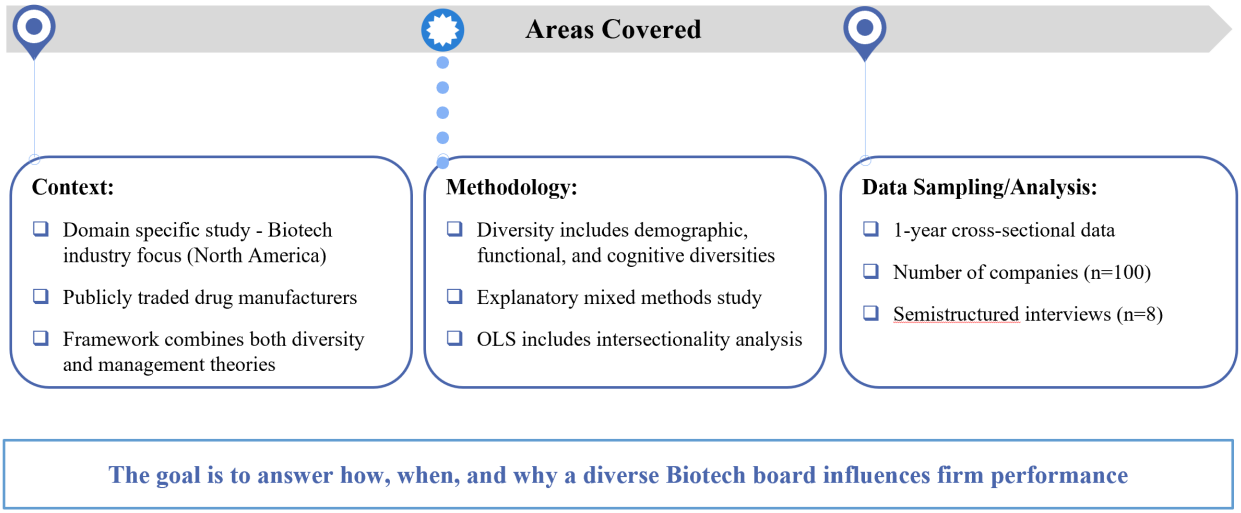
Study Contributions

This study made several unique contributions to the research on board diversity and corporate governance literature (see Appendix D). Specifically, the study addressed gaps

pertaining to three key areas in the literature (i.e., context, choice of diversity index, and methodology; see Figure 2).

Figure 2

Study Contributions



First, the study was a domain specific study with a focus on the North American biotech industry—a deviation from the literature, which is replete with examples of cross-industry studies. The study used 1-year cross-sectional data from 2019–2020, which was developed manually unlike the bulk of the literature that drew upon databases developed by private companies (e.g., BoardEX or CompuStat). To organically build the database, a systematized approach was developed to access information from four different public databases, (i.e., SEC filings for board information, company websites for biographical profile, LinkedIn to capture board member gender/racial characteristics, and Yahoo! Finance database to capture a firm's financial information). The approach developed in this study to capture the data can be easily extended to compile similar database in any other domain. The study used a unique theoretical framework by combining diversity theories, theories of corporate governance (e.g., agency

theory), and applied management theories (e.g., CMT) to better understand the correlation between board diversity and firm performance.

The diversity typology, computation of diversity indices, and applying the diversity typology to a board diversity problem was based on the theories developed in the social sciences research and literature (Harrison & Klein, 2007). Another unique contribution from the study is the method to estimate gender diversity as a combination of a linear term and quadratic term in gender ratio to capture the nonlinearities in gender diversity. This proposed index can be a substitute for Blau's gender index. The relevance and validity of the proposed index was explained in an earlier section.

The diversity analysis was further extended to understand the interactions of the three diversity attributes with each other (i.e., the influence of both gender and race or gender, race, and expertise), which is known as intersectionality or interaction between diversity attributes. The notion of intersectionality was first introduced in the social sciences literature and states that a diverse individual (e.g., person of color and woman) not only brings in the attributes and values of gender but also their race, ethnicity, functional expertise, and education (Hankivsky et al., 2009). This study attempted to unravel the complex interactions between different diversity attributes (e.g., which are assumed to be nonlinear in nature) and intersectionality from these diversities using an OLS regression analysis. Analyzing all three indices along with intersectionality was complex but it is a valuable contribution to the board diversity or management literature.

Another unique contribution of this study is the application of the slope dummy variable approach to help the understanding of the interactions between gender diversity and other independent variables. This interaction effect was analyzed by representing the interaction term

as the product of the gender ratio and a dummy variable, which captured the qualitative attributes of shift in Tobin's Q from a negative to a positive value.

The study also had a qualitative component—unlike most studies that are quantitative in nature. The qualitative part of the study entailed conducting a semistructured interview with eight board members selected from the quantitative dataset. To the best of my knowledge, this was the first explanatory mixed method study in the literature that is domain specific with a focus on the biotech industry. The analytical techniques developed to quantify cognitive diversity and compute gender diversity, and the use of all three dimensions of diversity in the analysis of board diversity on firm performance, was also unique to the literature.

Organization of the Study

I have organized the remainder of the dissertation as follows. Chapter 2 contains the process for literature search, a comprehensive review of several diversity theories, a brief overview of corporate governance, and the role of corporate boards. In this chapter, I discuss key findings from select literature and highlight the insights and developments to-date on this topic. In this chapter, I also identify the gaps and/or limitations evident in the literature analyzed. Chapter 3 is the methods section where I describe the research design, conceptual framework, initial hypothesis, and key management theories applied to analyze the research problem. Chapter 4 is the quantitative analysis section. In this section, I describe the data collection process, computation of diversity indices, and variables selected for regression analysis. Chapter 5 is the qualitative analysis section where I describe the process used for the semistructured interviews and qualitative data captured through board member interviews. In this section, I also describe the approach to recruit board members and the topics selected for discussions as part of the semistructured interviews. The process for the integration of the results from both the

quantitative and qualitative methods are also detailed in this chapter. In Chapter 6, I discuss the key findings starting with quantitative findings and closing out with the findings from the qualitative study. Chapter 7 is the final chapter, which summarizes the conclusions based on the quantitative and qualitative findings. This is followed by a description of the limitations of the current study. In the final section, I present opportunities for future research.

CHAPTER TWO: LITERATURE REVIEW

This section provides a general overview of the research on board diversity. Due to the exhaustive nature of the literature on board diversity, only select publications are reviewed in-depth and key insights highlighted, which were used as building blocks for this study. The review starts by analyzing different diversity theories and their applications to the current study. This is followed by discussing the role of corporate boards, board composition, Securities and Exchange Commission (SEC) regulations, and the argument for board quotas to enhance board governance. The next section of the review summarizes the literature into three categories (i.e., studies showing a positive influence of diversity on firm performance, a negative influence of diversity on firm performance, and having no impact at all). The final section captures the gaps and limitations of the literature and identifies research opportunities for this study.

Process for Literature Search

The process for the literature search was based on standard keyword search techniques using multiple databases like Academy of Management Association, Academy.edu, Elsevier, Google Scholar, JSTOR, and J. Wiley & Sons. The objective was to extract peer-reviewed studies published in leading international journals on economics, business management, and law. Additional sources included relevant PhD dissertations, and books or book chapters on board diversity. The time frame for the literature search ranged from 1970 to 2019. Papers were selected and sorted based on relevancy and impact factor (Seglen, 1997).

The records were searched based on key words containing simultaneously the terms “board diversity,” “gender diversity,” or “ethnic diversity” and “firm performance” in the title and/or abstract. The search yielded a total of 160 papers. These papers were categorized by relevance and importance to the research topic. Approximately, 30–40 articles closest to the

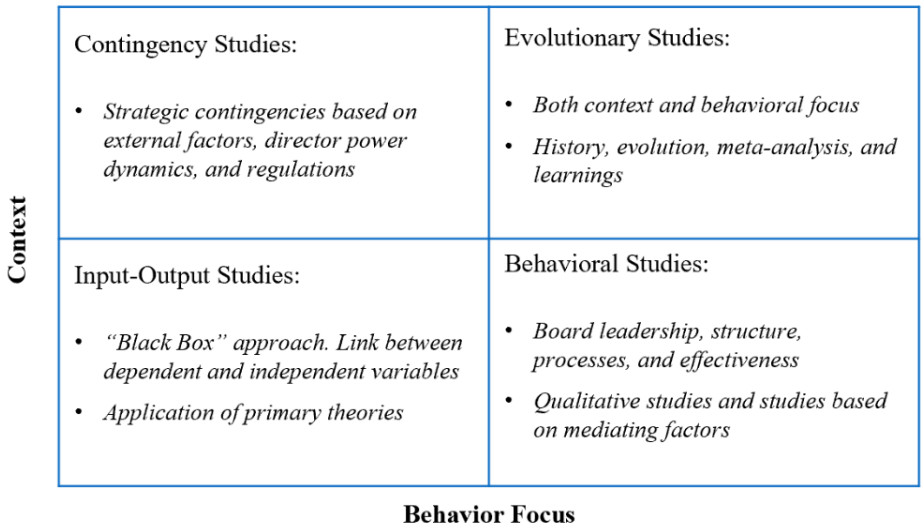
research topic were chosen for in-depth analysis and review. The papers that were excluded from the review were those focused on countries in Asia (e.g., Malaysia), mathematically oriented papers on governance, and others that focused on law and the ethics of diversity.

Key Findings From the Literature

The literature on board diversity can be categorized in the form of a two-by-two matrix into four groups (see Figure 3): (a) input–output studies covering 80%–90% of the literature, which focus on insider and outsider ratios, board size, director's shareholding, and CEO duality; (b) contingency or contextual studies, which focus on the context (i.e., industry, country, governance system), strategic contingencies faced by a firm, and relative power of board of directors with respect to external sources; (c) behavioral studies, which cover board composition, processes, decision making, relationships, and interactions inside and outside the boardroom; and (d) evolutionary studies, which combine both context and behavior and examine the evolution of the field over time (Finkelstein & Mooney, 2003; Gabrielsson & Huse, 2004).

Figure 3

Literature Review Positioning Matrix



My review of the literature focused on input–output and behavioral studies where the diversity attributes were used as independent variables, such publications constituted the bulk of the literature or approximately 80%–90%. Select references were made to contingency and evolutionary studies, as needed.

Theoretical Foundations: Diversity, Board Composition, and Corporate Governance

Diversity has been defined as "the distribution of differences among the members of a unit with respect to a common attribute, X, such as tenure, ethnicity, conscientiousness, task attitude, or pay" (Harrison & Klein, 2007, p. 1200). At the company level, most still use the Equal Employment Opportunity Commission (EEOC) definition of diversity, which prohibits discrimination based on race, religion, color, ethnicity, race, sex, sexual orientation, national origin, physical disabilities, and age (EEOC, 2022). In the corporate governance literature, diversity is typically defined and operationalized by race/ethnicity, gender, characteristics, skills, age, education, and expertise (Carter et al., 2003; Dalton et al., 1999; Walt & Ingley, 2003).

Diversity Typology

To organize various types of diversity, researchers have proposed several theories to define diversity and explain its effect on organizational performance. The three common theories used to define diversity typologies include:

- Social categorization theory, which asserts that variations in demographic composition of teams or groups can result in members coalescing into groups with similar characteristics (e.g., gender). This process can lead to the formation of in-groups or out-groups, which potentially hinders communication and cohesiveness of the group thereby affecting organizational performance (Hillman & Dalziel, 2003; Tajfel, 1981; Turner et al., 1987).

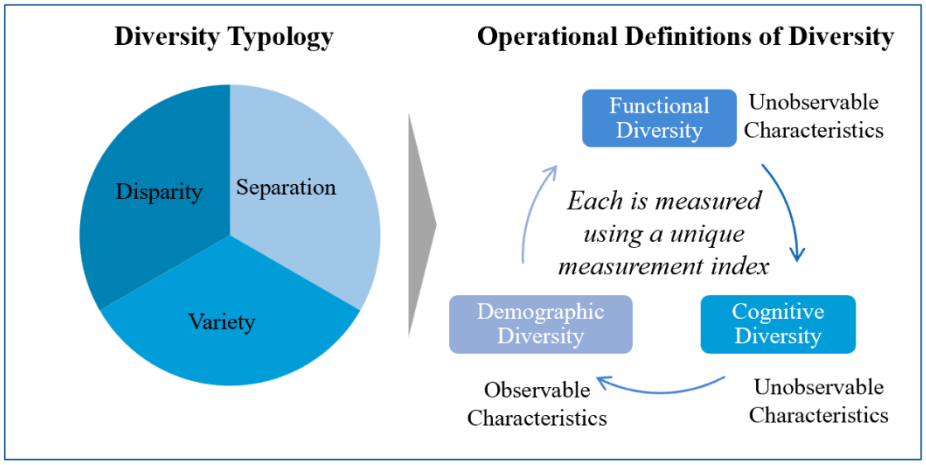
- Similarity or attraction theory asserts that the demographic composition of groups can result in members with similar characteristics (e.g., gender, race) being more cohesive, well integrated, and highly communicative thereby affecting organization performance (Byrne, 1971; Hillman & Dalziel, 2003; Pfeffer, 1985).
- Informational diversity and decision-making theory explores how diversity in a group impacts information processing and decision making. Based on these two theories, a diverse group can provide multiple viewpoints, process information differently, and enable more effective decision making, thereby affecting organizational performance. The role of the board is to advise the CEO on strategic decisions, allocate resources, and facilitate support from external stakeholders, all of which fall within the purview of information or decision-making theory (Harrison & Klein, 2007; Hillman & Dalziel, 2003; Williams & O'Reilly, 2000).

Based on these theories, diversity can be conceptualized along three dimensions: (a) separation, (b) variety, and (c) disparity. These conceptualizations generally refer to diversity within a unit or a group in an organization; however, the same concept can be extended to the composition of a corporate board as it also functions as a team or a unit. Separation is indicative of the horizontal differences in position or opinion or values among board members; variety is the differences in categorical characteristics like skills, knowledge, and functional expertise; and disparity is the vertical difference in power status, education, valued social assets, hierarchy or external relationships (Harrison & Klein, 2007). To quantify each diversity dimension, the diversity typology needs to be mapped to the operational definitions of diversity, which are commonly referred to as demographic diversity, functional diversity, and cognitive diversity.

Figure 4 shows the relationship between the diversity typology and operational definitions of diversity.

Figure 4

Diversity Typology and Operational Definitions



From an operational perspective, diversity is categorized into two groups based on observable and unobservable characteristics. The observable characteristics are defined as *demographic diversity*, which include age, gender, race, ethnicity, national origin, color, culture, and religion (Erhardt et al., 2003; Ratzan & Lant, 2019; Walt & Ingley, 2003). Among the unobservable characteristics are attributes like skills, career experience, functional expertise, and business sector experience, which are defined as *functional diversity*, whereas attributes like problem solving, power status, beliefs, education, valued social assets, and social networks are characterized as *cognitive diversity* (Erhardt et al., 2003; Maznevski 1994; Miller et al., 1998; Milliken & Martins, 1996; Petersen, 2000; Ratzan & Lant, 2019; Timmerman, 2000; Walt & Ingley, 2003). There has been a significant amount of research focused on analyzing the

influence of these board attributes on firm performance (Dowling & Aribi, 2013; Wagana & Nzulwa, 2016; Wellalage & Locke, 2013; Zahra & Pearce, 1989).

Demographic Diversity

The commonly used method of measuring demographic diversity (i.e., race and gender) is the well-known Blau's index, which captures the proportion of a unit member in each group or category (i.e., male or female). This index quantifies the probability that two members randomly selected from a group will be in different categories assuming either the population is infinite, or the sampling is based on replacement. The higher the value of the index the more dispersed the group is and the lower the value the group is more homogenous (Blau, 1977; Harrison & Klein, 2007; Solanas et al., 2012).

Research on board diversity has been replete with examples of analyzing gender focused boards and its relation to firm performance (Pettigrew 1992; Zahra & Pearce, 1989). Many studies have shown that boards with female directors gain a competitive advantage (Bilimoria & Huse,1997; Segal 1996), bring unique experiences and perspectives (Daily et al., 2003), and female directors also serve as role models to other female executives (Burke 1994; Ely 1995).

Functional Diversity

The predominant argument in the explanation of functional diversity is its impact on team performance and effectiveness due to the range of skills, expertise, and experience that each team member brings to a team. There are several studies that made the case for functionally diverse teams versus functionally homogenous teams. The findings highlight the positive influence on team performance as evidenced by increased innovation (Bantel & Jackson, 1989), improved strategic decision making (Bantel, 1993), ability to implement effective organization changes (Williams et al., 1995), and effectively responding to competitive threats (Hambrick et al., 1991).

Some researchers have used a more nuanced approach to conceptualizing functional diversity by classifying functional diversity as dominant functional diversity, which is the traditional classification based on the time spent by a team member in a functional area for most part of their career. Functional background diversity is diversity in the functional experiences of team members. This form of diversity focuses mainly on the differences in the functional background of each member, thus minimizing the overlap in their knowledge and expertise. Functional assignment diversity is diversity in team members based on functional assignments (Bunderson & Sutcliffe, 2002). Functional background diversity is positively associated with a diversity of beliefs and perceptions and those members with these traits tend to communicate more effectively (Glick et al., 1993; Sutcliffe, 1994). Empirical studies on teams with functional assignment diversity showed that this attribute enhances external communication (Ancona & Caldwell, 1992), allows teams to perform better in turbulent environments (Keck, 1997), and demonstrates sustained firm performance (Keck & Tushman, 1993). The current study focused only on dominant functional diversity by analyzing the specific functional expertise of a board member and the influence this diversity attribute had on board selection and governance (Dayan et al., 2017). The functional diversity was measured using Blau's index as it captures different categories in a group, which was the approach chosen in the study.

Cognitive Diversity

Cognitive diversity is a measure of how comprehensively and extensively executive decisions are made by senior executives (Miller et al., 1998). Cognitive diversity is defined as "relatively stable individual differences in preferred ways of organizing and processing information that cut across the personality and cognitive characteristics of an individual" (Kozhevnikov, 2007, p. 468). Each team or board member can interpret a problem differently

based on their ability to capture information, process information, and thereby develop unique solutions (Kress & Schar, 2012). To avoid the trap of having like-minded members in a team or a board, it is effective to have a nonhomogenous group with different problem-solving capabilities (Reynolds & Lewis, 2017). At a board level, such an approach to problem solving influences how a board collaborates and takes effective strategic decisions, thus impacting firm performance. The measure of cognitive diversity also varies based on the nature of topic assessed. Some have used psychometric survey tools (Kress & Schar, 2012), several used education level as a proxy for cognitive diversity (Aifuwa et al., 2020), whereas several others have proposed capturing the disparity between the members in a group using the Gini coefficient (Harrison & Klein, 2007). In the current study, cognitive diversity was measured as a function of the education level of a board member.

Corporate Governance

Corporate governance is the process of ensuring that all stakeholders act responsibly in the protection, generation, and distribution of wealth invested in the firm. The critical role of corporate boards is to ensure good governance through effective monitoring and control, resolving conflict among diverse interests of stakeholders, and providing board leadership (Daily et al., 1999; Ferreira, 2010; Hillman & Dalziel, 2003). Such effective governance is thought to improve the reputation of an organization, minimize the principal–agent problem, and preclude corporate scandals, frauds, and legal liabilities. These positive benefits of effective governance imply that corporate boards are central to the effective functioning of a firm (Hassan et al., 2015; Lipman & Lipman, 2006).

The Role of Boards

Corporate boards were developed in response to the increased complexity of businesses and to ensure separation of ownership and control. The boards are a link between the internal organization (e.g., composition, organization structure, and board dynamics) and their external ecosystem (e.g., industry, market, and regulations) and the interplay between them is inherently complex with significant implications for board composition and firm performance. The board is also the key decision-making body in a corporation, responsible for approving major strategic and financial decisions, and does the hiring and firing of top executives (Chambers et al., 2013). The role of boards includes the executive function performed by the inside directors, whereas the monitoring, controlling, and instrumental functions are performed by the outside directors, as it helps ensure board independence (Baysinger & Butler, 1985; Campbell & Mínguez-Vera, 2008; Hillman & Dalziel, 2003).

Board Composition: Arguments for and Against Diversifying Membership

Boards are considered to be either homogeneous, if there is a lack of diverse members, or heterogeneous, if it has diverse members. By analyzing the boards within the larger social structural context Westphal and Milton (2000) argued, “Boards have traditionally been viewed as a homogenous group of elites who have similar socioeconomic backgrounds, hold degrees from the same schools, have similar educational and professional training, and, as a result, have similar views about business practices” (p. 366). A board can be further classified into four major components: (a) composition (e.g., size and mix), (b) characteristics (e.g., age, education, style), (c) structure (e.g., number of committees, leadership), and (d) processes (e.g., decision making, frequency of meetings). A board consists of both inside and outside directors; this ratio varies based on the size of the board (Ferreira, 2010). Each board member brings a unique

perspective to the board based on their background, education, gender, ethnicity, skills, experience, and social connectedness; cumulatively called board attributes.

Changing workforce demographics and globalization has put intense pressure on companies to move toward a more diverse or heterogeneous board (Walt & Ingley, 2003). Taking note of these developments, many industry federations and political leaders have drawn attention to the significant loss of business value to firms if qualified minorities are excluded from consideration (Kurylko, 2005; Terjesen & Singh, 2008). Additionally, homogenous boards also raise significant political, economic, and ethical issues as the workforce continues to become diverse (Carter et al., 2003; Daily et al., 1999; Singh et al., 2001). The proponents of board diversity argue heterogeneous boards improve organizational processes, decision making, and board effectiveness as diverse members bring a wide range of skills like innovation, problem solving, creativity, and new perspectives. These attributes are claimed to positively influence firm performance (del Carmen Triana et al., 2014; Walt & Ingley, 2003; Zahra & Pearce, 1989). Lastly, there are many socially conscious investors who evaluate a company's board diversity prior to making investment decisions (Rampling, 2011).

On the other hand, opponents of board diversity, or heterogeneous boards, argue heterogeneous groups breed conflict, inhibit decision making, and form in-groups and out-groups, which increases agency costs and negatively impacts firm performance (Ely & Thomas, 2001; Richard et al., 2007). It can be inferred from previous information that board diversity and composition is complex, which entails striking a balance between ensuring social equity versus business value maximization.

New Regulations and Board Diversity

The collapse of companies like Enron, WorldCom, Lehman Brothers, and Bear Stearns in the early 2000s and the subsequent financial crisis of 2008 amplified the calls for more accountability and oversight of corporate boards. These events brought to fore the shortcomings in the corporate governance system. To address these shortcomings, the U.S. Congress passed the Sarbanes-Oxley Act in 2002, which mandated more accountability of CEOs and boards. This led to the demand for additional independent directors, which opened opportunities for hiring board members of color. In parallel, many existing directors reduced their presence in multiple boards due to more regulatory scrutiny and liabilities, which again created opportunities for women and directors of color (Fairfax, 2005).

The passage of the Shareholders Bill of Rights Act of 2009 resulted in changes to the board structure (i.e., CEO or chairman duality), director elections, shareholder proxy access, risk management, and compensation (Sarbanes-Oxley Act, 2002; Wilson, 2014). In 2010, the SEC passed Regulation S-K Item 401(e) to address the lack of diversity among board members (Fessler & Anslow, 2019). This regulation requires all publicly listed firms to disclose the application of diversity policy to the board nomination process, and if so, how the policy's effectiveness is assessed (Harding & Lemayian, 2018). These reforms have resulted in increasing the number of independent directors and opened many corporate boards to more diverse membership.

Legislating Board Quotas

Another emerging development on board diversity is the push for gender quotas, which is a concept driven by the principles of social justice to ensure equitable representation of all groups. In 2003, Norway became the first country to introduce 40% gender-based board quotas.

This was followed by Finland, France, Iceland, Spain, and Germany all at 40%; Canada and Israel at 50%; Belgium and Kenya at 33%; United Kingdom at 25%; and Australia at 30% (Terjesen et al., 2016). Asian countries like Malaysia stipulated a 30% gender quota, and since 2013 India has stipulated that public companies must have at least one female board member. In October 2018, the state of California passed legislations AB 979 and SB 826,[1] which stipulated that public companies:

> A bill signed into law by former Gov. Jerry Brown in September 2018 required public companies with headquarters in California to name at least one female director by the end of 2019. The law further mandates that companies with five-member boards have at least two female directors by the end of 2021; corporations with six or more directors need at least three women (Groves, 2019).

Empirical Studies Showing the Influence of Board Diversity

The results on the relation between board diversity and firm performance has been mixed and inconclusive. Studies can be broadly organized into four distinct arguments on greater board diversity: (a) it is positively correlated with firm performance, (b) it is negatively correlated with firm performance, (c) it shows no correlation with firm performance, and (d) the impact of endogeneity on firm performance.

Positive Correlation Between Board Diversity and Firm Performance

Studies have covered gender and ethnic diversity as mediating factors with positive influence on firm performance. In analyzing both ethnic and gender diversity, Erhardt et al. (2003) examined 127 large U.S. companies covering production, financial, and service industries. The cross-industry data for the study consisted of two separate single year data (i.e.,

[1] *On April 1, 2022, the Los Angeles County Superior Court struck down both the SB 826 and AB 979 legislations and deemed them unconstitutional.*

1993 and 1998). Both correlation and regression analysis were used to examine the relationship between variables. A hierarchical regression analysis (i.e., a two-stage process) of board characteristics (i.e., independent variables) showed a positive correlation with firm performance (i.e., dependent variable) as measured by return on assets (ROA) and return on equity (ROE). This conclusion was in line with other studies, which analyzed the impact of diversity at the organization level (Murray, 1989; Richard, 2000). The study did not explore if the behavior of diverse board members was different from nondiverse board members and if the differences in behavior contributed to a firm's performance. The positive correlation suggested a diverse board enhances monitoring and controlling functions, and thereby, increases firm performance. This argument was in line with agency theory, which states that effective monitoring and control increases firm performance. Agency theory is a commonly used theoretical framework by researchers in finance and economics based on the premise of a conflicting perspective between the principal and the agent. This theory posits that the agency relationship is a contract under which one or more persons (e.g., the principal or shareholders) engages with another person (e.g., the agent or managers) to perform services on their behalf (Jensen & Meckling, 1976; Wagana & Nzulwa, 2016). This natural separation between the principal and agent gives the agents a distinct advantage over the principals by way of asymmetric information and knowledge due to their proximity to the day-to-day operations of the company. Agency theory suggests the role of the board is to monitor, control, resolve the principal–agent conflict, minimize the self-serving interest of the agents, and ensure the agents act in the best interests of the shareholders (Carter et al., 2003; Chambers et al., 2013; Jensen & Meckling, 1976).

In analyzing the effect of board gender diversity (i.e., female directors only), Campbell and Mínguez-Vera (2008) examined 5-year panel data of 68 nonfinancial publicly listed Spanish

firms between 1995–2000 using a two-stage least squares (2SLS) regression analysis. The authors used the 2SLS to overcome issues around endogeneity and proved that the presence of female directors affected firm performance. Resource dependence theory was used as a framework to suggest that gender-diverse boards are more innovative, bring new perspectives, exhibit a wider range of knowledge and skills, and help expand external relationships. Unlike agency theory, resource dependence theory argues the key role of the board is to provide strategic resources (e.g., legitimacy, strategic guidance, fiduciary), reduce environmental uncertainty, and expand external relationships to maximize firm performance (Chambers et al., 2013; Salancik et al., 1978). Although agency theory highlights the internal relationships between board and CEO/staff, resource dependence theory emphasizes the external role of boards in securing funding and legitimacy.

Conyon and He (2017) studied the influence of gender diversity by examining 7-year panel data of 3,000 publicly listed firms (i.e., Russell Index) using quantile regression analysis. This type of regression is generally used when the conditions of linear regression (i.e., linearity and homoscedasticity) are not met. Quantile regression is also more robust against outliers in the response measurements (Conyon & He, 2017). The results from the study were segmented into high-performing and low-performing firms. A key finding was that female directors had a significantly larger positive impact in high-performing firms relative to low-performing firms, suggesting a heterogeneous use of their knowledge, skills, and expertise. The authors drew upon threat-rigidity theory (Gladstein & Reilly, 1985) from social psychology and job matching and sorting theories from labor economics (Wheeler, 2001) to explain the heterogeneous impact of gender diversity. The inference was smaller companies felt threatened by the knowledge and

expertise of female directors, whereas well-performing and more mature companies were open to new perspectives.

Another frequently referenced study linking board diversity to firm performance is the research by Catalyst. This study compared over 500 leading U.S. firms between 2001 and 2004 and the results indicated firms with the greatest proportion of female board members showed significantly higher returns on three different financial measures (i.e., ROA, ROE, and return on invested capital; Catalyst, 2009).

In a study exploring the concept of mediating factors, Miller and del Carmen Triana (2009) considered firm reputation and innovation as mediating factors to examine the board diversity and firm performance relationship. The authors selected data from 432 publicly traded Fortune 500 firms and used two major theories as part of their analysis (i.e., the behavioral theory of the firm [Cyert & March, 1963] and signaling theory [Certo, 2003; Deutsch & Ross, 200]). Behavioral theory was used to explain the connection between board racial and gender diversity and innovation, whereas signaling theory was used as a mechanism to enhance firm reputation by intentionally signaling board composition and board characteristics to the public (Certo, 2003). The authors concluded: (a) innovation and firm reputation effectively mediate the relationship between board racial diversity and firm performance, (b) a positive relationship exists between board diversity (i.e., gender and racial) and innovation, and (c) in the selected sample the influence of gender diversity on firm performance was positive but not statistically significant.

A key challenge in board composition is determining the critical number of women or ethnic minority directors required to ensure board diversity without compromising firm performance. To overcome this challenge, Kanter's (1977b) seminal work on gender diversity in

groups (i.e., CMT) is leveraged to determine the optimal board compositions. The CMT postulates that until a certain threshold or critical mass of women in a group is reached, the focus of the group members will not turn toward the different skills and abilities that women bring into the group (Kanter, 1977b).

Several researchers have applied this concept to board diversity research. Notably, Joecks et al. (2013) built on Kanter's (1977a) CMT to argue that a critical mass of female directors was required for a positive impact on board effectiveness and firm performance. The authors analyzed 5-year panel data of 151 publicly listed German firms between 2000–2005 to examine the link between gender diversity and firm performance. The results showed when gender diversity reached a critical mass of about 30% of total board membership, the firm performance was on par with all male boards. This conclusion also supported the earlier work of a corresponding magic number of women in the boardroom (Joecks et al., 2013; Konrad & Kramer, 2006; Torchia et al., 2011).

In a subsequent study of an ethnically diverse board, Carter et al. (2003) used single year data from 1977 of 797 Fortune 1000 U.S. firms to explain the influence of board diversity on firm performance. About 50% of the sample had a minimum of one or more directors of color. The firms with single directors of color were excluded from the study to avoid the trap of tokenism. The results showed firms with two or more directors of color had larger asset values, larger board size, and conducted more annual meetings in comparison to the average data in the sample. These firms also performed better in terms of Tobin's Q, or ROA, in comparison to boards with single female directors. It indicated that monitoring and controlling functions are more effective in boards with higher numbers of directors of color resulting in reduced agency costs (Carter et al., 2003).

In a study by Radu and Simali (2022) on the impact of gender diversity and corporate response to cyber risk, the results showed a positive relation between the level of cybersecurity disclosure and board gender diversity. The study used panel data of 60 companies listed on the Standards & Poor (i.e., United States) and Toronto Stock Exchange (i.e., Canada) and covered the period 2014–2018. More importantly, the study proved a board with a critical mass of three women will have a positive impact on corporate response to cyber risk and corporate governance. These results validated the earlier research findings that a critical mass of women (30%) is required to support positive corporate governance (Carter et al., 2003; Joecks et al., 2013; Kanter 1977a).

Taking a qualitative approach, Konrad and Kramer (2006) interviewed female directors of Fortune 1000 companies and concluded that in situations with a board representation of three or more female directors, women tend to have a greater impact on board decision making and board effectiveness. This again validated the earlier result of 30% representation based on Kanter's (1977a) CMT (as cited in Joecks et al., 2013).

A 2017 comprehensive qualitative study by Cheng et al. analyzed board effectiveness, size and composition, practices, and internal governance. The authors surveyed 2,390 directors of global companies between 2012 and 2015, followed by semistructured interviews of 75 directors to capture detailed information on board dynamics. The responding directors represented public and private firms from a wide variety of industries and countries, which included both common law and civil law systems.

There were several findings from the study of Cheng et al. (2017). First, the results confirmed findings that boards place more emphasis on providing counsel to the CEO rather than monitoring the top management team. Secondly, directors of public common law companies are

older, more experienced, and internal governance practices are also more mature. Third, new directors were invariably selected based on prior connection to the CEO or another board member. This called to question if a newly appointed director can function truly as an independent and outside director. Finally, the results from the survey suggested the board has increased effectiveness based on a directors' skills and experiences rather than just demographic diversity.

In a comprehensive meta-analysis, Post and Byron (2015) synthesized 140 studies in the literature covering 35 countries in five continents to explain the prevailing mixed results in the literature. The meta-analysis used proximal factors (i.e., board monitoring activities) as mediating factors to establish a link between board composition and firm performance. The upper echelons theory was applied to understand if and under what conditions female board representation affects firm performance. Upper echelons theory was used to explain the differences in male and female directors' cognitive frames (i.e., their knowledge-seeking and information evaluation processes), which are derived from their experiences, knowledge, skills, and values. The upper echelon theory was used to explain the differences in cognitive frames in a diverse board, which ultimately shapes the monitoring, advising, and controlling functions of a board (Hambrick, 2007; Hambrick & Mason, 1984).

Despite several studies showing positive correlations with firm performance, the meta-analysis identified three major gaps in the literature, which negated the positive implications as evident by the results of some studies. First, the meta-analysis highlighted the lack of literature that considers natural or cultural contexts when analyzing board diversity. Factors like regulatory/legal mechanisms, the degree of shareholder protection, gender parity, and countries in which a firm operates significantly influence firm performance. Second, the analysis pointed

to very few studies using intermediary mechanisms to explain the link between board diversity and firm performance; thus, studies have not addressed questions on why board diversity is related to firm performance. Third, the literature has used varied aspects of diversity to define board composition.

In a 2021 study, Mohsni and Shata examined the moderating effect of firm size on the relationship between board diversity and firm performance of 371 firms cutting across industries, which are traded on the Canadian stock exchange. The authors used panel data covering the years 2010–2019. The analysis considered three different measures for gender diversity: (a) the number of women on a board, (b) the percentage of women on a board, and (c) a dummy variable to indicate the presence of at least one female member on a board. The independent variable also included an interaction term defined by the product of diversity and firm size. This interaction term was used to capture the moderating effect of firm size on the relationship between board diversity and firm performance. In this study, ROA and ROE were used as a measure of firm performance.

The results showed the board gender diversity effect on firm performance was positive for most industries except for industrials. The results also showed that as firm size increased, the positive relationship between board gender diversity and firm performance diminished. This suggested that female directors have a positive impact on the performance of smaller firms compared to larger ones. A major reason supporting this finding was that smaller firms offer a more conducive environment to maximize the potential impact of female directors.

Negative Correlation Between Board Diversity and Firm Performance

Although there has been significant research pointing to a positive correlation between board diversity and firm performance, such positive correlations have been questioned in many

of the board diversity studies. Adams and Ferreira (2009) analyzed panel data between 1996 to 2003 of 1,939 large U.S. firms and found the average effect of gender diversity on firm performance to be negative even though boards with more women were considered to be better at monitoring (e.g., agency theory). It can be inferred from this study that in cases of stricter monitoring the benefits described in the agency theory may not hold. The authors concluded "the positive correlation between performance and gender diversity shown in prior literature is not robust to any method of addressing the endogeneity of gender diversity. If anything, the relation appears to be negative" (Adams & Ferreira, 2009, p. 306).

In a study of heterogeneous versus homogeneous board composition, it was found homogenous boards members are known to cooperate well, have less emotional conflict, and exhibit more trust in each other due to social similarity (Carter et al., 2010; Erhardt et al., 2003; Walt & Ingley, 2003; Westphal & Milton, 2000). On the other hand, heterogeneous boards have different leadership styles, personalities, and sociocultural differences, which can result in conflicts leading to suboptimal board effectiveness (del Carmen Triana et al., 2014; Walt & Ingley, 2003; Zahara & Pence, 1989). Several research studies showed that diverse boards are less cohesive, tend to form in-groups and out-groups, experience communication breakdowns, and slow down decision making (Adams & Ferreira, 2004; del Carmen Triana et al., 2014; Kanter, 1977a, 1977b; Wellalage & Locke, 2013). Such suboptimal board effectiveness could potentially increase agency costs, decrease firm performance, and be a severe detriment to succeed in a competitive business environment (Hambrick et al., 1996).

Shrader et al. (1997) conducted an exploratory study of 200 Fortune 500 U.S. firms and found a negative correlation between the percentage of women on the board and firm performance. Of the non-U.S. publications, Smith et al. (2006) examined 2,500 listed and

unlisted Danish firms between 1993–2001 and concluded that female board representation failed to have a positive link with firm performance. In a similar study, Rose (2007) examined 443 Dutch firms and found no significant relationship existed between the percentage of female directors on Danish boards and firm performance as measured by Tobin's Q.

Many companies have identified organizational and board diversity achievement as a corporate goal. To assess the impact of such corporate objectives, Farrell and Hersch (2005) examined board diversity of a list of Fortune 500 companies from 1990 to 1999. The study found that when the goal of the company is gender diversity it tends to add female directors to make-up for any underrepresentation on the board and/or will allocate a vacant seat caused by a director exiting the board to a female director. The results showed that female directors did not have a significant effect on company performance. A possible explanation is that firms performing well and having diversity as a corporate goal seek out diverse members and vice versa, but once appointed women and/or directors of color may not have the desired effect (Dobbin & Jung, 2011; Rhode & Packel, 2010).

No Correlation Between Board Diversity and Firm Performance

The third stream of empirical studies are those finding no correlations between board diversity and company performance. The lack of correlation in results is typically attributed to the contextual factors (e.g., governance systems), input parameters (e.g., data sources, size of data), intervening mechanisms (e.g., board functioning), and the methodology used to control endogeneity (Banff & Sur, 2006; Dobbin & Jung, 2011; Schultz et al., 2010).

In the analysis of 142 New York Stock Exchange firms, Hermalin and Weisbach (1991) compared the percentage of outsiders on boards to firm value as measured by Tobin's Q. The authors concluded there was no significant relationship between the percentage of outsiders on

the board and firm value. Similarly, Carter et al. (2010) studied a sample of Standards & Poor 500 companies from 1998 to 2002 and did not find any correlation between board diversity and firm performance.

Zahra and Stanton (1988) investigated the relationship between the percentage of directors of color and firm performance using several financial measures (e.g., ROE and earnings per share) and found no statistically significant relationship. Similarly, Farrell and Hersch (2005) examined a sample of 300 Fortune 500 firms between 1990 and 1999 and showed that firms with strong profits (i.e., ROA) appointed female directors but once appointed these directors did not have significant impact on firm performance.

Ong (2019) analyzed board diversity and performance relationships of 300 publicly listed companies in Australia with board data ranging from 2008 to 2015. The study highlighted that the conflicting findings in prior studies in the literature was due to endogeneity and suboptimal attempts to address the causal relationship. This study used a dynamic generalized method of moments (GMM) estimation with an external instrumental variable. The findings of this study showed that board gender diversity had no significant relationship with company financial performance, as measured by Tobin's Q.

Wang and Clift (2009) examined 500 listed Australian companies and found, even though gender diverse boards do not perform poorly, the results between diversity and firm performance was not statistically significant. The authors argued the absence of a critical mass of directors prevented female directors to fully exploit their potential and talent. In a similar qualitative study, Broome et al. (2011) explored critical mass theory (CMT) by interviewing 45 directors on how a diverse board adds value. Even though every director interviewed supported a diverse board, most failed to come up with concrete examples about the benefits of a diverse

board. A synthesis of the interview notes summed up the dilemma about the value of a diverse board. According to Broome et al. (2011), “You’re never going to have a board that will honestly question whether or not there is a value associated with that diversity. And people will accept it and move on” (p. 805).

Methodological Challenges: Endogeneity and Board Diversity

Endogeneity may be present in any complex relationship and is of concern as it undermines causal inference (Ong, 2019; Schultz et al., 2010). The link between board diversity and firm performance is one such complex relationship. For example, successful firms may seek out directors with certain characteristics to establish diverse boards and, at the same time, female and directors of color want to join boards of successful companies. Thus, endogeneity can manifest itself across several dimensions, namely, omitted variables, reverse causality, and measurement errors (Ong, 2019; Schultz et al., 2010).

A primary reason for the mixed results in the literature on board diversity is also due to inadequate treatment of endogeneity and reverse causality (Ong 2019; Schultz et al., 2010). Additionally, other issues have been identified as undermining the validity of diversity studies. These include generalizing results across industries, smaller sample sizes, shorter time period of data, and methodological limitations to treat endogeneity, which generally contributes to mixed results (Hermalin & Weisbach, 2001; Ong, 2019; Rhode & Packel, 2010; Schultz et al., 2010; Wintoki et al., 2012).

Schultz et al. (2010) and Wintoki et al. (2012) outlined three possible sources of endogeneity, which are common in most studies. These are: (a) unobserved heterogeneity (i.e., a relation between two or more variables is affected by an unobservable factor), (b) simultaneity (i.e., the dependent variable and one or more of the explanatory variables are jointly determined),

and (c) dynamic endogeneity (i.e., a variable's current value is influenced by its value in the previous period). The widely accepted analytical approaches to deal with endogeneity and reverse causality issues are ordinary least square (OLS) fixed effects models, OLS fixed effects models with instrumental variables, and one-step models with lagged dependent variables (Arellano & Bond, 1991). Some studies also use a 2SLS regression analysis with instrumental variables and a few others use the GMM with instrumental variables (Campbell & Mínguez - Vera, 2008; Dobbin & Jung, 2011; Hermalin & Weisbach, 2001; Ong, 2019; Schultz et al., 2010).

Conclusions: Lessons Learned and Gaps in the Literature

The results on board diversity are varied and advance arguments supporting positive, negative, and/or no effect. Some studies attributed the negative and neutral results to the existence of spurious relationships between independent variables. The mixed results are context driven for numerous reasons starting with the choice of theories, approach to compute diversity attributes (e.g., gender ratio vs. Blau's gender vs. percentage of women), methodological approaches, and assumptions around the role of board, all of which contribute to different outcomes.

The synthesis of the literature showed that studies have used a variety of datasets, which includes panel data, longitudinal data, and cross-sectional data types covering a range of time periods (i.e., single to multiyear). The literature largely emphasized demographic diversity with limited studies on functional and/or cognitive diversity. In terms of quantitative approaches, studies used different types of regression analysis based on the problem statement, dataset, board composition, and governance systems. In general, the most frequently used regression analysis was the fixed-effects model in cases where the omitted variables are arbitrarily correlated with

the explanatory variables or the random effects model when the omitted variables are not arbitrarily correlated with the explanatory variables. More advanced statistical techniques like the 2SLS regression or a GMM method with instrumental variables or hierarchical regression analysis are used to address the issues of endogeneity, reverse causality, and to overcome any spurious correlations between independent variables.

The literature fell short in terms of considering natural or cultural contexts. For example, factors like regulatory and legal mechanisms, gender parity, gender quotas, interaction between diversities, and the countries in which a firm operates. Finally, there was a limited number or lack of qualitative studies examining the intermediary mechanisms (e.g., board member selection process, board functioning, and board governance) to explain the link between board diversity and firm performance. As a result, the questions on how, when, and why board diversity influences firm performance has not been completely addressed (Finkelstein & Mooney, 2003; Roberts et al., 2005).

Establishing the Case for the Current Study

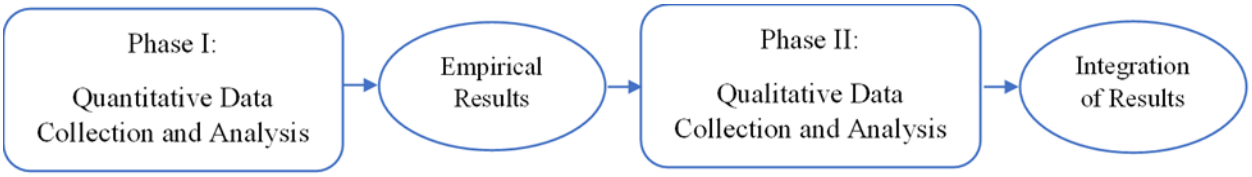
The conclusions from the literature survey highlighted the following: (a) context matters (i.e., governance system, theory); (b) preference for gender and the percentage representation is critical for positive performance; (c) the case for other forms of diversity beyond gender is important; and (d) the social, political, and business environments continue to focus on diversity, inclusion, and equity. Finally, there is a need to understand the voice of the board members to gather real-world insights on board diversity, board selection, and board governance. The current study built on the findings from the extant literature to examine the case for board diversity with the premise that a diverse board, when accounted for multiple forms of diversities, positively influences firm performance.

CHAPTER THREE: RESEARCH METHODOLOGY

This study was a mixed method explanatory sequential design, which occurred in two distinct phases (see Figure 5). The decision to use an explanatory sequential method was based on the problem statement, access to data, and the limited set of such studies in the literature. The quantitative analysis was prioritized for the first phase of research because compiling board of directors' data through secondary research was much faster and easier. The subsequent phase of study entailed collection and analysis of qualitative data obtained from semistructured interviews of eight board members selected from the quantitative dataset. The purpose of the qualitative phase was to validate key quantitative findings and to capture more in-depth insights about board recruitment practices, board diversity, and board governance. The qualitative phase provided more context, depth, and complements the empirical results derived in the quantitative phase (Creswell & Plano Clark, 2018).

Figure 5

The Explanatory Sequential Design



Note. From "Designing and Conducting Mixed Methods Research (3rd Edition)," by J. W. Creswell and V. L. Plano Clark, 2018, SAGE Publications, p. 66. Copyright 2018 by SAGE Publications. In the public domain.

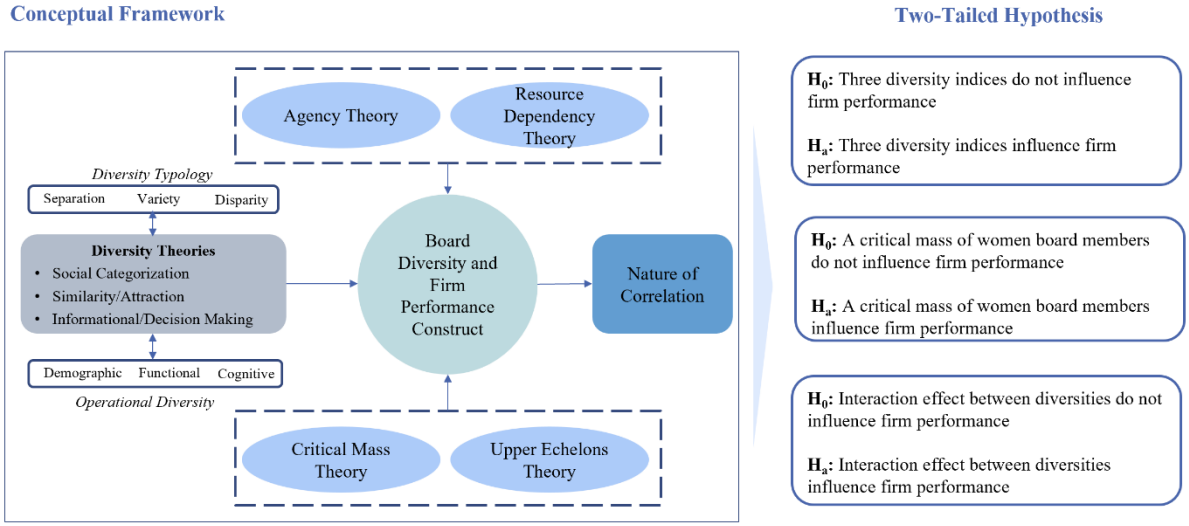
Research Framework

The theoretical framework and research design of this study was based on the application of the foundational theories of the agency and resource dependence theories. These foundational theories were supplemented by other theories such as the critical mass theory (CMT) and upper echelon theory. Most importantly, the study applied the social categorization, similarity attraction, and information processing theories to define the diversity typology and operationalize each diversity attribute with appropriate diversity measurement techniques.

Other theories like stakeholder theory, human capital theory, social justice theory, or behavioral theory could have also been considered. However, based on the proposed problem statement and in the interest of conciseness only the theories shown in Figure 6 and described in detail in the subsequent section were considered in the development of the theoretical framework.

Figure 6

Conceptual Framework for Board Diversity and Firm Performance



Agency Theory

Agency theory is a commonly used theoretical framework by researchers in finance and economics to understand the link between board characteristics and firm performance (Carter et al., 2003; Hermalin & Weisbach, 2001; Zahra & Pearce, 1989). It is based on the premise of conflicting incentives arising due to the asymmetric information between the principal and the agent. This theory posits that the agency relationship is a contract under which one or more persons (i.e., the principal) engages with another person (i.e., the agent) to perform certain services on their behalf (Carter et al., 2003; Jensen & Meckling, 1976; Wagana & Nzulwa, 2016). This natural separation between principal (i.e., the board) and the agent (i.e., the CEO) gives the agents a distinct advantage over the principals by way of asymmetric information and knowledge due to their proximity to the day-to-day operations of the company. The agents are assumed to be self-interested individuals who tend to maximize their personal utility over that of the shareholders resulting in higher agency costs. For example, the CEO or staff may withhold certain information or shirk their responsibilities if there are no consequences. As per the theory, the role of the board is to monitor and control, resolve the principal–agent conflict, and ensure that the agents act in the best interests of the shareholders. Such mediating actions reduce the agency costs, and thereby, increase firm performance (Carter et al., 2003; Chambers et al., 2013; Jensen & Meckling, 1976).

Resource Dependence Theory

Although agency theory emphasizes internal relations between board and the CEO, resource dependence theory highlights the external relations of boards. This theory provided a theoretical foundation for the role of directors in corporate boards. The resource dependence theory adopts a more consensus driven perspective where the managers are intrinsically

motivated and act in the best interest of the shareholders (Chambers et al., 2013; Davis et al., 1997). The central argument of resource dependence theory, first developed by Salancik et al. (1978), is that companies operate in an open system and boards serve as a link between the corporation and external environment (Mintzberg, 1983). According to this theory, the primary purpose of the board is to provide strategic resources (e.g., legitimacy, advice and counsel, links to other organizations; Chambers et al., 2013; Rao & Sivakumar, 1999).

The board of directors are expected to bring four major benefits to a corporation: (a) expertise and counsel, (b) establishing communication links between the firm and the external ecosystem, (c) preferential access to resources (i.e., financial, physical, knowledge, information etc.), and (d) legitimacy (Salancik et al., 1978). Several empirical studies have used the four elements to study the effects on board governance and its link to firm performance (Boyd, 1990; Dalton et al., 1999; Pfeffer, 1985).

Some limitations of resource dependence theory are rooted in the dependency factor with external organizations. This dependency often leads to power imbalances and lowers negotiating power (i.e., excessive dependence on defense contracts, which will allow the government to dictate policies) with external organizations and internal groups who are well positioned with more resources.

Upper Echelons Theory

Upper echelons theory states that both the strategies and effectiveness of organizational outcomes are reflections of the values and cognitive biases of powerful actors (i.e., senior executives) in the organization (Carpenter et al., 2004; Hambrick, 2007; Hambrick & Mason, 1984). This theory was originally designed to study top management teams; however,

researchers have extended this to analyze corporate boards as the board members are considered as “supra top management teams” (Post & Byron, 2015, p 10).

This theory states each director will differ in their cognitive frames, or in other words, their information-seeking and information-evaluation processes due to their experiences, knowledge, and values (Hambrick, 2007). Such a variation in cognitive frames shape the board functioning and decision-making processes, which in turn influences firm outcomes (Hambrick, 2007). It can be inferred that the difference in the cognitive frame of the director’s results in heterogeneous ideas in a diverse board. It should be noted that cognitive frames are difficult to capture, as a result researchers have used observable characteristics of directors such as their race or gender as proxies for cognitive frames (Dezsö & Ross, 2012; Krishnan & Park, 2005).

CMT

A central concept in research on board diversity is the notion of a critical mass needed to influence board performance. The CMT is based on the seminal work of Kanter as part of her work on the status of women in large U.S. corporations (Kanter, 1977a, 1977b, 1987). Kanter (1977a) suggested the nature of group interactions depends upon the size of the group and further argued that when the size of the subgroup (i.e., women and/or people of color) reaches a certain threshold, or critical mass, the subgroup’s degree of influence increases. In other words, the theory suggests when the minority group reaches critical mass, a qualitative change will take place in group interactions. It indicates underrepresented members are essentially operating in majority-dominated environments and have little chance to exert influence on the organization until they are a sizable number (Granovetter, 1978; Kanter, 1977a). Based on group interactions Kanter constructs four categories of groups:

Uniform groups – These are when all the members of a group share the same external characteristics, also defined as a homogenous group. In the case of gender, the group will be 100% male even though some in-group differentiations may exist (Kanter, 1977a).

Skewed groups – The group is skewed toward dominant members (e.g., men) and these dominant members control the minority (e.g., women). The culture of the group is driven by the dominant members. The few "minority" members are referred to as *tokens* and are treated as categories rather than as individuals. The *skewed* group consists of up to 20% women (Kanter, 1977a).

Tilted groups – These are when the distribution of minority group (e.g., women) is less extreme. In this group, minority members can develop coalitions and influence the majority. These members are not considered as part of a social category but recognized more for their skills and expertise. This group has 20%–40% representation of women (Kanter, 1977a).

Balanced group – This is when the distinction between majority and minority groups gets blurred. Instead, these groups turn into subgroups where skills and expertise are emphasized more, and gender-based differences are less important. This group has 40%–60% representation of women (Kanter, 1977a).

Intersectionality

The history of intersectionality can be traced to the marginalized and oppressed experiences of minority women in and outside the United States. It gained momentum during the black and Latina feminists movements of the 1970s and 1980s, which highlighted the artificial separation of gender and ethnicity and the continued neglect of the voices of minority women by mainstream feminism. The term intersectionality was coined in 1989 by U.S. legal race scholar Crenshaw (2015). As intersectionality has gained popularity, it has been interpreted and

described in various ways (e.g., as a theory, paradigm, methodology, or framework). At a fundamental level the concept of intersectionality is to bring about social transformation, build coalitions among different groups, and ensure social justice (Else-Quest & Hyde, 2016).

In general, the basic definition underlying intersectionality is that every member of a unit or a team can be characterized as belonging to multiple social categories (e.g., race, age, gender, ethnicity, and religion). These socially constructed categories carry individual and contextual facets while portraying power and power interrelations dynamics. It is argued that these social categories intertwine with individual identities at the individual level and at the organization level with the wider institutional processes/practices and structural systems (Else-Quest & Hyde, 2016). If intersectionality is viewed as a critical theory, then it conceptualizes contextual knowledge and reflects political and economic power.

Intersectionality is viewed by scholars (Crenshaw, 2015; Else-Quest & Hyde, 2016) as lending itself to qualitative research methods due to the central role of understanding the lived experiences of oppressed minorities through focus groups, storytelling, observations, and or interviews. Intersectionality can also be used in quantitative studies to help understand the individual effects (i.e., additive approach) or system interactions (i.e., the multiplicative effect of race and gender) of different social categories. In this study, intersectionality is factored as part of the quantitative analysis by including the multiplicative effect of the diversity attributes in the ordinary least square (OLS) regression model (Atewologun, 2018; Crenshaw, 2015).

As the workforce continues to become more diverse the notion of intersectionality continues to gain importance both in business management and academic research. Intersectionality becomes relevant not only at the organizational level, but even at the executive and board level. After all, a board is a unit that consists of members with different diversity

attributes. Accounting for intersectionality in board diversity analysis is akin to extending the logic of a holistic approach to diversity by examining the interrelations between social categories (Else-Quest & Hyde, 2016). To my knowledge, such an approach is not evident in applied management or board diversity literature.

Initial Hypothesis

This section presents the research hypothesis based on the proposed theoretical framework (see Figure 6) in the earlier section and the literature review. The diversity theories described earlier suggested the three dimensions of diversity have an impact on firm performance in varying degrees. However, the research studies were restricted mostly to demographic diversity with results showing that a greater percentage of women on boards leads to enhanced firm performance (Adams & Ferreira, 2009; Carter et al., 2003). Despite these positive results, such a narrow view of diversity is suboptimal in nature as it discounts the impact of functional and cognitive diversities on firm performance. A similar argument can be made for studies not focusing on the interaction effect between each of these diversities. As the business environment and workforce demographics become more diverse, so does the need to examine the influence and interaction effect between each of the three diversity attributes.

Functional diversity, a hidden attribute, is defined as a board member's specific area of expertise such as leadership, innovation, operations, sales and marketing, or finance and measured by how it complements the overall expertise of a board (Bunderson & Sutcliffe, 2002; Dayan et al., 2017). Cognitive diversity is also a hidden attribute like functional diversity. A standard way to operationalize and measure cognitive diversity is lacking. Some researchers consider cognitive diversity as a measure of how comprehensively and extensively executive decisions are made by senior executives (Miller et al., 1998). Other studies have argued

cognitive diversity as a specialized skill in problem solving in the context of a project team or a decision-making group and its subsequent implications for team performance. This study extends these three definitions of diversity to analyze the implications of board diversity on firm performance using the following two-tailed hypothesis:

- H_0: Board diversity (i.e., either demographic diversity – race and gender, or functional diversity, or cognitive diversity) does not influence firm performance.
- H_a: Board diversity (i.e., demographic diversity - race and gender, or functional diversity, or cognitive diversity) does influence firm performance.

In line with Kanter's (1977a) CMT, this study argues that a diverse board is more likely to contribute unique experiences, knowledge, and values when the number of diverse members reach a critical mass or an optimal number (i.e., 20% to 40%), which positively influences firm performance (Ely, 1994; Joecks et al., 2013; Kanter 1997a, 1997b; Radu & Smaili, 2022). These arguments put forth by Kanter and subsequent researchers on this topic led to the establishment of the following hypothesis:

- H_0: A critical mass of female members do not influence firm performance.
- H_a: A critical mass of female members do influence firm performance.

The ability of the firms to consider multiple perspectives due to its diverse composition tends to improve the monitoring, advising, and controlling functions and decision making, which results in increased firm performance (Alvarez & McCaffery, 2003; Loyd et al., 2013). Based on these arguments the following hypotheses were examined:

- H_0: Interaction between diversities does not influence firm performance.
- H_a: Interaction between diversities does influence firm performance.

Research Design

This section outlines the research design, methodological frameworks, and empirical measures used to analyze the board diversity and firm performance relationship. This study used a combination of both the postpositivist and the interpretivist paradigms. The postpositivist paradigm reflects the need to identify and assess the causes that influence outcomes, such as found in experiments. The knowledge developed through this paradigm is based on observation and measurement of the objective reality that exists in the world, in this case it is the existence and effects of diversity (Creswell, 2014). In contrast, the interpretivist paradigm focuses on the belief that individuals seek an understanding of the lived experiences (Frechette et al., 2020). This approach enables the researcher to gather insights based on the participant views (e.g., board member interviews), which by nature lends itself to qualitative analysis. A combination of these two paradigms or the quantitative and qualitative approaches is the well-established mixed method study (Creswell, 2014).

Mixed methods leverage the strengths of both the qualitative and quantitative studies, and thereby, offset any prevalent weakness seen in each of these methods. Thus, a combined approach provides more in-depth insights and new knowledge of a research problem in contrast to studying a problem using either a quantitative or qualitative approach separately (Creswell & Plano Clark, 2018).

Operationalization of Key Concepts

As the demographics of the biotech industry continues to change, the issue of diversity becomes central to board governance. At the board-level, diversity is not only a composite construct, but also attribute specific. The references to a diverse board composition points to the board as a whole and not necessarily to the specific differences or features of the individual

board members. In this study, the focus was on the specific and unique diversity attributes of each board member, which was aggregated at the board level description to assess its influence on firm performance. Accordingly, the unit of analysis for the quantitative study was the board and the unit of analysis for the qualitative study was the board processes.

The operational definitions of diversity (i.e., demographic, functional, and cognitive) can be mapped to the diversity typology based on the approach proposed by Harrison and Klein (2007; see Table 1). Both the demographic and cognitive diversities can be aligned with separation and disparity as they are treated as a continuous function. Whereas functional and/or demographic diversity is aligned with variety as these are discrete functions (Harrison & Klein, 2007; Tsui & Gutek, 1999; Williams & O'Reilly, 2000). These three diversity elements can be measured using various indices like the standard deviation, Blau's index, and the Gini coefficient (Blau, 1977; Campbell & Mínguez -Vera, 2008; Roberson et al., 2007; Stirling, 1998). These diversity indices range from 0 to 1 with 0 indicating no diversity and 1 indicating maximum diversity.

Table 1

Definition and Properties of Diversity Types

Diversity type	Operational definitions	Description	Attribute shape	Measurement indices	Measurement scale and min to max range
Separation (S)	Demographic and/or cognitive	Differences in position or opinion among board members (e.g., values, beliefs, or attitudes)	Bimodal distribution with half of unit members at highest and lowest endpoints of S continuum	$(G/R + (G/R)^2)$, where G/R = gender ratio, OR $1 - \sum_{i=1}^{n} p_i^2$, where I = 1, . . . n categories	Ratio: Min = 0, Max =1 Blau's - categorical 0 to (k - 1)/k Min = 0, Max = 1
Variety (V)	Functional and/or demographic	Differences in source, or relevant knowledge or experience (e.g., unique or distinctive information)	Uniform distribution with even spread of members across all possible categories of V (no continuum)	$1 - \sum_{i=1}^{n} p_i^2$, where I = 1, . . . n categories	Categorical 0 to (k - 1)/k Min = 0, Max = 1
Disparity (D)	Demographic and/or cognitive	Differences in proportion of socially valued assets or resources held among members; inequality or relative concentration	Positively skewed distribution with one member at highest endpoint of D continuum and others at lowest	Highest degree = 1 Cognitive ratio = No. with highest degree / Total no. of members	Ratio Min = 0, Max = 1

Even though it appears that different diversity elements can be combined (i.e., summed or averaged) to get a total diversity index, researchers caution against such an approach as each index lies on a different continuum. Besides, any addition or averaging can mask the actual effect of the individual diversity elements, which could potentially result in inaccurate research conclusions (Harrison & Klein, 2007). However, a few researchers have used an average or summation approach after defining the context and the assumptions for the analysis (Dayan et al., 2017; Rao, 1982).

Most studies in the literature use demographic diversity as a proxy for both functional and cognitive diversity as it is sometimes challenging to capture these two sets of data. In contrast, demographic data are easy to capture and measure using Blau's index. However, there were a handful of studies that captured functional diversity and used a different index to measure this diversity type (Dayan et al., 2017; Rao, 1982). An effective approach to capture the functional and cognitive diversity data are through a qualitative study or through secondary sources, which was the intent of this study. The current study applied the following indices to measure the different forms of diversity extracted from Table 1:

Demographic Diversity Index is estimated using any of the following:

- Blau's index = $1 - \sum_{i=1}^{n} p_i^2$ i = 1,…n (n is no. of categories)

Blau's index is a well-established index that is used by most researchers. However, the current study proposed a different way to measure the gender diversity index with the premise that the nonlinearities inherent in gender diversity (GD) can be explained using a combination of a linear function and a quadratic function of gender ratio. This supposition resulted in the following equation to estimate gender diversity, $GD = F(GR, GR^2)$:

- Gender Diversity Index = $\left(\frac{No.\ of\ diverse\ members}{Total\ number\ of\ members}\right) + \left(\frac{No.\ of\ diverse\ members}{Total\ number\ of\ members}\right)^2$

The Functional Diversity Index was measured using the Blau's index:

- Blau's index = $1 - \sum_{i=1}^{n} p_i^2$ i = 1,…n (n is no. of categories), or

The Cognitive Diversity Index was measured as follows:

- Cognitive = $\frac{No.\ with\ highest\ degree}{Total\ number\ of\ members}$ Highest degree = 1, otherwise 0

Appendix E captures the approach used in this study to compute different diversity indices.

Properties of Blau's Index

Blau's index is the probability that two randomly selected individuals from a particular population belong to different subgroups (Kader & Perry, 2007). A higher value (i.e., probability) reflects a higher degree of diversity. Blau's index has an upper bound and a lower bound. Its minimal value is 0 when all the observations are concentrated in one category (e.g., $P_1 = P_2 = \ldots P_K = 0$); its maximum value is 1 indicating the group is significantly diverse and is achieved when the distribution over the K categories is uniform (i.e., $P_1 = P_2 \ldots = P_K = 1$).

Blau's index is sensitive to the number of categories or groups in a particular setting. One way to overcome any problems that may arise when seeking to compare distributions that have different numbers of categories is to "normalize" Blau's index relative to its upper bound (Agresti & Agresti, 1978). A normalized Blau's index allows for direct comparisons of results from studies with different numbers of categories. For a group with K categories, the normalized maximal value can be expressed as (K - 1)/K, and it is achieved when the distribution over the K categories is uniform (i.e., $P_1 = P_2 \ldots = P_K = 1/K$). The normalized Blau index can be expressed as Blau's index multiplied by the normalization factor K/(K - 1).

- Normalized Blau's Index = Blau's index/ Blau(Max) = $(K/(K-1))$ * (1 - $\sum$1- $(P_i)^2$)

An example of calculating the three diversity indices is shown in Appendix F for Amgen Inc. corporate board, a large Fortune 100 company, which was part of the dataset.

Qualitative Analysis

A qualitative study followed by a quantitative study with the purpose of validating specific results and to help explain or complement the quantitative results and provide more insights, is known as the explanatory sequential design. Such a study is ideal when a researcher leverages qualitative data obtained through the perspectives of research subjects to validate the significance of the quantitative results and/or explain the anomalies or surprising results, which cannot be easily explained through a quantitative analysis (Silverman, 2017). The choice for an explanatory sequential design is most advantageous when:

- The problem is skewed more towards a quantitative analysis and is best to first start with the quantitative phase (e.g., as in the case of the current study).
- The critical variables are known *a priori* based on prior literature with the ability to capture key measurements or metrics.
- Availability of time to conduct the research in two phases but limited resources (i.e., sole investigator) allow to collect and analyze only one set of data at a given time.

The current study used a two-phased approach to analyze the complexities inherent in board composition. The aim of the first phase was to identify the overall trends and statistically significant diversity, board, and firm level variables through a variety of OLS analysis. The quantitative study also acted as a bridge to establish the sampling plan and interview protocol for a subsequent qualitative study (Creswell & Plano Clark, 2018). The qualitative phase of the study was used to validate some of the findings of the quantitative analysis and record the voice of the board members on various aspects of board diversity, board selection, and board governance through semistructured interviews.

CHAPTER FOUR: QUANTITATIVE APPROACH

The quantitative analysis portion of this study entailed first capturing board member characteristics, board level data (e.g., size, number of independent directors), and firm level data (e.g., age, number of employees, total assets) of 100 North American based biotech companies. The dataset was cross-checked for validity and redundancy through multiple data sources. The initial step in the analysis was to aggregate the individual board member data to a company board level. The next step was computing the diversity indices based on the equations determined in Table 1. The firm level financial metrics (e.g., Leverage, Tobin's Q) were computed using standard formulas based on the financial data captured in the dataset.

The entire dataset was analyzed using both the descriptive statistics and ordinary least squares (OLS) techniques. The goal of the quantitative study was to understand the correlation between diversity indices, board variables, and firm variables with firm performance and to recognize those variables that enable this correlation. Some of the findings from the quantitative analysis was further validated by a follow-up qualitative study, which included semistructured interviews of a small sample of board members randomly selected from the dataset.

Steps Involved in Quantitative Analysis

In general, the approach to both quantitative and qualitative analysis involves using similar set of steps, if not the same. The approach adopted for this study for the quantitative analysis, according to Creswell and Plano Clark (2018), can be broadly classified into the following five steps:

1. *Preparing the data for analysis* – Includes creating the data structure, developing the database, data scrubbing, and verifying the data for accuracy. Additional steps are standardizing the dataset, and transforming the data using algorithms, or formulas.

2. *Assessing the data* – Visually inspecting data, resolving the data gaps, understanding the distribution, running descriptive analysis, and evaluating data for reliability and validity of measures.
3. *Analyzing the data* – Developing research questions, deriving hypothesis, determining the type of inferential statistical tests needed to prove or disprove the hypothesis. Finally, analyzing the dataset using the SPSS software package.
4. *Summarizing the results* – Understanding the impact on the dependent variable, evaluating R^2, significance based on *p* value, and checking for issues of multicollinearity.
5. *Interpreting the results* – This includes interpreting the results in relation to hypothesis or research questions, highlighting key findings and comparing these findings to the literature. Final step is assessing implications for future research and highlighting the limitations of the study.

Data Collection Process

The data collection process consisted of identifying 100 drug development and manufacturing companies listed in the U.S. stock exchange through a publicly available list of biotech company databases. This list included start-ups, midsize, and large size firms cutting across all regions in the United States. The sample selection was based on the following conditions:

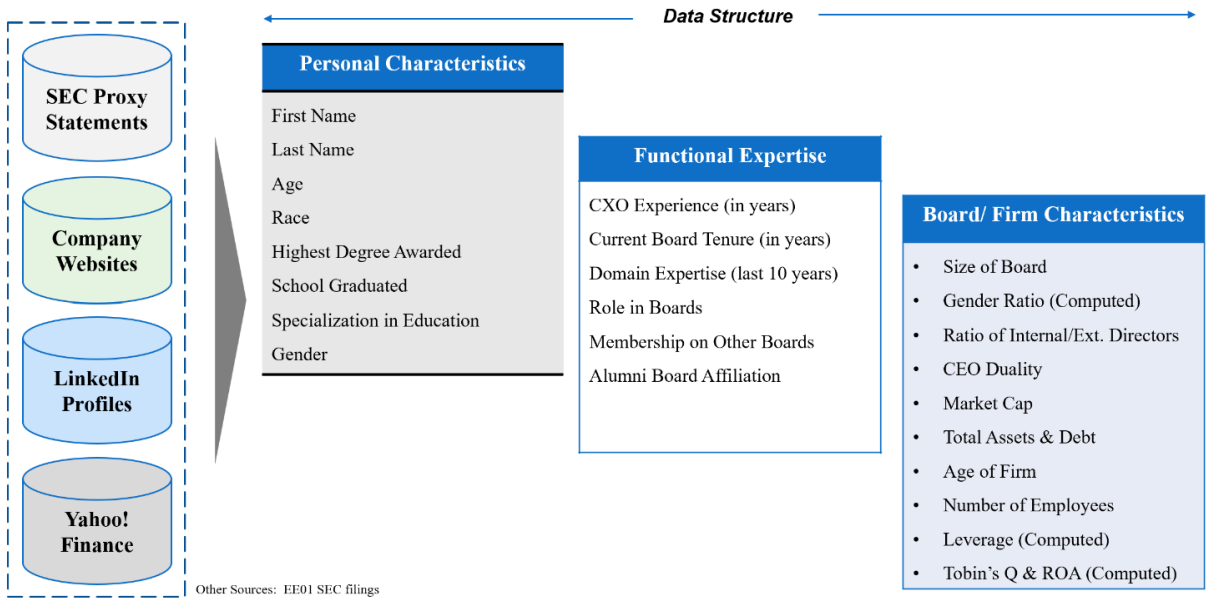
- The number of board members should be greater than 5
- Company age should be greater than 5 years
- Companies with and without revenues (e.g., a mix of large, midsize, and start-ups)

The dataset was 1-year cross-sectional data of clinical development and drug manufacturing companies for 2021. Initially, a total of 106 companies were identified. Six companies from the total were discarded for either (a) not being a biotech company, (b) having headquarters outside the United States, or (c) being a professional services company. This resulted in a final sample of 100 companies with a total of 909 records of board member data.

The data collection methodology consisted of first defining the data structure and identifying key variables required for the quantitative analysis. The data structure and the choice of variables was identified based on the problem statement, hypothesis, and research questions. Another source used to validate the choice of variables was prior literature on this topic. The data structure consisted of three major categories (a) board member or personal characteristics, (b) functional expertise, and (c) board and firm level characteristics (see Figure 7).

Figure 7

Board of Directors Data Structure



Board Member Data

The biographical, demographic, and education details of a board member was captured from company websites, which listed the names and biography of each board member. The websites also listed prior executive roles and education. In cases where data gaps existed, LinkedIn was used to capture the missing information. The race and gender characteristics of the board member was based on the picture profile posted on the company website or LinkedIn pages. The gender ratio, ratio of independent directors to inside directors, and board size were all computed using standard formulas from the captured board data for each company.

Member Expertise Data

The member expertise data were captured by analyzing an individual member's biography on the company website, LinkedIn, and Securities and Exchange Commission (SEC) filings. The SEC proxy statements were a good source to capture the board member's enrollment date, age, and the committee role assignment in a board. The goal was to capture their dominant career roles in the last 10 years along with their industry and domain expertise. The membership on other boards and total years of board experience was also captured through LinkedIn or from information presented on the company websites.

Board and Firm Level Data

The primary source for board and firm level data were the company SEC filings (i.e., 10K and proxy statements), which captures the board size, number of independent directors, board role assignment, expertise, and the dual role of a CEO (i.e., chairman and CEO). The firm level financial data like market capitalization, total assets, total debt, beta, number of employees, and year founded was obtained from Yahoo! Finance by searching for each company using the

stock symbol. This information was used to compute the financial metrics like the Tobin's Q, return on assets (ROA), leverage, and debt to equity ratio using standard financial formulas.

Cross-Check of Board of Directors and Firm Level Data

Several approaches were considered to cross-check and validate the compiled data. The approach used in this study to validate the board of directors' data was to compare the captured information against annual reports, news articles, and Bloomberg or Morningstar databases. Any data discrepancies were reconciled after validating the information from these secondary sources.

Data Aggregation

A total of 909 individual board member data spreading over 100 companies was captured in a 24 column Excel spreadsheet. Excel was the preferred choice as it provided the flexibility to automate the data analysis using Visual Basic (VB) programming language. As the board was the unit of analysis, the individual board member data were summarized to a company board level through a process of aggregation. This aggregation was done by grouping board members belonging to the same company. For example, if company ABC had a board size of 10 members, then the diversity characteristics (i.e., demographic, functional, and cognitive) were calculated by factoring the information for all the 10 members and computing the diversity index for the ABC company, which by default was the board. Similarly, the board age was an average of the ages of the individual board members and aggregated to the company level. The experience of the board was computed as the average experiences of all the board members in each board. The whole process of data aggregation was automated by writing a VB program in Excel. The aggregation of all 909 records resulted in a total of a 100-line dataset, where each line represented the data for a single company. The time to compile a VB code for data aggregation took about 2 to 3 weeks, which included writing the script, testing, and validation of the VB code.

It should be noted that the board member data capture process was manual and tedious at least initially until a structured process was established, which optimized the time to compile each company board of directors' data. It took approximately 4 to 5 hours to accurately compile the dataset for each company. If such a manual information gathering process had been automated by writing a software code that could "crawl" multiple websites and grab the required information, then automation of the data capture and the data aggregation technique could be effectively employed to compile board level data of any domain or industry.

Empirical Methods

This study employed OLS multiple regression analysis to test the hypotheses concerning the implications of board gender diversity on firm performance. SPSS statistical software was used to run the diagnostic testing, descriptive statistics, and regression analysis of the dataset. The following subsections present the methods employed in the quantitative part of the study.

Descriptive Statistics

Descriptive statistics were used to draw out the minimum, maximum, mean, variance, and standard deviation of important explanatory variables and the dependent variable. A significant variation of a variable from the mean provided insights on the nature of the distribution of the variable, which was used in the regression analysis.

Multicollinearity Test

Pearson's correlation matrix was used to examine the data for multicollinearity. The guideline adopted for identifying if multicollinearity existed between two explanatory variables is a correlation greater than 0.8. If multicollinearity existed among the explanatory variables, then it would have resulted in incorrect parameter estimates and produced biased results. Multicollinearity could also increase the variances and standard errors of the estimates and these

estimates would also be sensitive to the changes in specifications. All this would undermine the impact of the explanatory variables on the dependent variable (Studenmund, 2014).

OLS Analysis – Method 1

The study was a comprehensive statistical analysis that examined the effect of board diversity parameters on firm performance. The analysis included descriptive statistics, OLS with fixed effects, OLS with intersectionality, and OLS with dummy variables to analyze the interaction effect of gender (i.e., slope dummy variable approach). The general expression of the OLS regression model for the board diversity problem can be written as follows:

$$FP_i = \beta_0 + \beta_1 GR_i + \beta_2 GD_i + \beta_3 RD_i + \beta_3 FD_i + \beta_4 CD_i + \beta_5 BCV_i + \beta_6 FCV_i + €_i \quad (1)$$

Where, i = 1, … n observations (n = 100), and

FP_i – The n x 1 matrix of financial performance (Tobin's Q) across n observations

GR_i – The n x 1 matrix of gender ratio measured across n observations

GD_i – The n x 1 matrix of gender diversity (i.e., either Blau's index or the proposed gender index which is a function of gender square) measured across n observations

RD_i – The n x 1 matrix of Blau's racial diversity measured across n observations

FD_i – The n x 1 matrix of Blau's functional diversity measured across n observations

CD_i – The n x 1 matrix of cognitive diversity (ratio) measured across n observations

BCV_i – The n x 1 matrix of J categories of board level variables across n observations:

- $Boardsize_i$ – n x 1 matrix of the size of board across n observation
- $CEODulaity_i$ – n x 1 matrix of the CEO's dual role across n observation
- $MemOnOtherBoards_i$ – n x 1 matrix of the membership on other boards

FCV_i – The n x 1 matrix of K categories of firm level variables across n observations

- ROA_i – n x 1 matrix of the return on assets across n observation

- $FirmAge_i$ – n x 1 matrix of the age of a firm across n observation
- Leverage – n x 1 matrix of a firm's leverage ratio on other boards

β – The unknown m x 1 vector of regression parameters or coefficients

ε – A n x 1 vector of the error term

i – The number of n observations of the sample

m – The number of control variables used in the analytical model

The coefficients (i.e., β_0, β_1) in the regression equation described the impact of a 1-unit increase in a control variable (e.g., GR_i) on the dependent variable FP_i (i.e., firm performance) by holding all the other variables constant. A similar explanation can be made for the impact on a 1-unit increase in FP_i by any other control variable while holding the remaining variables constant. The stochastic error term ε was added to explain the variations in FP_i, which could not be explained by all the control variables (Studenmund, 2014).

In the literature, it is common to see the application of either an accounting-based metric (e.g., return on assets [ROA] or return on equity [ROE] or a market-based metric like Tobin's Q or a combination) to determine the company financial performance. In this study, Tobin's Q was used to measure the company's financial performance. Tobin's Q reflects the market value and market's expectation of the companies' future growth (Adams & Ferreira, 2009; Campbell & Mínguez-Vera, 2008; Dezsö & Ross, 2012) and is estimated as follows:

$$Tobin's\ Q = \frac{Market\ Value\ of\ Equity\ +\ Book\ Value\ of\ Debt}{Book\ Value\ of\ Assets}$$

Where,

Market value of equity = (Total number of shares issued X share price)

Book value of debt = Total liabilities, and

Book value of assets = Total assets

Control Variables

The objective is to include several critical control variables both at the board level and firm level to assess their influence on firm performance. The board level variables define the key characteristics of the board and similarly the firm level variables define the key characteristics of the firm. The approach to the selection of board and firm variables was based on prior literature, the research questions, and industry experience (Adams & Ferreira, 2009; Mohsni & Shata, 2021; Pham et al., 2011; Schultz et al., 2010; Yan et al., 2021).

Board-Level Control Variables. The board variable selected in this study was the size of board, which was equal to the total number of directors in a board. Board size is an indicator of the extent of monitoring, controlling, and advising function required by a board (Fama, 1980; Jensen & Meckling, 1976). Large boards are generally seen in big companies (i.e., several billion dollars in market cap and several thousand employees) with complex global businesses. In such cases, the governance mechanism is also complex, requiring more members to ensure effective functioning of the board. The disadvantage of such large boards is the potential increase in agency costs, thus negatively impacting firm performance (Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Hermalin & Weisbach, 2001; Lückerath-Rovers, 2013). On the other hand, there were studies that argued smaller boards create more value than larger boards, tend to be more effective, and incur lower agency costs (Bhagat & Black, 2002; Mak & Kusnadi, 2005; Yermack, 1996). Some studies have also mapped the relationship between board size and performance and showed board size and performance construct follow an inverted U-shaped curve (Perez de Toledo, 2009; Yan et al., 2021). The question arises as to how to balance these competing arguments versus board size. The studies on the optimal number of directors suggested boards with seven or eight members are most effective, whereas boards greater than

this number are less effective in performance. These findings aligned with the concepts described in the agency and resource dependency theories (Lipton & Lorsch, 1992; Yan et al., 2021).

The dual role of chairman and CEO of a company by one board member is referred to as "CEO duality" (Iyengar & Zampelli, 2009, p. 1092). The role of the chairman is to be an unbiased and effective mediator between the external board members and the internal directors. This requires effective coordination, communication, and advising roles to ensure effective board functioning (Ammari et al., 2014; Iyengar & Zampelli. 2009). On the other hand, the CEO as an internal director has an intimate knowledge of the functioning of the company, thus giving the CEO an advantage into taking appropriate decisions and dealing with problems in an effective and timely manner. There are numerous companies with the CEO having a dual role. However, it should be noted that CEO duality can potentially result in a concentration of excessive power with one individual, thereby limiting a board's monitoring and controlling ability and diluting the board independence and governance mechanism (Fama & Jensen, 1983). It was not surprising to see studies that argued for the separation of the role of CEO and chairman as it reduces conflict of interest, minimizes abuse of power, and ensures board independence while enhancing firm performance (Carty & Weiss, 2012; El-Faitouri, 2014; Jensen & Meckling, 1976).

Firm-Level Control Variables. Several firm-level variables were considered based on the research questions and prior board diversity studies. These were ROA, leverage ratio, firm age, and number of employees. These firm-level variables were obtained from secondary research by analyzing the financial reports, company SEC filings (e.g., 10K, proxy statements), and company websites. The age of a company was computed as the difference between the current date and the day of its inception (Boone et al., 2007; Fama & Jensen, 1983). The log of employees, which was used as a proxy for the size of the company, was a computed value by

taking the logarithm of the total number of employees obtained from the financial statements (Boone et al., 2007). Leverage is a financial ratio, which is a computed value and is the ratio of total debt over total equity. Leverage is a frequently used control variable in gender diversity studies (Adams & Ferreira, 2009; Schultz et al., 2010; Wang & Clift, 2009). The leverage ratio essentially indicated the ability of a company to meet its financial obligations. A ratio greater than 1 indicated the company has more liabilities than assets and is highly leveraged. Such companies require a higher level of board monitoring resulting in increased agency costs, and thereby, reduced firm performance.

ROA is another financial performance variable that has been used in many studies either as an independent variable or as a dependent variable. The ROA is computed as the ratio of the earnings before interest and taxes to the total assets, which can be obtained from a company's financial statements (Adams & Ferreira, 2009; Farag & Mallin, 2017; Terjesen et al., 2016).

Gender Ratio and an Alternative to Blau's Diversity Index

Gender ratio is the ratio of the number of female directors to the total number of board of directors and is a linear term. It is a commonly used ratio that considers the board size in relative terms and provides a meaningful board diversity measure (Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Ong, 2019).

Based on the diversity analysis and to account for nonlinearities in gender, it was determined that the gender diversity index can be expressed as a combination of a liner term and a quadratic term in gender ratio (GR). Adopting the principle of structural multicollinearity, the proposed gender diversity index can be expressed in the form $AX + BY^2$, where the "X" term is the linear value of GR and the "Y^2" is the quadratic value GR^2 (Joecks et al., 2013). On the other hand, Blau's gender index was the proportion of both male and female members in the board

composition. It factored only the quadratic value of relative representation of each category (i.e., men and women). To better understand the nonlinearities in gender, the alternative or proposed index can be used as a substitute for Blau's diversity index.

OLS Regression With Intersectionality – Method 2

Intersectionality by its very definition moves beyond single or typically favored categories of analysis (e.g., gender, race, and class) and denotes simultaneous interactions between different aspects of social identity (e.g., race, ethnicity, indigeneity, gender, class, religion, geography, age, ability, immigration status; Bauer, 2014; Dubrow, 2008; Hankivsky et al., 2009). Traditional quantitative researchers have mainly focused on investigating the individual axes of inequities (e.g., race, gender, class) and have not gone beyond potential interconnectedness between axes (Hankivsky et al., 2009).

The quantitative research on intersectionality adopts two key approaches to study interconnectedness between categories. The two common approaches are the additive, or unitary approach, and the multiplicative approach. The additive approach is commonly used in regression models to assess the individual effects of the various control variables (e.g., race, gender) on a predefined dependent variable while controlling for other variables. However, such an approach may not be ideal to capture the interactions between categories. An intersectionality focused approach should include both the additive and multiplicative approaches to capture the interaction effect between identities (Bauer, 2014; Dubrow, 2008; Rouhani, 2014). The traditional OLS regression model as given in Equation 1 is rewritten:

$$FP_i = \beta_0 + \beta_1 GR_i + \beta_2 GD_i + \beta_3 RD_i + \beta_3 FD_i + \beta_4 CD_i + \beta_5 BCV_i + \beta_6 FCV_i + €_i \quad (2)$$

The first four variables which define the diversity categories are additive in nature with little emphasis on interaction between their categories of difference. The drawback from such a

quantitative approach is that the model assumes these diversity categories to be mutually exclusive, when they are not (Weber & Parra-Medina, 2003). If one were to consider intersectionality, then the equation needs to be modified to include the multiplicative factor to the prior equation resulting in the following:

$$FP_i = \beta_0 + \beta_1 GR_i + \beta_2 GD_i + \beta_3 RD_i + \beta_3 FD_i + \beta_4 CD_i + \beta_5 BCV_i + \beta_6 FCV_i + \beta_7(X1*X2) + \beta_8(X1*X3) + \beta_9(X1*X4) + \beta_{10}(X2*X3) + \beta_{11}(X2*X4) + \beta_{12}(X3*X4) + \beta_{13}(X1*X2*x3*x4) + €_i \quad (3)$$

Here, X1 represents gender, X2 is race, X3 is functional diversity, and X4 is cognitive diversity. The product of these diversity variables characterizes the interaction between these categories of differences. In contrast to the additive approach, the multiplicative approach is not mutually exclusive and this approach captures the multiple interactions of various diversity attributes (i.e., two-way, three-way, and beyond; Bauer, 2014; Dubrow, 2008; Rouhani, 2014).

OLS Analysis Slope - Dummy Variable Approach – Method 3

The use of qualitative variables to evaluate the regression model based on meeting certain conditions (e.g., seasonality, gender) is a common approach in econometrics. These qualitative variables use a binary index (i.e., either yes or no or 1 or 0) to indicate the presence or absence of a "quality" or an attribute. Such variables are known as dummy variables (Gujarati, 2004).

Dummy Variables

Dummy Variables are a way to represent or "quantify" qualitative or nominal scale variables by assigning binary or extreme values in the form of either 1 or 0. In such cases, the value of 1 indicates the presence of an attribute, whereas 0 indicates the absence of an attribute or vice versa. For example, in the case of measuring a boards' gender ratio the presence of a female member can be assigned a 1 and the absence of a female member can be assigned a 0.

The benefit of such an approach is that it enables the researcher to classify a category or categories of data into mutually exclusive categories (e.g., male or female). Another important property of dummy variables is that they are nonstochastic in nature. Because the independent variables in most regression models are fixed or nonchanging it is easier to replace any independent variable with a dummy variable (i.e., as they are nonstochastic in nature) without impacting the estimates of the regression model.

The choice of qualitative variables and the use of dummy variables must be made with much thought otherwise the analysis can run into issues of multicollinearity. For example, assigning a dummy variable with the value of 1 for one data point and 0 for all other observations will result in eliminating these observations from the dataset which could potentially generate inaccurate estimates. Similarly, one must be cautious in using dummy variables to describe two different conditions. Consider the example of using a dummy variable for gender in a regression equation. If $D_1 = 1$ for a person who is a man and the second dummy $D_2 = 1$ if a person is a woman then in such a situation D_1 plus D_2 would always add up to 1 resulting in perfect collinearity, as D_1 is perfectly correlated with D_2. Such type of equations violates the classical model assumption which stipulates that no explanatory variable must be a perfect linear function of any other explanatory variables (i.e., no perfect collinearity).

Another characteristic of a dummy variable approach is that it can be extended to define more than two qualitative conditions (e.g., describing 4 financial quarters in a year). In case of more than two categories the number of dummy variables chosen will depend on the number of categories. The general rule of thumb is that if a qualitative variable has m categories, then the number of dummy variables selected should be $(m - 1)$ including the intercept to avoid the perfect collinearity trap. A distinguishing feature of dummy variables is the ability to interact

with other continuous variables in a regression model. This enables the analysis to capture the interaction effects as in the case of gender or race (Gujarati, 2004; Studenmund, 2014). It is this concept of multiplying the dummy variable with an independent variable that is leveraged to capture the gender interaction effect in the board diversity study.

Slope Dummy Variable Regression Approach

In general, a dummy variable that changes the constant or intercept in a regression equation is known as the intercept dummy variable approach. The dummy variable that changes the slope of the relationship between the dependent variable and an independent variable is known as the slope dummy variable approach. Specifically, the slope dummy approach involves adding a variable to the regression equation which is a product of the independent variable whose slope needs to be changed and the dummy variable which drives the change in slope when certain qualitative conditions are met. The resultant variable will contain three terms namely the regression coefficient, a control or independent variable, and a dummy variable (e.g., $\beta_i X_i D_i$). The combination of the independent variable and the dummy variable (i.e., the slope dummy variable) is also known as the interaction term, which was the focus of this study to draw out the interaction effect of gender ratio with other independent variables.

The slope dummy variable can also be extended to include more than one quantitative variable ($\beta_i X_i X_j D_i$) or two dummy variables ($\beta_i D_1 D_2$), but the most frequent application of interaction terms involves using one quantitative variable and one dummy variable ($\beta_i X_i D_i$). Whenever a slope dummy approach is used, it is important to include both $\beta_i X_i$ and $\beta_i D_i$—where X_i is an independent control variable and D_i is the dummy variable—in the regression equation to avoid bias in the estimates of the coefficients of the slope dummy term. It is equally important

to note that each interaction term is not only a product of an independent and dummy variable but has its own regression coefficient (Studenmund, 2014).

The general form for studying the interaction effect of an independent variable X_i with a dummy variable D_i can be written as follows:

$$Y = \beta_0 + \beta_1 X_i + \beta_2 D_i + \beta_3 X_i D_i + e_i \quad (4)$$

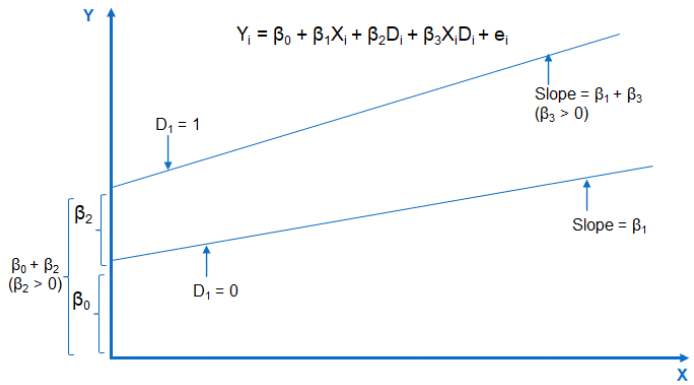
Figure 8 indicates that the equation will have different slopes and different intercepts depending on the value of the qualitative condition specified by the dummy variable (i.e., D = 0 or D = 1). If the qualitative conditions for D are applied to Equation 4 then it can technically split into two equations: (a) Equation 5 for D = 0, and (b) Equation 6 for D = 1:

$$Y_i = \beta_0 + \beta_1 X_i + e_i \quad (5)$$

$$Y_i = (\beta_0 + \beta_2) + (\beta_1 + \beta_3) X_i + e_i \quad (6)$$

Figure 8

The Slope Dummy Variable Graph



Comparing the first two terms of Equation 5 and Equation 6 shows that Equation 5 has a smaller intercept as given by β_0 when D = 0 but the intercept increases by β_2 to $(\beta_0 + \beta_2)$ when D = 1 as seen in Equation 6. Similarly, the coefficients of X_i are the slopes in Equation 5 and

Equation 6. The slope is β_1 when D = 0 and increases by β_3 to ($\beta_1 + \beta_3$) when D = 1 as seen in Equation 6. The changes in slope and intercept between these two equations capture the interaction effect (Studenmund, 2014).

The current study applied the previous slope dummy variable principle defined in Equation 4 with a slight revision to accommodate an additional dummy variable to meet a specific qualitative condition of gender ratio. To recap, the objective was to analyze the interaction of gender ratio with respect to the other independent variables. Accordingly, the governing equation was:

$$FP_i = \beta_0 + \beta_1 X_i + \beta_2 D_i + \beta_3 * GR * D_i + \beta_4 * GR * D_i + e_i \quad (7)$$

From the OLS analysis it was found that the gender ratio cut-off point was 22% at which point there is shift in Tobin's Q from a negative value to a positive value and which continues to increase with increasing value of gender ratio. The cut-off value of 22% or 0.22 gender ratio results in two different qualitative conditions for gender ratio, namely gender ratio <= 0.22 when Tobin's Q is negative and gender ratio > 0.22 when Tobin's Q is positive. These qualitative conditions are used to estimate the interaction effect of gender ratio on other independent variables.

Equation 7 was structured such that the first term represented the intercept or a constant, the second term was a set of control variables (i.e., accounts for both board and firm level control variables), and the third term was the dummy variable, which takes on a value of 1 if GR > 0.22 otherwise 0. The fourth and fifth terms were the interaction effect terms defined as the product of GR and the dummy variable when the two qualitative conditions of GR > 0.22 or GR <= 0.22 were fulfilled. Accordingly, the fourth term translated to the product of GR and the dummy variable where $D_i = 1$ if GR > 0.22, otherwise $D_i = 0$ when it reduced the interaction term to 0.

Similarly, the fifth term translated to the product of GR and dummy variable where D_i =1 if GR <= 0.22, otherwise D_i = 0 when it reduced the interaction term to 0.

The change in slope of Equation 7 was estimated by applying the two qualitative conditions for the dummy variable (i.e., $D_i = 0$ or $D_i = 1$). This transformation yielded the following two equations:

when $D_i = 0$, $FP_i = \beta_0 + \beta_1 X_i + e_i$ (7a)

when $D_i = 1$, $FP_i = (\beta_0 + \beta_2) + \beta_1 X_i + (\beta_3 + \beta_4)*GR + e_i$ (7b)

The slope effect is given by the coefficient of GR in Equation 7b, which was $(\beta_3 + \beta_4)$. This result was further verified by differentiating Equation 7a and Equation 7b with respect to GR, which resulted in the following two equations:

when $D_i = 0$ then, $\frac{\Delta FP}{\Delta GR} = 0$ (7c)

when $D_i = 1$ then, $\frac{\Delta FP}{\Delta GR} = \beta_3 + \beta_4$ (7d)

Equation 7d denoted the rate of change in the slope of firm performance with respect to GR and this result was consistent with that of Equation 7b. This change in slope was the estimate of the gender ratio interaction effect (Lustgarten & Mande, 1995; Studenmund, 2014).

CHAPTER FIVE: QUALITATIVE APPROACH

A qualitative study provides a deeper understanding of a problem by analyzing the issue at an individual level versus a quantitative study that analyzes the problem more at an aggregated level (Creswell & Plano Clark, 2018). The data from a quantitative study may not tell the complete story, which requires the researchers to adopt a qualitative approach. In research, both methods accomplish different objectives and complement one another as each method has its own limitations. The rich insight from a qualitative study is captured by observing, interviewing, surveying, and/or a combination of these methods, typically from a small group of subjects (Creswell & Plano Clark, 2018).

Explanatory Sequential Design

In an explanatory sequential study, Ivankova and Stick (2007) studied the issue of student persistence in higher education. The researchers implemented their study in two phases. The first portion was a quantitative strand, which used a cross-sectional survey design to collect an online survey of 207 participants that measured nine predictor variables based on the theories of student persistence. The responding participants were segmented into four different group for analysis. The researchers subsequently conducted a second phase qualitative study by using a purposeful sampling methodology. In this method, one student with an above average score from each group was selected to conduct an in-depth case study of each person's experiences of the program. The primary form of data collection was one-on-one interviews, which was supplemented by data from electronic interview transcriptions, written responses, and related documents. The approach consisted of a case study followed by a cross-case analysis to identify important themes about persistence in the program. The researchers concluded that one method was not sufficient to capture the trends and details of complex situations such as student persistence in the program

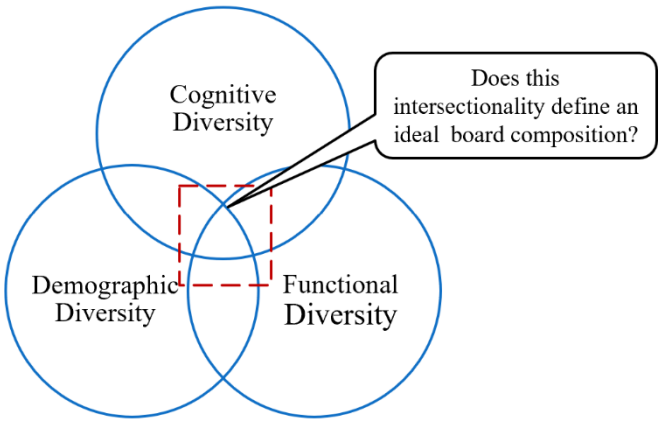
(Ivankova & Stick, 2007). Similarly, the current study adopted an explanatory sequential approach with the quantitative analysis in the first phase and qualitative phase in the second phase, which consisted of semistructured interviews with a small set of board members selected from the quantitative dataset.

Purpose of the Interviews

The focus areas for the interviews were to assess the: (a) relevance of different diversity parameters and its interaction effects, (b) board selection mechanism, (c) board dynamics and composition, and (d) diversity and inclusion. In the interest of time and to facilitate a free-flowing, focused, and richer discussion on the previous topics, the following framework along with the research questions (see Figure 9) was used as a guideline for the interviews.

Figure 9

Framework for Research Questions



Research Questions

To facilitate a free-flowing and smooth discussion several research questions were formulated and shared with the participants 1 week in advance. The purpose was also to orient and help the members prepare for the interviews. A total of six questions were formulated:

1. Which diversity attribute is most important in board composition?
2. What is the process for selection of a board member?
3. How does the focus on diversity vary by size of boards and/or size of firms?
4. What is an optimal gender composition to enhance board effectiveness?
5. How does CEO duality impact board independence?
6. What are the successful strategies to ensure a diverse and inclusive board?

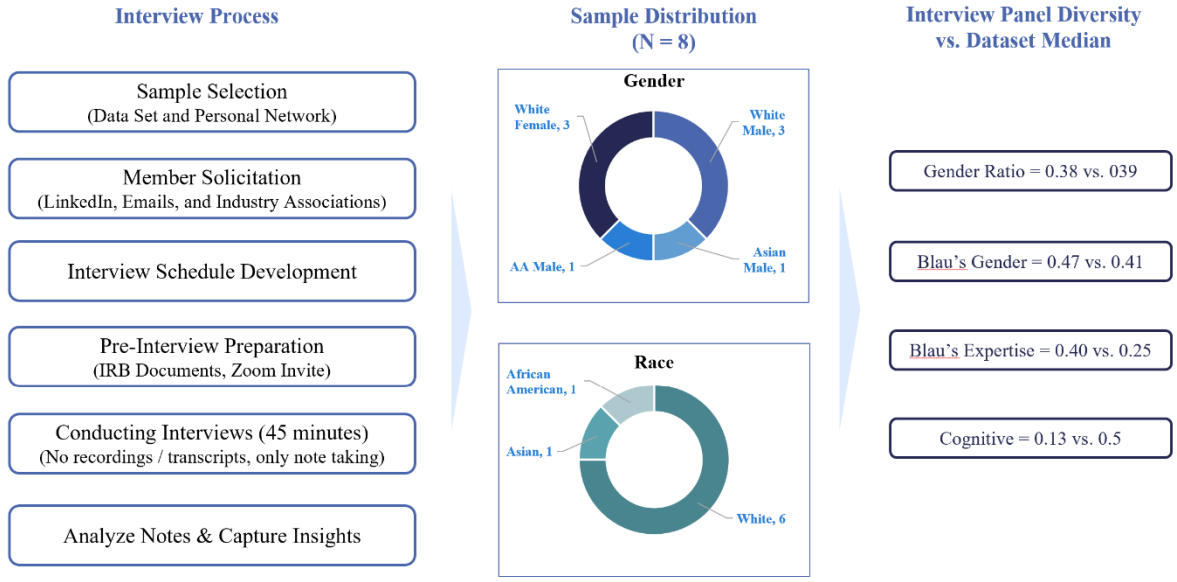
Sample Plan and Interview Protocol

The sample selection for Phase 2 of this study was purposeful, targeted only board members in the dataset, and ensured coverage in terms of diversity of board members. No survey instrument was used as part of this outreach to the board of directors. Semistructured interviews were restricted to eight board members for three reasons: (a) time constraints - any larger sample would have taken a much longer time given the fact that it takes approximately 3 to 4 weeks to engage with a board member after initial contact, (b) the outreach was restricted to directors in the dataset and with whom I had a prior professional relationship, and (c) the challenges in contacting and recruiting board members due to their busy schedules. As a result, it was concluded that a sample size of eight members was a reasonable number to draw meaningful inferences.

The interview protocol process along with the sample gender and racial distribution is shown in Figure 10. The initial effort consisted of reaching out to 14 board of directors in the dataset. Only 8 of 14 provided a positive response and volunteered to be interviewed.

Figure 10

Interview Plan and Sample Distribution



The process of recruiting board members involved reaching out to each member first via LinkedIn and stimulating their interest to participate in an interview. In a few cases, the response was received within 2 to 3 days but in most cases, it was about 1 to 2 weeks. In case of nonresponse, a follow-up message was sent after a gap of about 1 week. If there were no further responses, the member was dropped from the list.

To generate an interest on this topic, the word interview had to be replaced with free-flowing discussion on board diversity. Most of the targeted board of directors were known to me through my professional network and it so happened that these members sat on the board of companies that were in the analyzed dataset. Despite having a professional connection, it was very challenging to evoke a positive response as some members declined the invite for lack of time. Once the members consented to the interview, they would readily share their email for further correspondence. Most members were flexible and provided more than one interview slot.

After the interview date and slot were confirmed by the board member, a Zoom invite, IRB informed consent form, and the discussion questions were emailed 1 week in advance. The intent of sharing the research questions was to orient the members to the research objectives, enable them to be prepared for the interview, and reassure them that the discussion on the topic was time bound. In preparation for the interviews, a simple and structured interview guide was developed to keep the conversation focused on the research questions. All interviews were conducted via Zoom video conferencing and lasted for an average of 56 minutes. The video calls were not recorded, and transcripts were not generated to respect the privacy of the board members (see Appendix G).

Some of the responses from board members to the initial request for interview were one sentence responses. For example, “I am willing to engage,” “Let’s talk in 3 weeks,” and “Interesting topic. Let’s meet in a couple of weeks.” Once the commitment to the interview was made, every member was engaged 100% in the interview process. The interview started off with general background on the research topic and explaining my academic pursuit while working full time. The discussions were free flowing and covered all the research questions. The discussions evolved naturally from one area to the next almost seamlessly. During the interview, the members were open and willing to share their perspectives and opinions freely with respect to member selection, relevance of diversity, and the board power dynamics. A common theme was on appreciating and valuing all aspects of diversity and some of the phrases used to describe diversity was “diversity of thoughts is important,” “all forms of diversity are important,” and “groupthink is not good.” After the discussions was complete, every member requested that I send a synopsis of my final findings. The free-flowing type of interview format resulted in many

members willing to have a follow-up conversation on this topic (Deterding & Waters, 2018; Merriam & Tisdell, 2015).

Data Collection and Validation

Prior to the interviews, only the research problem statement and the purpose of the interview were shared with each board member. The consent to take contemporaneous notes was obtained verbally at the start of each interview. The notes captured the research process, insights provided by the board members, any distinguishing body language, and the nature of interactions with each board member. These hand-written notes were translated into a word document after redacting any identifying board member information. The initial idea of member checking and data triangulation (Creswell & Miller, 2000) was not pursued after realizing that the board members would not be interested in such an exercise.

The interview questions were framed based on the quantitative results and information in the literature. A total of five questions formed the interview guide which covered the following categories: (a) relevance of diversity attributes, measurement, and intersectionality (Harrison & Klein, 2007; Rao, 1982); (b) board leadership and functional expertise including the number the years of C-level and board experience (Adams & Ferreira, 2009); (c) board member selection process (Ely, 1994; Kanter 1997a, 1997b; Marimuthu & Kolandaisamy, 2009; Miller & del Carmen Triana, 2009); and (d) board dynamics, which covered board independence and the interactions between diverse members (Iyengar & Zampelli, 2009; Milliken & Martins, 1996; Walt & Ingley, 2003). The question on the gender or ethnicity identification of board members was not part of the interview guide as this was easily available through secondary research or company websites.

Data and Interview Analysis

The process for qualitative data analysis consisted of the standard approach to qualitative data collection (Creswell & Plano Clark, 2018) but with refinements to suit the current study:

1. Preparing the data: Transcribing the interview notes, checking for accuracy, organizing the data by participant type, and loading into Word.
2. Exploring the data: Repeated reading of the complete set of notes to familiarize myself with the discussion flow and the insights provided by each board member. In this step, repeated statements or ideas, and potential themes were highlighted.
3. Analyzing the data: The notes were reviewed and analyzed for general themes and expressions that were common across board members. These were then categorized into different groups. Traditional coding was replaced by grouping the notes into common themes.
4. Summarizing the results: The identified themes were scrutinized for consistency and coverage. These results were organized into categories with each category containing key points or statements made by respective board members. These categories were compared across board members to capture common statements or viewpoints. Where applicable, specific quotes or statements are used to reinforce the themes.
5. Interpreting the results: The key findings were summarized, and the results were interpreted in the broader context. This interpretation includes explaining if the results validate or complement the quantitative results, or how it addresses the research questions or hypothesis.

The interview notes from multiple participants were synthesized and categorized into five categories or themes: (a) biographical information, (b) importance of board diversity attributes,

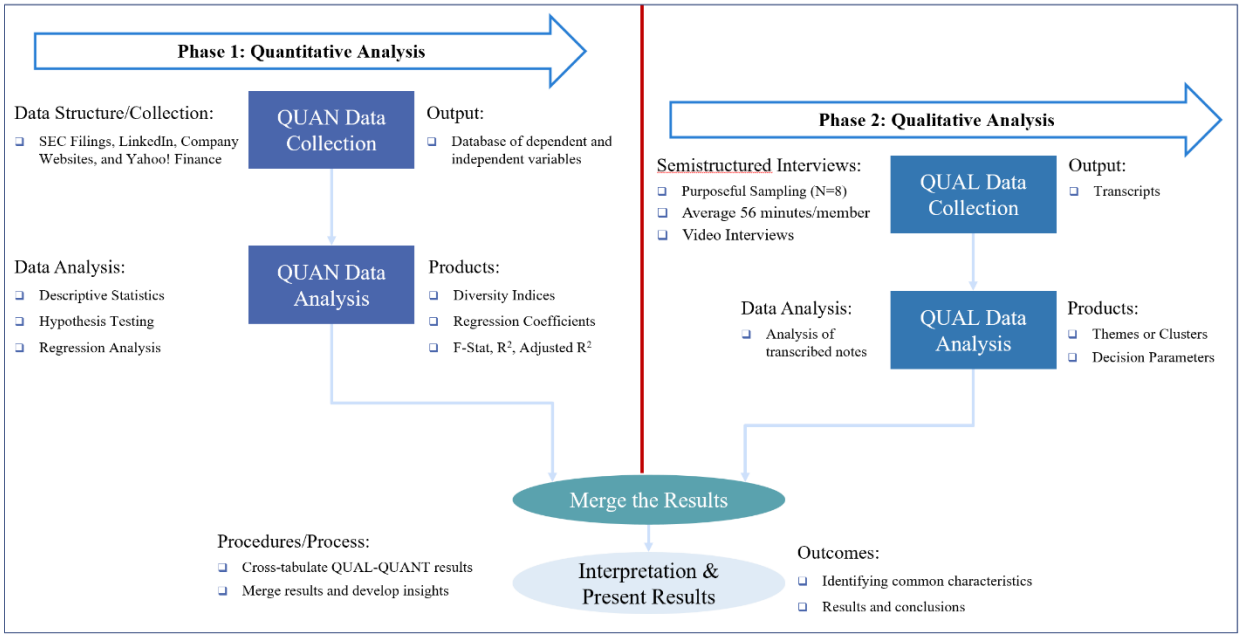
(c) board selection process, (d) board dynamics, and (e) board inclusion. There was no coding involved other than drawing conclusions for each category of questions by comparing the insights provided by each board member. The decision to not code was due to a small sample size and the fact that the qualitative analysis did not involve a survey frame prior to the interviews. However, the coding was substituted for drawing out general themes and patterns from the interviews.

Integration of Results

The final step in the study was to integrate the results of both quantitative and qualitative (see Figure 11) parts of the study to draw broad inferences and specific insights. The insights and conclusions from both these studies are captured in Chapter 6 and 7.

Figure 11

Integration of Quantitative–Qualitative Studies



The integration of both types of results helped present new insights in a concise and holistic manner versus the insights generated by analyzing the quantitative and qualitative analysis separately. In other words, the integration produces a whole result, which is greater than the sum of the individual quantitative and qualitative parts.

CHAPTER SIX: DISCUSSION OF RESULTS

This chapter describes the findings from the quantitative analysis followed by the discussion of results from the qualitative study. The quantitative part of the study leveraged descriptive statistics and ordinary regression analysis (OLS) to test the hypotheses developed in Chapter 3. The aim of the analysis was to capture the significance of the three diversity attributes on firm performance, test the minimum number of women required on the board for positive performance, and assess the effect of interaction between diversities on firm performance. The study also used the advanced OLS technique of the slope dummy variable approach to validate the interaction effect between gender diversity and other variables.

The quantitative analysis was followed by a qualitative analysis, which captured the voice of the board members through semistructured interviews of eight board members, which are summarized in the subsequent sections.

Quantitative Analysis

The first step in the quantitative analysis involved data cleansing. This included organizing the data, eliminating redundant data, and fixing errors or gaps in the data prior to statistical analysis. A demographic analysis of the dataset showed a split of 72% men and 28% women, indicating that women continue to be underrepresented at the highest levels of the corporate structure in comparison to the percentage of women entering the workforce (i.e., 45%). The same argument is true for ethnic minorities whose representation in corporate boards has been less than 20% with African American directors accounting for about 6% (see Appendix B). This underrepresentation could be one reason for the racial diversity index to be insignificant in the regression analysis. The data for women in terms of education and work experience indicates

that women are equally qualified as men with more women having advanced degrees (i.e., hold more PhDs).

Descriptive Statistics

SPSS software was used to run descriptive statistics for the variables of interest in the dataset. The mean, median, variance, and standard deviation was obtained for key variables as shown in Table 2. Several variables (i.e., board size, diversity indices, board experience, and Tobin's Q) have a wide dispersion of the data from the mean (see Table 2). Such variations indicated that some of these variables likely have an influencing effect in the regression analysis. Because the three diversity indices were critical variables in the regression model, the distribution of these indices were also evaluated. I found that racial diversity was negatively skewed; cognitive diversity was positively skewed; whereas functional diversity, gender diversity, and board size were found to be close to a normal distribution (see Appendix H).

Table 2

Descriptive Statistics

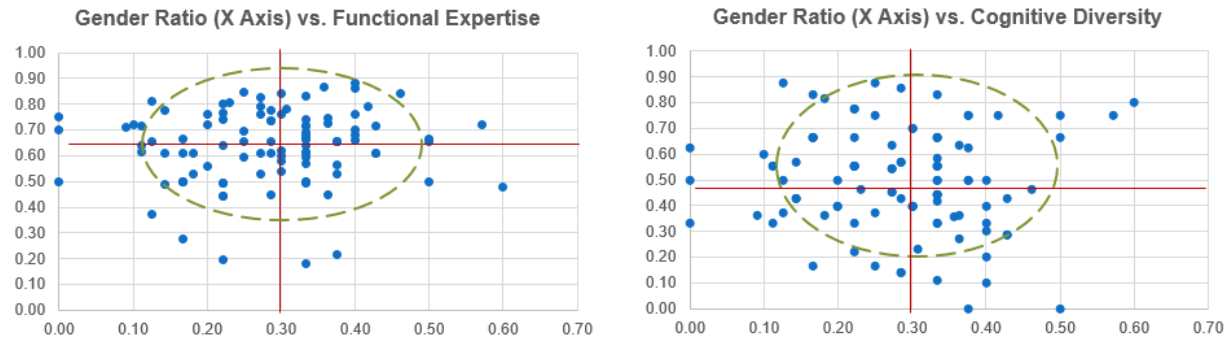
	n	Minimum	Maximum	*M*	*SD*
Board size	100	5.00	15.00	9.01	2.10
Gender ratio	100	0.00	0.60	0.28	0.12
Blau gender	100	0.00	0.61	0.38	0.11
Blau_race	100	0.00	0.74	0.29	0.19
Blau_expertise	100	0.18	0.88	0.64	0.14
Cognitive diversity	100	0.00	0.88	0.50	0.20
Ave age of board	100	48.67	70.17	59.83	4.10
Ave board experience	100	0.00	26.83	11.57	5.74
Ave mem., other boards	100	0.00	4.33	2.23	0.87
Tobin's Q	100	0.78	40.41	6.34	6.79
CEO duality	100	0.00	1.00	0.40	0.49
Leverage	100	1.54	2.72	1.02	0.53
Age of the firm	100	3.00	173.00	24.94	30.50
Valid *n* (listwise)	99				

The significance of the variables shown in Table 2 were tested using Pearson's correlation matrix. Only variables with a *p* value less than 0.05 and/or *p* value less than 0.1 in a two-tailed test were selected for the OLS analysis. This approach enabled me to determine the degree of correlation between the independent and dependent variables. Accordingly, all the independent variables shown in Table 2 were regressed against firm performance Tobin's Q.

Because gender ratio (GR) was central to the diversity calculation, gender ratio was mapped against the other diversity variables. Based on this approach, I found that cognitive and functional diversities were significant when the GR was between 10% and 40%, whereas racial diversity did not appear to be significant. The strong correlation of gender ratio with the gender diversity index was also on expected lines (see Figure 12).

Figure 12

Cross-Correlation of Gender Ratio Versus Functional Expertise and Cognitive Diversity



Note. Red lines denote the mean for both the X and Y axes.

An exercise of interchanging the order of the diversity indices and running the regression to capture any variances in R^2 or the adjusted R^2 between each interchange of the diversity

indices did not yield much significance or any variations. This indicates that the choice or order of selection the diversity indices in a regression model does not make any difference.

Board Size as a Mediating Factor

The median size of the board in the current dataset was nine individuals. In this study, the boards sizes less than or equal to nine were characterized as a small board and board sizes greater than nine were characterized as a large board. The board size was used as a mediating factor to run the regression analysis and assess its impact on Tobin's Q (see Appendix I). The results showed that gender ratio and gender diversity were well correlated across all board sizes. Both cognitive diversity and functional diversity did not appear to be significant for small boards (i.e., boards <= 9). In the case of large boards (i.e., boards > 9), the emphasis was on functional diversity and cognitive diversity in addition to gender diversity. Large boards were representative of large companies and complex business environments. The boards of these companies seek out board members with specialized expertise and advanced degrees (e.g., PhD, MD). It was no surprise that both functional and cognitive diversities along with gender diversity were relevant in large boards. When the racial diversity index was mapped against board size, the results showed that race was not significant for any board size.

OLS Regression

The purpose the OLS regression analysis was to analyze the dataset for the influence of the three diversity indices, board-level variables, and firm-level variables on firm performance. The board-level attributes were board size, CEO duality, and average membership on other boards. The firm-level attributes were leverage (i.e., ratio of total debt to total assets) and the number of employees in the firm. The dependent variable was the firm performance given by Tobin's Q.

The gender diversity index was measured as the proposed index (i.e., F[GR, GR^2]) and using the well-known Blau's diversity index. The racial diversity index and functional diversity index was also measured using the Blau's index. The cognitive diversity index was measured based on assigning 1 if a member had the highest degree such as PhD, MD, or JD otherwise 0, counting the total number of such advanced degrees on the board, and converting it as a ratio in relation to the total board size.

Three different OLS models were tested. The first model considered Blau's index for gender diversity, whereas in the second model, the Blau's gender diversity index was replaced by the proposed gender diversity index. In the last model, an additional board variable represented by average membership on other boards was included to test its significance and impact on firm performance. Table 3 shows a side-by-side comparison of the results of the three models.

Table 3

Comparing Results of Various OLS Models

Description	Model A – w/Blau's gender diversity		Model B – Replace gender square for Blau's gender		Model C – Add memb. in other boards as a variable	
	Unstd. Coeff.	Sig.	Unstd. Coeff.	Sig.	Unstd. Coeff.	Sig.
Constant	22.05	< 0.001	16.19	< 0.001	26.58	0.001
Board size	-0.64	0.099	-0.86	0.03	-0.68	0.08
Gender ratio	68.92	< 0.01	-28.29	0.11	66.38	< 0.01
Blau's gender	-72.02	< 0.01			-69.38	0.001
Gender square			63.76	0.07		
Blau's race	0.07	0.984	-0.37	0.92	0.86	0.81
Blau's expertise	-7.04	0.190	-5.95	0.38	-7.81	0.14
Cognitive diversity	6.12	0.063	6.37	0.06	4.75	0.16
CEO duality	-2.00	0.130	-1.50	0.27	-1.95	0.14
Ave. memb., other boards					-1.38	0.09
Leverage	1.71	0.453	1.94	0.42	1.03	0.65
Number of employees	< 0.001	0.63	< 0.001	0.60	< 0.001	0.72
R^2	0.27		0.21		0.29	
Adjusted R^2	0.20		0.13		0.22	
Sig. *F* change	< 0.01		0.01		< 0.01	
Std. error of the estimate	6.08		6.35		6.02	
df	92		92		92	

The comparison of the regression results of the three different models showed that R^2 varies from a minimum of 0.21 to a maximum of 0.29 and the adjusted R^2 varies between 0.13 to 0.22. The OLS models can explain on an average of 18% variation (i.e., based on adjusted R^2) in Tobin's Q. The significance of the *F* value was less than 0.001 across all the three models, which validated the relevancy of the three models.

In Models A and B, the *p* values for the independent variables board size, gender ratio, gender diversity, and cognitive diversity were all less than the $p = 0.05$ level, and the R^2 values were 0.27 and 0.21, respectively. The only difference between Models A and B and Model C was the addition of one more independent variable: average membership on other boards. Once this variable was included it became significant, but in the process displaced cognitive diversity as being a significant variable in the model. Average membership on other boards signified the brand value of a board member or the access to outside resources and professional network. It can be inferred that cognitive diversity and average membership on other boards can be used interchangeably without impacting the overall effect on firm performance. The results of the OLS across all the models showed that race and expertise were not significant. These findings validated that both gender diversity and cognitive diversity were significant to firm performance, which caused a rejection of the null hypothesis (H_0), which stated either of the diversity indices had no impact on firm performance.

Validating Critical Mass of Theory

In examining the effect of various indices on firm performance it was discovered that gender ratio was extremely important in deriving reliable and meaningful solutions. For example, if the gender ratio was dropped as an independent variable then Blau's gender was not significant indicating gender diversity was irrelevant. This finding goes against the natural logic or board composition reality as majority of the boards do not ignore gender diversity.

To better understand such an anomaly, both the gender ratio and Blau's gender were plotted against Tobin's Q in the Y-axis. The results showed that the gender ratio follows a nearly U-shaped curve and Blau's gender follows almost a liner form as it is already quadratic in nature (Appendix J). This led to the conclusion that gender diversity can be expressed as combination of both the linear and a quadratic distribution, which can be expressed in the form $Y = Ax + By^2$.

By applying the principle of structural multicollinearity, the linear term can be the gender ratio and the quadratic term can be expressed as the square of the gender ratio. This approach helps to keep the index consistent with one category (i.e., gender ratio) unlike Blau's index, which is a proportional representation of the two gender categories (i.e., both male and female). The resultant term for gender diversity can be rewritten as $Y = A(GR) + B(GR^2)$, where "GR" is the linear term of gender ratio and "GR^2" is the quadratic term in gender ratio.

Table 4 and Table 5 capture the OLS results using the alternative form of gender diversity index.

Table 4

Results of OLS With Diversity Index as a Function of Gender Ratio f(GR, GR2)

Model summary									
					Change statistics				
Model	*R*	R^2	Adjusted R^2	Std. error of the estimate	R^2 change	*F* change	*df1*	*df2*	Sig. *F* change
1	.45[a]	.20	.14	6.30	.201	3.30	7	92	.004

Note. a. Predictors: (Constant), G/R Sq, Board Size, Cognitive Gini Coeff Ver B, CEO duality, Blau race, Blau expertise, Gender Ratio = (Fem/Total Dir).

Table 5

Coefficients of Regressed Variables

Coefficients[a]						
		Unstandardized coefficients		Standardized coefficients		
Model		*B*	Std. error	Beta	*t*	Sig.
1	(Constant)	15.38	4.59		3.35	.001
	Board size	-.72	.35	-.22	-2.04	.044
	Blau_race	-.37	3.59	-.010	-.10	.919
	Blau_expertise	-3.70	5.28	-.08	-.70	.485
	CEO duality	-1.49	1.35	-.11	-1.11	.272
	Gender ratio	-30.97	19.40	-.53	-1.60	.114
	G/R square	69.55	33.37	.70	2.08	.040
	Cognitive diversity	5.59	3.25	.16	1.72	.089

Note. a. Dependent variable: Tobin's Q

Analyzing the coefficients in Table 5 demonstrates the constant term was positive, the coefficient of the gender ratio term was negative, and the coefficient of the square of the gender ratio term was positive. If these coefficients are substituted into the equation $Y = A(GR) + B(GR^2)$, then it translates to:

$$Y = (-30.965)(GR) + (-69.547)(GR^2) \quad (8)$$

The prior equation can be solved for GR by differentiating it with respect to GR and equating to 0, which gives

$$dY/d(GR) = (-30.965) + 2*(69.547)*(GR) = 0 \quad (9)$$

Solving for GR results in GR = 22.2%. This GR value is the inflection point for Tobin's Q when the firm performance shifts from a negative to a positive value. These findings aligned with Kanter's (1977a) critical mass theory (CMT). The theory states that boards having a gender ratio between 20% to 40% fall under the tilted group category. In this group, members move from tokenism to a minority group and members cease to be treated as representing a social category. At this stage the minority members can form subgroups or alliances and can potentially change the dynamics or culture of the group (see Figure 13).

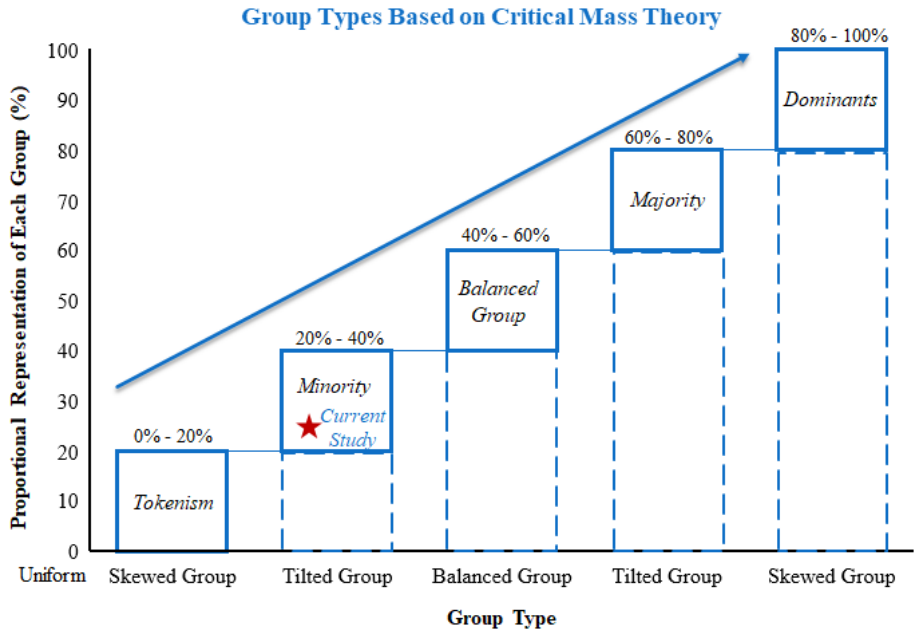
Blau's index is a widely used measure of gender diversity when examining categorical variables. The index captures the proportional representation of both male and female categories. In the case of board diversity, the number of categories was two (i.e., male and female or K = 2). When the OLS Equation 8 was tested using the Blau's diversity index and solved for the gender ratio as in Equation 9, the results showed an inflection point at 47% gender ratio.

Applying Kanter's (1977a) CMT, this translates to a balanced board. In a balanced board, the social identifications or social categorizations get blurred as there is equal representation of different groups of members. At this stage, the majority and minority groups can form subgroups

and alliances much more effectively. As a result, the dynamics and the culture of the group is also more balanced (see Figure 13). Blau's index tends to provide a higher inflection point and the reasons for this are explained in the next section.

Figure 13

Group Types Based on Proportional Representation



There are multiple reasons for obtaining a higher inflection point using Blau's index versus the proposed index based on gender ratio:

- Blau's index is ideal when analyzing multiple evenly distributed categories in a population. As such, Blau's is more biased toward an evenly distributed population (e.g., proportion in each category = 1/K), which is why the inflection point is closer to a balanced board.

- In the case of board diversity, the number of categories was two (i.e., male and female or K = 2). If only one category is considered (e.g., female) then K =1 which reduces Blau's index to the same form as the square of gender ratio.
- Blau's index is technically a mathematical transformation of gender ratio but captures the effects of multiple categories possibly leading to higher coefficient values in the OLS.

Finally, if the dataset is analyzed for the number of companies with gender ratio greater than 47%, the total number is six companies or less than 10% of the dataset. It can be concluded that such a high inflection point using Blau's index is not a realistic representation of the dataset. As such, I chose the inflection point at 22%, which was obtained using the proposed gender diversity index (i.e., $F[GR,GR^2]$), as a more accurate and realistic representation of the dataset. In this case, over 75% of the firms in the dataset have a gender ratio of >22%, which is the inflection point determined in this study.

By combining these arguments, the null hypothesis (H_0) stating a critical mass of women members do not impact firm performance was rejected and the alternate hypothesis (H_a) was accepted. In this study, the critical mass of women required for a positive firm performance was greater than 22% representation in a board.

Intersectionality Using Standard OLS

The effect of intersectionality was analyzed using Equation 2. This equation includes both the additive terms to account for the contribution of each diversity index and multiplicative factors to account for the interaction effect of each of the diversity index. The board- and firm-level parameters are additional independent variables. The OLS analysis of such a model did not yield any meaningful results and showed no impact on firm performance. One explanation for

such a result was that all the diversity indices except cognitive diversity were quadratic in nature and when multiplied these transformed into a fourth order polynomial. The numerical values of these fourth order polynomials are low or near zero; hence, their contribution to intersectionality effect was negligible.

Because the intersectionality analysis of all the three diversities did not yield meaningful results, a slope dummy variable approach was attempted to assess only the interaction effect of gender diversity on other independent variables. The subsequent section describes the results from the slope dummy variable approach.

The Slope Dummy Approach – Analyzing the Gender Interaction Effect

I applied the slope dummy variable principle defined in Equation 4 to study the interaction effect of diversity with other independent variables. The interaction effect of the gender is examined using three independent variables as shown in the following equation.

$$FP_i = \beta_0 + \beta_1 X_i + \beta_2 D_i + \beta_3 GR_i D_i + \beta_4 GR_i D_i + e_i \quad (10)$$

In Equation 10, the first term is a constant and the second term Xi denotes the board and firm level variables (i.e., board size, return on assets [ROA], and CEO duality). In the previous section it was established that Tobin's Q shifts from a negative value to a positive value for a gender ratio greater than 22%. This cut-off percentage was used to define the two qualitative conditions given by (a) GR_i less than or equal to 0.22 when Tobin's Q is negative and (b) GR_i greater than 0.22 when Tobin's Q is positive.

The third term D_i, an independent dummy variable, which takes the value of 1 if gender ratio is greater than 0.22, otherwise it takes the value 0. The fourth and fifth terms given by the product of the dummy variable and the gender ratio define the gender interaction effect. The value of the dummy variable changes if the two predefined qualitative conditions in gender ratio

are met, which in turn drives the change in slope of the two interaction terms in the governing equation. The results of the OLS are summarized in Table 6 and Table 7.

Table 6

Regression Analysis Using Slope Dummy Variable Approach

Model summary									
				Std. error	Change statistics				
Model	*R*	R^2	Adjusted R^2	of the estimate	R^2 change	*F* change	*df1*	*df2*	Sig. *F* change
1	.48[a]	.23	.14	6.28	.23	2.67	10	89	.007

Note. a. Predictors: (Constant), Beta, cognitive diversity, GR X DMY GT 0.22, Blau_race, ROA%, CEO duality, board size, Blau_expertise, GR X DMY LT 0.22, GR DUMY GT 0.22.

Table 7

Coefficients of Regressed Slope Dummy Variables

Coefficients[a]						
		Unstandardized coefficients		Standardized coefficients		
Model		*B*	Std. Error	Beta	*t*	Sig.
1	(Constant)	11.96	5.71		2.09	.04
	Board size	-.65	.37	-.20	-1.74	.09
	Blau_race	-.59	3.60	-.02	-.17	.87
	Blau_expertise	-3.75	5.50	-.08	-.68	.50
	Cognitive diversity	5.30	3.26	.16	1.63	.11
	CEO duality	-1.77	1.40	-.13	-1.27	.21
	GR X DMY LT 0.22	8.47	17.65	.10	.48	.63
	GR X DMY GT 0.22	30.21	11.12	.79	2.72	.01
	GR DUMY GT 0.22	-9.01	5.02	-.63	-1.79	.08
	ROA%	-.03	.02	-.14	-1.32	.19
	Beta	-1.09	1.31	-.09	-.84	.41

Note. a. Dependent variable: Tobin's Q.

In Table 7, “GR X DMY LT 0.22” is the interaction term, which was the product of gender ratio and the dummy variable and takes on the value of 1 for gender ratio less than or equal to 0.22, otherwise a 0. Similarly, “GR X DMY GT 0.22” was the product of gender ratio and the dummy variable (i.e., 1 or 0) for gender ratio greater than 0.22. The term “GR DUMY GT 0.22” is the independent dummy variable, which takes the value of 1 for gender ratio greater than 0.22, otherwise a 0.

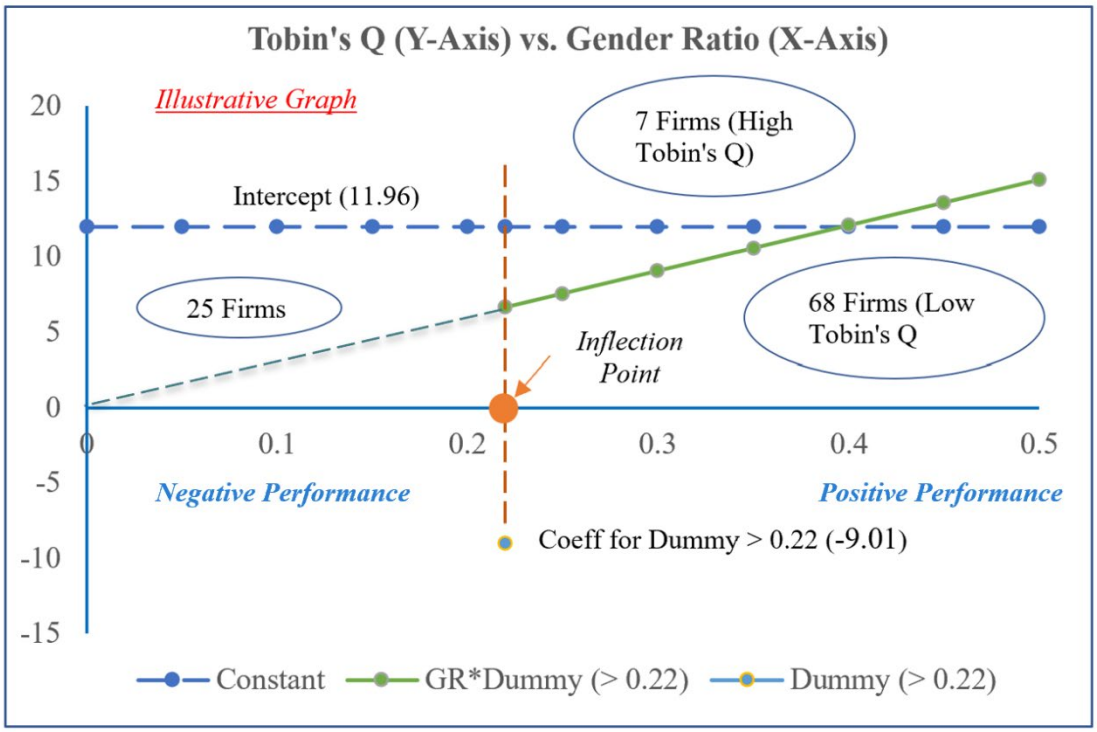
The prior model explains around 23% (R^2) of the variation and was consistent with the earlier OLS results. Interestingly, the gender interaction effect was statistically not significant when the gender ratio was less than 0.22. A similar argument can be made for cognitive diversity. However, the interaction effect was statistically significant when gender ratio was greater than 0.22. Both the dummy variable and the interaction effect represented by the product of gender ratio and the dummy variable are statistically significant with a p value less than 0.05. Board size was significant for a p value less than 0.1.

The coefficient of the interaction effect variable (i.e., GR*Dummy > 0.22) was a positive value and statistically significant. Similarly, the coefficient of the dummy variable, which represented the qualitative condition of gender ratio greater than 0.22, was negative but still statistically significant. When these two statistically significant coefficients were plotted against Tobin’s Q for various gender ratio, the resulting graph (see Figure 14) shows a shift from a negative to a positive firm performance. Such a shift in trend emphasizes the significance of gender interaction effect on firm performance when gender ratio in a board is greater than 22%. The results from the slope dummy approach are consistent with earlier OLS results stating that boards with gender ratio greater than 22% have a significant influence on positive firm performance.

Figure 14

Results of OLS for Gender Diversity Interaction Effect

$$FP_i = 11.96 - 9.01*D_{i(>0.22)} + 8.47*(GR_i)*D_{i(<=0.22)} + 30.21*GR_i*D_{i(>0.22)}$$



It can be inferred from Figure 14 that gender diversity was not significant for 25 firms, which had a gender ratio less than 0.22. The other 75 firms in the dataset had a gender ratio greater than 0.22 and a lower Tobin's Q except for 7 of the 75 firms, which had a higher Tobin's Q and a gender ratio greater than or equal to 0.40. A review of the dataset showed 68 of the 75 firms (i.e., with a gender ratio greater than 0.22 and a lower Tobin's Q) are mostly small and midsize companies in early-stage clinical development with minimum or no revenues. On the other hand, a distinguishing feature of the seven firms with high Tobin's Q was that these firms generated some revenues through a recent product launch or through licensing deals and a few others were in advanced stages of clinical development (e.g., Moderna, Agios).

It can be inferred from the prior results that early-stage clinical development firms tend to choose more female board members, typically with higher degrees as cognitive diversity is significant, and likewise women tend to gravitate towards these firms alluding to a possible endogenous relationship. Additionally, there is also the possibility of selection bias in these firms wherein the CEOs or other board members tend to choose female board members form their professional network.

Based on the above results, the null hypothesis (H_0) which stated that intersectionality does not influence firm performance was rejected.

Qualitative Analysis

The qualitative analysis entailed conducting purposeful semistructured interviews of eight board members selected from the quantitative dataset. To ensure diversity in the interview panel, a couple of members were chosen from outside the dataset but still within the biotech or life sciences domain. The purpose of the interviews was three-fold: (a) understand which type of diversity attribute is most important, (b) gather insights on board selection process for boards of all sizes, and (c) capture how boards can be made not only more diverse but also inclusive.

The interviews were generally free flowing with the discussions centered within the framework of research questions that were detailed in Chapter 5. All the board members were excited to learn and share their experiences on this topic. Many of the board members reiterated the importance of this topic both for research and companies. The discussions started by describing the problem statement and defining each diversity attribute. Almost all the members were intrigued by the inclusion of cognitive diversity as most members had not thought about such a form of diversity. Some members spent quite a bit of time understanding how cognitive diversity was measured. Once the problem definition phase was complete, the discussions were

engaging, positive, and productive. Even though members committed to a 45-minute discussion most went over this allotted time limit and some members were willing to have a follow-up conversation, if it was required. The average interview time was 56 minutes.

The interview panel consisted of three women and five men, which meant the gender ratio was 0.375 for the group—this is well above the gender ratio inflection point (i.e., 22%) established in the previous section. In terms of racial distribution, six board members (i.e., three women and three male board members) were White, one male board member was South Asian, and the other male board member was Black. The Blau's gender diversity index for the panel was 0.47 (e.g., the dataset median was 0.41), Blau's racial diversity index was 0.40 (e.g., the dataset median was 0.25), and the cognitive diversity index for this group was 0.13 (e.g., the dataset median was 0.5). The demographic distribution of the interview panel showed it was diverse both in terms of gender and race. The panel was also functionally diverse as each member had a different functional expertise covering strategy, operations, sales and marketing, finance, and entrepreneurship. The number of years of board experience ranged from 6 to 30 years for six of the members with the remaining two members having less than 5 years of board experience. Seven members sat on multiple boards of small and midsize companies in addition to the existing boards and one member did not sit on any outside boards other than the company board (see Appendix G).

Members allowed me to capture contemporaneous notes and a few of the members gave me enough time to write down key points. Members also requested that a short summary of the research findings be shared with them once the dissertation was complete. The contemporaneous notes were typed into a Word document, any member identifiers were de-identified, and the notes were organized into common themes. The common themes approach was essential to

compare each member's perspectives. The insights from the interviews are captured under the following six categories: Perspectives on Board Diversity, Board Recruitment Process, The Influence of Board Size (i.e., Large Boards Versus Small or Midsized boards), Board Composition, Board Governance, and Board Inclusion.

Perspectives on Board Diversity

The consensus of the interviewed members was that all forms of diversity are important for a board, and it was described as "diversity of thoughts, diversity of skills, diverse life experiences, different perspectives, and emotional quotient." Members also stated that having diverse members encourages different thought processes and avoids the pitfall of groupthink. Most members agreed that functional diversity or having a unique experience is the strongest differentiating factor as the business is scientific in nature. For example, public accounting experience, which helps one to get onto the audit committee, is a key differentiator. Similarly, experience as a former CEO is valuable or expertise in commercial operations, or experience in early-stage and late-stage manufacturing gets visibility and noticed at the board level.

Even though various forms of diversity are recognized, boards do not make a conscious attempt to rank order different diversity characteristics in recruiting or selecting a board member. In one instance, it was noted that "gender was not nearly central to their board selection process as the strategic outcomes of a board would not change if a board was less diverse or more diverse." So, the emphasis was more on getting the right talent; gender and race are complementary to the selection process. A few other members echoed similar sentiments by confirming that boards necessarily do not look to fill a quota or a requirement (i.e., except for Sarbanes-Oxley compliance) but it happens naturally. One member mentioned that changing the composition deliberately in some "predefined way or measure does not happen."

In a contrasting view, many members contended that having a woman or a member belonging to a different ethnicity adds value as they bring different life experiences and look at problems differently. But it was expressed that, ultimately, it is the merit of a member's recommendations that is recognized rather than looking from a social categorization perspective.

A notable discussion with a board member with over 30 years of board experience brought out the key challenges in diversifying a board. This member has been part of only one board that had a single female board member over the entire career as an executive and a board member. The member opined that boards in the biotech space are not diverse enough given the diverse workforce or population demographics. This member's opinion was that biotech boards do not push themselves to promote diversity as it takes "serious and concerted effort by the CEO/chairperson and everyone else on the board to change the power structure and the composition of the board."

There was not much discussion on cognitive diversity as most members heard about this diversity attribute for the first time. The members were primarily interested in understanding how cognitive diversity is measured and can be applied to the board selection and governance.

One more component that was not factored in the quantitative dataset is the issue of board diversity in pre-IPO or private companies. The study dataset only captured publicly traded or post-IPO companies. Some of the board members highlighted that the board composition in pre-IPO companies is different from post-IPO companies. In pre-IPO companies the board composition is driven by the investors (e.g., venture capital and private equity firms). If the investments firms are diverse at the partner level, this automatically translates into a diverse pre-IPO company board as most partners sit on the boards of such companies. One member summed up the challenges to diversify the pre-IPO or privately held companies, saying:

> The VCs [venture capital] and PE [private equity] firms see themselves as the smartest, hardworking, healthier, and God's gift to human race. They are interested in profit maximization and don't see a benefit in sharing this with others. Their goal is Series A and exit and not in a diverse board.

Board Recruitment Process

The recruitment process for a board member is like finding another executive job that aligns with a member's background and experience. It takes significant amount of professional networking, developing relationships with CEOs, and other board members. The key is gaining visibility in the marketplace as a successful leader and achieving name recognition. One member suggested that executing successful mergers and acquisitions when in an executive position or as a board member gets visibility with other boards. A big challenge is landing the first board seat as lack of prior board experience is a big hurdle. In general, members highlighted five major avenues to get into a board: (a) through a professional relationship with the CEO/chairperson of the board, (b) referral from another board member, (c) experience in the C-suite, (d) a well-recognized leader in the industry, and (e) through an executive search firm.

Sometimes an individual is also recruited for holding a senior executive position in a partner company. For example, one of the members was the head of European Union finance division and this member was nominated to the board of one of the supplier companies, which was a strategic partner. In this case, the company was also looking for a board member with public accounting experience to fill the audit committee position and it was a perfect fit. This emphasized that having unique experiences provides opportunities. Another avenue that is very common in early to late-stage start-ups is through the investment companies that invest in start-

ups. Typically, investors get a board seat, or boards seats, based on the type of investment made and invariably a partner of the firm sits on the board.

One member made an interesting observation on board member selection. It was mentioned that female board members tend to give preference to other women in their network, which highlighted some form of a selection bias. On the other hand, men appeared to be more open to go beyond their network to recruit members from the other gender. There was agreement that some form of endogeneity exists in board member selection as board members generally pick candidates from their own network. It should be noted that such an endogeneity is more prevalent in smaller and midsize boards that are early-stage to late-stage clinical development companies. These firms are constrained for resources and time to hire an external executive search firm and to find members outside their network. In some instances, the board positions are filled by hiring members from a company's scientific advisory board. On the contrary, large boards that are characterized by large and mature companies have significant resources and tend to use executive search firms to seek members outside a board's professional network.

The Influence of Board Size (i.e., Large Boards Vs. Small or Midsize Boards)

One of the research questions related to assessing the reasons for a high gender ratio in smaller or midsize boards. There was a consensus among male and female members that the bar to get into small or midsize boards is less stringent compared to large boards. This is a major reason for the evidence of higher gender ratio in small and midsize boards. Additionally, female board members preferred small boards as it offers flexibility to balance their personal and professional lives. It was expressed that small boards also offer a variety of work and are less bureaucratic. On small boards, it is also much easier to develop a personal rapport with the

CEO/chairperson and other board members. Most members also felt that a member's impact on small boards is much higher compared to large board.

Members felt that large boards are like big companies, highly bureaucratic with multiple committees and subcommittees, and tend to be less productive. On a large board, it is more challenging to get the attention of the CEO/chairperson or have a close working relationship with other members. Additionally, the discussions on large boards are more scripted and structured with little room for free-flowing discussions unlike the small and midsize boards.

The recruitment process also varies between the large boards and the midsize or small boards. The large boards are characterized by large companies, which have global businesses, and the nature of the business is generally complex. Hence, the qualifications, requirements, and the competition to get into such boards is also much higher. In case of large boards, the process is more structured, longer, and elaborate recruitment process as the companies have more time and resources to expend to get the right talent. The compensation package in larger boards is more attractive compared to small boards, which are mostly tied to stock options. It can be inferred from these insights that the agency costs of large boards are much higher than small or midsize boards, thereby aligning with the concepts outlined in the agency theory.

Optimal Gender Composition in a Board

The next research questions related to the minimum representation of women on a board and whether a diverse composition can potentially change the board dynamics and culture. To this question, several female members expressed that it is always good to have more than one female member as they can form a partnership to work on key issues. This does not discount the fact that these female members were comfortable in making alliances with members of the other gender. A couple of members felt that women tend to work in groups and are more productive.

One member was part of a board with four female members out of 10. The female members on this board have formed a solid alliance and work very well. The CEO trusted the work of these female board members and empowered them to drive strategic decisions. This is a case that aligned with Kanter's (1977a) CMT.

In cases of a board with a single female member (i.e., the case of tokenism), the board values the merit of the member's recommendations rather than viewing the board member as being part of a particular social category. This showed that even if there is tokenism from an outside world view, the board does not subscribe to such a social categorization perspective, which is very positive and encouraging. One of the female board members stated that she had been on many boards as a lone female member but did not find it difficult to mediate effectively due to her leadership skills and prior board experience. Both men and women reiterated that if there is a single woman on a board it really depends on the confidence and comfort level of that member to work in an otherwise male dominant board. In situations wherein a member is the only woman and/or person of color or if it is the first board experience, then there is a significant learning curve.

Board Independence and Governance

One of the research questions related to board independence, especially when a CEO holds the dual role of a CEO and the chairperson of the board. Most members did not have a position for or against CEO duality. However, they did recognize that separating the roles could provide more independence to the board. There are instances when members are hesitant to question the CEO for fear of losing the board tenure, which potentially compromises a member's independence. However, it was mentioned that such situations are less common. Generally, the CEOs are forward thinking and listen to the advice of the members and do not interfere with

board independence. The CEOs seek members who can help the company and play an advisory role and as a result are open to opposing views and comments.

One way to ensure neutrality and resolve the CEO duality conundrum is by nominating a lead board member to play a mediating role between the CEO and other board members. In the event the CEO duality role is split, then the chairman should complement the CEO in having a productive relationship with the board. A strong board also helps in case the CEO does not have an operational background (e.g., scientific founders).

In terms of driving strategic decisions, the burden is primarily on the CEO or the chairperson of a board. Several members emphasized that for a board to be productive the CEO/ chairperson has to be a good facilitator, ensure the participation of all members, and provide leadership in taking strategic decisions. Such leadership skills are especially relevant in large boards that sometimes have close to 20 members. One of the members gave an example of a nonprofit with over 20 members. This board was run by a strong chairwoman who was an excellent facilitator. She ensured that every group got enough participation time to discuss the topics on the agenda and pushed for resolution of key issues that were presented to the board.

From the perspective of a board member, it was suggested that every board member should take the initiative to develop a productive relationship with the CEO/chairperson and other board members. Such an effort will contribute to effective decision making, result in successful collaborations with other members, and ensure that the board is highly productive.

Board Inclusion

The last research question related to the evidence of a smaller percentage of board of directors of color (i.e., less than 20%, of which African Americans were less than 6%) and what strategies can be adopted to make the boards more diverse and inclusive. Most members were

generally not surprised by the lower percentage (i.e., 6%) of African American board of directors. Some board members attributed the lower percentage of African American directors to a supply shortage as the percentage of African Americans entering the biotech space has been much lower compared to other ethnicities.

A few members opined that most racial minorities are generally stuck in the middle management roles and do not get senior leadership roles, mentored, or groomed to be at the C-suite level. One of the board members shared a best practice example from a large board in which this member has participated for the last 20 years. To begin with the board was an all-White male board. As the workforce within the company and the demographics around the company headquarters changed, the board took a unanimous decision to diversity the senior management roles and the board to reflect this changing landscape. The company instituted a 3-year strategic plan to diversity the management positions, vendor base, and eventually the board. At the time of this study in 2022, the board is represented by 50% people of color and reflects the diverse customer base and the community. The member reiterated that it takes a concerted effort by everyone (i.e., CEO and board) to make changes across all the levels of the organization.

Members acknowledged that companies can do more to ensure a diverse leadership team through mentorship, recruitment, and finally by developing a proper succession planning mechanism. One of the members stated:

> As a CEO and a board member I have hired women leaders to run different functional organizations as I want to set an example to the company and the board. Soon I plan to share this example with the board to prompt changes to the composition of the board.

On a positive note, several members pointed out that there are currently many women and minorities in senior leadership roles, though in small percentages, indicating that demographic

changes are evident in many levels of management. Some members contented that based on such a trend it was a question of time before the company boards start to reflect the workforce and population demographics.

CHAPTER SEVEN: CONCLUSIONS, LIMITATIONS, AND OPPORTUNITIES FOR RESEARCH

This chapter presents the conclusions by integrating the insights from both the quantitative and qualitative parts of the study. The chapter highlights the implications of the study from a methodological framework, managerial perspective, and the unique contributions made to the board diversity literature. The subsequent sections discuss the limitations of the study followed by identifying opportunities for future research on the topic of board diversity.

The extant literature has not conclusively settled on the issue of the influence of board diversity on firm performance as the results have been mixed with positive, negative, and neutral results. The theoretical frameworks used to assess the board diversity problems neither account for all forms of diversity nor the interaction effects between diversities. Further, the issue of board diversity has been analyzed more broadly from a cross-domain perspective, which suppresses some of the variables relevant to a specific domain. Additionally, the literature lacks qualitative studies, which can bring out rich insights on board composition, governance, and inclusion from a board member's perspective.

The intuitive belief at the start of this study was that diverse boards have a positive influence on firm performance. In the process, this study developed some unique approaches to assess different diversity attributes and analyze interaction between gender diversity and other variables. However, the study was not able to address all aspects of intersectionality due to methodological shortcomings. The study used a qualitative approach to gain an improved understanding of board selection process, composition, and governance.

The study successfully addressed the following four areas: (a) analyzed diversity holistically by factoring all three forms of diversity; (b) established the minimum number of

women members required for positive firm performance; (c) assessed the impact of interaction effect of gender diversity on firm performance; and (d) qualitatively examined the board selection, composition, governance, and inclusion strategies through semistructured interviews.

Overall, the results of the study provide an improved knowledge and understanding on how, why, and when board diversity influences firm performance.

Conclusions

The following sections integrate the results from both the quantitative and qualitative parts of the study to address the key research questions developed in Chapter 3. In summary, the insights from both the studies complement each other. The areas where the quantitative studies cannot provide many answers is complemented by the insights from the rich discussions with board members in the qualitative study and vice versa. The conclusions can be grouped into the following categories:

- Diversity attributes – Which diversity attribute is more important?
- Board selection – What are the successful strategies for board selection?
- Gender ratio in a board – What is the optimal gender ratio for positive performance?
- Gender interaction effect – How does gender interaction influence firm performance?
- Board dynamics – What are the key enablers for board independence?
- Board inclusion – How can boards be diverse as well as inclusive?
- Pre-IPO boards – What are the key strategies to diversify pre-IPO boards?

The combined quantitative and qualitative results provide answers to several research questions and highlights opportunities for future research. The findings can also be a guideline for managers to enhance board diversity and governance.

Diversity Attributes – Which Attribute is More Important?

A key differentiator of this study was the application of social identity, social categorization, and information processing theories to holistically define diversity across the three dimensions of demographic, functional, and cognitive diversities and operationalizing these diversity attributes to apply them to the board diversity problem. The methodological framework used to measure and quantify gender diversity (i.e., gender ratio and the square of gender ratio) and cognitive diversity (i.e., assigning maximum value to the highest education) was intuitive and easy to measure. The dataset of the board of directors was developed organically using multiple secondary research sources, unlike most studies that use readily available databases like the BoardEx or CompuStat. This approach provided more granular details about the board member and firm-level characteristics.

The board diversity data segmentation showed that directors of color account for less than 20% of the directors, a finding which reconfirmed the gap between workforce demographics and board membership described in the industry analysis section (see Appendix B). In the dataset, women of all ethnicities account for 28% of board members, which again is a low number in relation to the percentage of women entering the workforce. On a positive note, the data sample suggested that women have similar educational levels and functional expertise as their male counterparts (see Appendix C). The gender rich boards should feel encouraged by this finding as inclusion of more female board members is compelling as it comes with the dual benefit of ensuring talent and increasing gender diversity.

Determining which diversity attribute is more important than the other, that is rank ordering the diversity attributes, is quite challenging from a quantitative analysis perspective as there is no predefined methodology. In general, the diversity attributes are dependent on the

board size, complexity of the business, and the life cycle of the company. The relevance of different diversity attributes change based on the board size. The small boards (i.e., less than or equal to nine, median size) focus more on gender diversity due to limited resources whereas large boards (i.e., greater than nine) take a broader approach to diversity preferences and prefer not only gender but also cognitive, and functional diversities. Large boards are typically seen in large multinational companies with multiple products and business lines. The nature of the Biotech business is complex and primarily science driven and as a result there is an emphasis on advanced degrees and specialized expertise. It is not uncommon to see many board members with PhD and MD degrees on biotech boards. As education is a proxy for cognitive diversity and specialized expertise is a proxy for functional diversity, hence, these two diversities along with gender diversity drives the composition of large boards. The study findings also confirmed that large boards unlike small boards have the resources and are structurally set-up to focus on other forms of diversity beyond gender.

Race did not present itself as a significant attribute in the study sample. A primary reason for this was that the dataset contained less than 20% directors of color, which is a small number to derive any meaningful results.

As stated earlier, it is challenging to rank order the diversity attributes using quantitative analysis. However, the qualitative analysis provides some direction in rank ordering the diversity attributes. The insights from board member interviews indicated that all members favored demographic diversity, but they also emphasized the importance of functional diversity. Because biotech is highly science driven, the ability of the board members to educate themselves and learn about new scientific innovations is a key differentiator, which also makes the case for board members to have advanced degrees (i.e., a high cognitive diversity). Boards seek out

unique experiences in leadership, manufacturing, commercial operations, mergers and acquisitions, and public accounting as these are valuable experiences irrespective of the life cycle of the company. Typically, a board member is recruited based on unique experiences and to add complementary skills to the existing board. If a woman or person of color has these functional experiences, then the board would have the dual benefit of superior functional expertise and a member belonging to a particular social category (i.e., gender or race).

A complementary and encouraging bit of evidence was that boards primarily value the merit of the recommendations regardless of the position of a member in a social category based on gender or race. This indicated functional expertise and cognitive diversity is ranked higher over demographic diversity. On the contrary, boards unanimously supported the case for diversity in all forms as it avoids the trap of groupthink, which is common to homogenous boards. Instead, boards value different perspectives, leadership styles, and life experiences of members, which is the hallmark of heterogeneous groups.

Based on the quantitative and qualitative results, it can be concluded that gender, functional, and cognitive diversities are highly valuable to a board and the importance of one over the other attribute depends on the size of the board, complexity of the business, and the life cycle of the firm.

Board Selection – What are the Successful Strategies for Board Selection?

The board selection process varies based on the board size. The small boards lack sufficient resources to cast a wider net and additionally these firms are generally time constrained to recruit a new member. Hence, these board tend to hire from known professional network. As such, a professional relationship with the CEO/chairperson and board members is critical to get into such boards. On the contrary, large boards have sufficient resources and hire

outside agencies to conduct a board member search, which makes the recruitment process more open, longer, and competitive. An interesting insight gleaned from the interviews is the differences in how male and female board members approach the board recruitment process. Men tend to think concurrently and look for a board seat while in an executive position, whereas women's approach appears to be more sequential in nature as most women members start to look for a board seat after the completion of their executive tenure.

Impact of a Diverse Board - What is the Optimal Gender Ratio for Positive Performance?

The results of the OLS (see Table 4 and Table 5) indicated that board size, gender ratio, gender diversity, and cognitive diversities were significant predictor variables that correlated positively with firm performance. The gender ratio stands out as a critical variable and through the quantitative analysis it was demonstrated that when gender ratio was greater than 22% the firm performance turned from a negative value to a positive value. This translated to the presence of three women in a 10-member board. From a practical standpoint, this is an achievable target just based on the percentage of women entering the workforce. The 22% minimum requirement of women on a board aligned with the seminal work of Kanter's (1977a) critical mass theory (CMT) and other research studies that have demonstrated similar conclusions such as Joecks et al. (2013) and Ong (2019).

The qualitative study further validated this finding. In cases with more than one female member on the board, these members tend to form alliances, work cohesively as a team, and drive positive outcomes. The qualitative study also reiterated that gender diverse boards benefit from diverse perspectives, knowledge, and varied life experiences of female members. In boards with gender ratio less than 22%, female members can still drive strategic outcomes, but it

depends on multiple factors ranging from prior board experience, leadership skills, confidence, and comfort level of the female member in navigating an otherwise male dominated board.

As a result of integrating the qualitative and quantitative results, it can be concluded that the 22% minimum gender ratio requirement is important to drive positive outcomes. This gender ratio value can be used as a guideline to avoid the trap of tokenism (i.e., gender ratio less than 20%) and instead develop strategies to enhance the percentage of female representation on boards with the eventual goal of moving towards balanced boards.

Gender Interaction Effect – How does Gender Interaction Influence Firm Performance?

The study was unsuccessful in establishing the significance of intersectionality between all three diversities by accounting for the multiplicative effect of each diversity index using the standard OLS methodology. Because gender ratio stood out as a critical variable, the study used a slope dummy variable approach to examine the interaction effect of gender diversity with other variables.

The results reconfirmed the dichotomous relationship between gender ratio and firm performance with a shift in Tobin's Q from a negative value to a positive value when gender ratio was greater than 22%. The key takeaway from this analysis was the bulk of the firms (i.e., 75%) had a gender ratio greater than 22% and a lower Tobin's Q. From the dataset, it was inferred that these firms are early stage clinical development companies with little or no revenues. Seven firms from this group of 75 firms have a higher Tobin's Q and a gender ratio greater than or equal to 0.40. A common theme among these firms (e.g., Moderna, Agios) is that some of these firms generate revenues through recent product launches and a few others generate revenues through licensing deals and/or on the verge of a product launch.

The interviews of board members validated the quantitative findings with respect to the endogenous relationship between women and boards of small and midsize firms. A plausible reason for such firms to have a higher gender ratio is due to the life stage of the company (i.e., most early-stage clinical development). At this stage, these companies are resource constrained to reach out to a broader network and thus the CEOs/board members focus on available talent within their network, who happen to be mostly women. On the other hand, there are multiple reasons for women members to choose such firms versus large boards. First, the small boards offer members the flexibility to balance their professional and personal lives. Secondly, small boards are less bureaucratic, which makes it easier to develop relationships with the CEOs and other board members. Third, small boards offer the opportunity for a variety of work compared to large boards where female members felt restricted to the roles in a few committees or subcommittees. Women members also contended that their impact in small boards is much higher compared to large boards. Finally, the requirements and qualifications to get into small boards is much lower compared to the large boards.

Both these quantitative and qualitative findings indicated that female board members in firms with gender ratio greater than 22% added significant expertise and value to the board. It is likely that women in such boards manage similar or a greater amount of workload compared to their male counterparts. Such gender diverse boards also emphasized the viewpoint that diverse boards contribute to enhanced board governance, thereby dispelling any notion that gender diversity negatively impacts firm performance.

Board Dynamics – What are the Key Enablers for Board independence?

The issue of board independence is of concern when the CEO has a dual role of a CEO and the chairperson of the board. The CEO duality role is more common in U.S. companies

compared to European companies where these two roles are separate. The primary concern when a CEO has a dual role is the issue of board independence and whether the CEO wields unilateral power thus compromising board independence, a situation which runs counter to the established corporate governance norms. In such boards, the biggest challenge for any board member is demonstrating independence while at the same time not coming across as adversarial to the CEO/chairperson's position as this could potentially jeopardize the board tenure. Participants opined that most experienced board members can mediate such conflicting issues effectively, but it can be challenging to a first-time board member especially if one is a woman and/or person of color.

Board Inclusion: What are the Successful Strategies for a Diverse and Inclusive Board?

A key finding from the study sample was the underrepresentation of certain directors of color. The board members indicated that such an underrepresentation is primarily driven by the supply problem in the industry. One way to fix the supply problem is through aggressive recruitment, additional efforts in succession planning, and grooming the underrepresented minorities to take on executive or C-suite roles. However, for such strategies to be successful and sustainable the board, executive leadership, and the CEOs of the organizations should champion and lead such transformational change.

The board members highlighted several success stories which confirmed that implementing such transformational changes requires commitment from the executive leadership and more importantly the openness to accept changes in power structure and power dynamics at the board and the organizational level. If boards can lead such transformational changes, then it will go a long way in making the boards both diverse and inclusive.

On a brighter note, several board members pointed out that many companies now have more women and minorities in leadership positions. If such a trend continues, it will help mitigate the supply shortage of underrepresented executive leadership, and boards in the future will tend to be more diverse and inclusive.

Diversity in Pre-IPO Boards: How Can it Change?

It is worthwhile to discuss the board composition challenges of pre-IPO companies as some of the board members highlighted this in the discussions. The board diversity challenges for pre-IPO are different than the publicly traded companies analyzed in this study. The board composition in the pre-IPO companies is mainly driven by the investors, which is the venture capitalists and private equity firms. These investors mainly focus on profit maximization, next round of capital raise, and exit; board diversity is not their priority. The only way gender or racial minority representation happens in a board is if one of the partners in these firms belongs to this social category. Another way to ensure diversity in pre-IPO companies is for the institutions (e.g., government entities, education institutions) that invest in these funds is to prevail upon the venture and private equity firms to ensure that board diversity is factored into the investment thesis of such firms.

Study Limitations

The study had several limitations which can be categorized across the following dimensions: (a) data size, (b) methodological limitations, and (c) qualitative approach. The dataset for the current study was generated organically through secondary research. Even though the dataset captured significant board- and firm-level characteristics it is still constrained by the limited sample size. The dataset in this study contained only 100 companies compared to approximately 700 publicly traded biotech companies in the United States, which put the study

sample size at less than 15%. A larger dataset (e.g., 40% to 60% of the 700 companies) could have minimized the significant variances of the demographic, functional, and cognitive variables across firms while providing more improved estimates of the regression coefficients and R^2. A further limitation is the use of 1-year cross-sectional data to explain the correlation between board diversity and firm performance. The industry environment and the individual firm-level environment evolves quickly over time, which can significantly impact the board composition. As a result, panel data or longitudinal data can capture the evolution of board diversity over time, while providing valuable insights on the correlation between board diversity and firm performance across time horizons.

As in other board diversity problems, this study also suffered from the issue of omitted variables and variables not being truly exogenous. Even though the focus on endogeneity was not a focus of this study, some endogeneity was evident when analyzing the results of the slope dummy variable approach. In this instance, firms with low Tobin's Q tended to have more women on the board and vice versa. A next level approach would be to use advanced statistical techniques like the two-stage least squares (2SLS) and generalized method of moments (GMM) methods to address such endogeneity issues. The current study did not use the 2SLS due to the small sample size and 1-year cross-sectional data. Ideally, 2SLS and GMM methods are effective in larger datasets with panel data or longitudinal dataset where lagged variables can help resolve the endogeneity issue.

The present study was also handicapped by the methodological constraints for evaluating the intersectionality between the three diversities. The existing approaches in the literature, which was basically multiplying the three diversity indices to assess the interaction effect, was

too simplistic in nature and not robust enough to capture the nonlinearities inherent in the relation between each diversity attribute.

The qualitative part of the study had significant limitations as well. The study did not include a survey instrument and only covered semistructured interviews of eight board members, which again was a smaller sample size. The sample was also missing interviews from members belonging to all ethnicities due to time constraints, though it included both male and female members of major racial groups. The topic of board diversity is a complex topic that requires more in-depth discussion with a wide variety of boards members. A survey framework that covers a large sample size (e.g., $N > 2{,}500$ members) and interviews of 10% to 20% of the response sample for longer periods of time would provide more in-depth perspectives on board diversity.

The board member interviews in the current study were broad based due to lack of time and did not go into in-depth questioning of multiple areas. The current study was further constrained for time and as a result did not investigate the successful strategies which some boards have used to enhance board diversity.

Opportunities for Future Research

It was evident from the academic research on this topic and the current study that further research is required to understand the complexities of board diversity. The present study touched upon a few key elements and enhanced the understanding of the correlation between board diversity and firm performance. It is possible to extend this study to a variety of quantitative and qualitative areas of research.

Future studies can cover multiyear, multiregional (e.g., United States, Europe, Asia, and Africa), and cross-industry datasets to draw comparisons and contrast between different regions

and industries on the influence of board diversity on firm performance. These studies can also include an assessment of countries with gender quotas versus countries without gender quotas to better understand the impact of board quotas across regions. There is also significant scope for developing a robust methodological framework to assess the effect of intersectionality between diversity attributes, an area that has received little attention in the literature. Similarly, future studies can extend the slope dummy variable approach used in the current study to understand the interaction effect of all three forms of diversity with other independent variables.

Another interesting study would be to track the impact on stock price by capturing stock price of companies 7 days prior to a board member selection and 7 after the selection of a board member. Such a study can provide interesting correlations between a board member selection and stock performance while highlighting the market sentiments for the selection of a board member. The current study used Tobin's Q as the measure for firm performance, which is a market-based metric; however, future studies can also look at accounting-based metrics like the return on assets (ROA) or return on equity (ROE).

The methodology developed in this study to determine the inflection point for firm performance can be extended to a cross-industry or cross-region studies to better understand how firms in different industries or different regions balance gender diversity versus firm performance. It would be interesting to understand which industries or regions are in different areas of Kanter's (1977a) critical mass grouping and to get a fundamental knowledge on the reasons why certain industries or regions have balanced boards or tilted boards or tokens. These insights would enable firms to formulate better board diversity and inclusion policies based on both industry and region.

The current qualitative study focused on capturing the voice of the board members in a brief period of time, but this was not sufficient to have a deeper understanding of such a critical and complex topic. A refined approach would be to have deeper and longer discussions on several topics of board diversity separately (e.g., board selection, board leadership, board dynamics, board inclusion) with a larger set of board members. Other complementary studies could involve interviewing only boards with one to two female members, boards with two to three female members, and an all-female board. A comparative analysis of these three different models will enable to comprehensively examine the board selection, governance, diversity, and inclusion mechanisms. An extension of such a study could involve a case study comparing insights from interviewing board members from a homogenous board versus board members from a heterogeneous board, which will be a compelling value add to the literature.

These suggestions for future studies described in the prior sections can be extended to the nonprofit domain but with the caveat that the structure, composition, emphasis on diversity attributes, and the outcome variables could be vastly different. However, the data collection process, methodology, analysis, and qualitative approaches are still valid. In the nonprofit sector the outcome variable could also be a nonfinancial metric like environment and sustainability goals. Nevertheless, the topic of board diversity is here to stay, which provides significant opportunities to contribute to its development through academic research and policy development.

Closing Remarks

In summary, the current study clarified many ambiguities evident in the board diversity literature with respect to the correlation of board diversity with firm performance. The quantitative study provided answers to the significance of different diversity attributes and

established a minimum of 22% female representation in a board to achieve a positive firm performance. On the other hand, the qualitative study provided a much broader view with the real-world perspectives from the board member interviews on rank ordering of different diversity attributes, board member selection process, and more importantly, strategies to enhance the participation of underrepresented minorities to make boards more diverse and inclusive.

By integrating the insights from the quantitative and qualitative analyses, I concluded that board size, complexity of the business, and life cycle stage of the company drives the importance of different diversity attributes. A single diversity attribute is not sufficient, but a combination of different diversity attributes is required due to the varying objectives of each board—a one size fits all proposition may not be optimal. Boards members stated that boards value the merit of recommendations by a board member much more than viewing the member as belonging to a particular social category. Board members further opined that boards prefer a heterogeneous board as it gains from different perspectives, leadership styles, and life experiences of board members while avoiding the trap of groupthink.

The supply deficit of underrepresented groups, highlighted in this study, can be mitigated through mentorship, succession planning, and grooming the next set of executive leaders. For board diversity to be successful it should be supported by the executive leadership, the board, and the CEO along with a commitment to change the board power structure. Sustaining this transformation is also dependent on cascading the efforts down to the senior management, organizational level, and even the supply base for the organization to mirror its workforce demographics, customer base, and the surrounding community.

REFERENCES

Adams, R. B., & Ferreira, D. (2004). Gender diversity in the boardroom. *SSRN Electronic Journal - European Corporate Governance Institute, Finance Working Paper, 57*(1), 30. https://doi.org/10.2139/ssrn.594506

Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, *94*(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007

Agresti, A., & Agresti, B. F. (1978). Statistical analysis of qualitative variation. *Sociological Methodology*, *9*, 204–237. https://doi.org/10.2307/270810

Ahern, K. R., & Dittmar, A. K. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. *Quarterly Journal of Economics*, *127*(1), 137–197. https://doi.org/10.1093/qje/qjr049

Aifuwa, H. O., Musa, S., Gold, N. O. & Usman, K. M. (2020). Board cognitive diversity and firm performance nexus: Evidence from Nigeria. *International Journal of Management, Innovation & Entrepreneurial Research, 6*(2), 88–99. https://doi.org/10.18510/ijmier.2020.629

Alvarez, R. M., & McCaffery, E. J. (2003). Are there sex differences in fiscal political preferences?. *Political Research Quarterly*, *56*(1), 5–17. https://doi.org/10.1177/106591290305600101

Ammari, A., Kadria, M., & Ellouze, A. (2014). Board structure and firm performance: Evidence from French firms listed in SBF 120. *International Journal of Economics and Financial Issues*, *4*(3), 580–590. www.econjournals.com

Ancona, D. G., & Caldwell, D. F. (1992). Demography and design: Predictors of new product team performance. *Organization Science*, *3*(3), 321–341. https://doi.org/10.1287/orsc.3.3.321

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Atewologun, D. (2018). Intersectionality theory and practice. In *Oxford Research Encyclopedia of Business and Management*. https://doi.org/10.1093/acrefore/9780190224851.013.48

Banff, A., & Sur, S. (2006, June 3–6). *Defining board effectiveness: An interdisciplinary process model* [Paper presentation]. Annual Conference of the Administrative Science Association of Canada, Banff, Alberta, Canada.

Bantel, K. A. (1993). Top team, environment, and performance effects on strategic planning formality. *Group & Organization Management*, *18*(4), 436–458. https://doi.org/10.1177/1059601193184004

Bantel, K. A., & Jackson, S. E. (1989). Top management and innovations in banking: Does the composition of the top team make a difference? *Strategic Management Journal, 10*(1), 107–124. https://doi.org/10.1002/smj.4250100709

Bauer, G. (2014). Incorporating intersectionality theory into population health research methodology: Challenges and the potential to advance health equity. *Social Science & Medicine*, *110*, 10–17. https://doi.org/10.1016/j.socscimed.2014.03.022

Baysinger, B. D., & Butler, H. N. (1985). The role of corporate law in the theory of the firm. *The Journal of Law and Economics*, *28*(1), 179–191. https://doi.org/10.1086/467079

Bhagat, S., & Black, B. (2002). Independent directors. In *The New Palgrave Dictionary of Economics and the Law* (pp. 941–945). Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-74173-1_179

Bilimoria, D., & Huse, M. (1997). Tales about directorates - As reported by women directors. *Proceedings of the International Association for Business and Society*, *8*, 139–150. https://doi.org/10.5840/iabsproc1997817

Biotech Innovation Organization. (2020). *The Bioscience Economy: Propelling Life-Saving Treatments, Supporting State & Local Communities BIO2020 Report*. https://www.bio.org/ia-reports

Blau, P. M. (1977). *Inequality and heterogeneity*. Free Press.

Boone, A. L., Field, L. C., Karpoff, J. M., & Raheja, C. G. (2007). The determinants of corporate board size and composition: An empirical analysis. *Journal of Financial Economics*, *85*(1), 66–101. https://doi.org/10.2139/ssrn.605762

Broome, L. L., Conley, J. M., & Krawiec, K. D. (2010). Dangerous categories: Narratives of corporate board diversity. *North Carolina Law Review*, *89*(3), 759 –808. http://doi.org/10.2139/ssrn.1415803

Bunderson, J. S., & Sutcliffe, K. M. (2002). Comparing alternative conceptualizations of functional diversity in management teams: Process and performance effects. *Academy of Management Journal*, *45*(5), 875–893. https://doi.org/10.5465/3069319

Burke, R. J. (1994). Women on corporate boards of directors. *Women in Management Review*, *9*(5), 3–10. https://doi.org/10.1108/09649429410066974

Byrne, D. (1971). *The attraction paradigm*. Academic Press.

California Life Science Association. (2020). *California Life Sciences Industry Report 2019*. https://www.califesciences.org/wp-content/uploads/2021/06/CLSA-PWC-2020-Sector-Report.pdf

Campbell, K., & Mínguez-Vera, A. (2008). Gender diversity in the boardroom and firm financial performance. *Journal of Business Ethics*, *83*(3), 435–451. https://doi.org/10.1007/s10551-007-9630-y

Carpenter, M. A., Geletkanycz, M. A., & Sanders, G. W. (2004). Upper echelons research revisited: Antecedents, elements, and consequences of top management team composition. *Journal of Management, 30*(6), 749–778. https://doi.org/10.1016/j.jm.2004.06.001

Carter, D. A., Simkins, B. J., & Simpson, W. G. (2003). Corporate governance, board diversity, and firm value. *The Financial Review*, *38*(1), 33–53. https://doi.org/10.1111/1540-6288.00034

Carter, D. A., D'Souza, F., Simkins, B. J., & Simpson, W. G. (2010). The gender and ethnic diversity of US boards and board committees and firm financial performance. *Corporate Governance: An International Review*, *18*(5), 396–414. https://doi.org/10.1111/j.1467-8683.2010.00809.x

Carty, R., & Weiss, G. (2012). Does CEO duality affect corporate performance? Evidence from the U.S. banking crisis. *Journal of Financial Regulation and Compliance*, *20*(1), 26–40. https://doi.org/10.1108/13581981211199407

Carver, J. (2002). Filling board vacancies. *Board Leadership*, *2002*(63), 2. https://doi.org/10.1002/bl.38620026303

Catalyst. (2009). *The 2009 Catalyst member benchmarking report*. http://www.catalyst.org/research/2009-catalyst-member-benchmarking-report/

Certo, S. T. (2003). Influencing initial public offering investors with prestige: Signaling with board structures. *The Academy of Management Review*, *28*(3), 432–446. https://doi.org/10.2307/30040731

Chambers, E. G., Foulon, M., Handfield-Jones, H., Franklin, S. M., & Michaels, E. G., III. (1998). The war for talent. *The McKinsey Quarterly*, 3, 44–57. https://doi.org/10.1002/ltl.40619981005

Chambers, N., Harvey, G., Mannion, R., Bond, J., & Marshall, J. (2013). Towards a framework for enhancing the performance of NHS boards: A synthesis of the evidence about board governance, board effectiveness and board development. *Health Services and Delivery Research*, *1*(6), 1–138. https://doi.org/10.3310/hsdr01060

Cheng, J. Y. J., Groysberg, B., Healy, P., & Vijayaraghavan, R. (2017, December). *Director perceptions of their boards' effectiveness, size and composition, dynamics, and internal governance* [Paper presentation]. Harvard Business School.

Conyon, M. J., & He, L. (2016). Firm performance and boardroom gender diversity: A quantile regression approach. *SSRN Electronic Journal*, *79*(6), 196–211. https://doi.org/10.2139/ssrn.2748558

Crenshaw, K. (2015, September 24). Why intersectionality can't wait. *Washington Post*. https://www.washingtonpost.com/news/in-theory/wp/2015/09/24/why-intersectionality-cant-wait/

Creswell, J. W. (2014). *A concise introduction to mixed methods research*. SAGE Publications.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory Into Practice*, *39*(3), 124–130. https://doi.org/10.1207/s15430421tip3903_2

Cyert, R. M., & March, J. G. (1963*). A behavioral theory of the firm*. Prentice-Hall.

Daily, C. M., Dalton, D. R., & Cannella, A. A. (2003). Corporate governance: Decades of dialogue and data. *Academy of Management Review*, *28*(3), 371–382. https://doi.org/10.2307/30040727

Daily, C. M., Certo, S. T., & Dalton, D. R. (1999). A decade of corporate women: Some progress in the boardroom, none in the executive suite. *Strategic Management Journal*, *20*(1), 93–100. https://doi.org/10.1002/(sici)1097-0266(199901)20:1

Dalton, D. R., Daily, C. M., Ellstrand, A. E., & Johnson, J. L. (1998). Meta-analytic review of board composition, leadership structure, and financial performance. *Strategic Management Journal*, *19*(3), 269–290. https://doi.org/10.1002/

Davis, J. H., Schoorman, F. D., & Donaldson, L. (1997). Toward a stewardship theory of management. *The Academy of Management Review*, *22*(1), 20–47. https://doi.org/10.2307/259223

Dayan, M., Ozer, M., & Almazrouei, H. (2017). The role of functional and demographic diversity on new product creativity and the moderating impact of project uncertainty. *Industrial Marketing Management*, *61*, 144–154. https://doi.org/10.1016/j.indmarman.2016.04.016

del Carmen Triana, M., Miller, T. L., & Trzebiatowski, T. M. (2014). The double-edged nature of board gender diversity: Diversity, firm performance, and the power of women directors as predictors of strategic change. *Organization Science*, *25*(2), 609–632. https://doi.org/10.1287/orsc.2013.0842

Deterding, N. M., & Waters, M. C. (2018). Flexible coding of in-depth interviews: A twenty-first-century approach. *Sociological Methods & Research*, *50*(2), 708–739. https://doi.org/10.1177/0049124118799377

Deutsch, Y., & Ross, T. W. (2003). You are known by the directors you keep: Reputable directors as a signaling mechanism for young firms. *Management Science*, *49*, 1003–1017. https://doi.org/10.1287/mnsc.49.8.1003.16399

Dezsö, C. L., & Ross, D. G. (2012). Does female representation in top management improve firm performance? A panel data investigation. *Strategic Management Journal*, *33*(9), 1072–1089. https://doi.org/10.1002/smj.1955

Dobbin, F., & Jung, J. (2011). Corporate board gender diversity and stock performance: The competence gap or institutional investor bias? *North Carolina Law Review, 89*(3), 809–838. http://scholarship.law.unc.edu/nclr/vol89/iss3/5

Dowling, M., & Aribi, Z. A. (2013). Female directors and UK company acquisitiveness. *International Review of Financial Analysis*, *29*(1), 79–86. https://doi.org/10.1016/j.irfa.2013.04.004

Dubrow, J. K. (2008). How can we account for intersectionality in quantitative analysis of survey data? Empirical illustration for Central and Eastern Europe. *ASK Research & Methods*, *17*, 65–100. https://doi.org/10.1007/978-3-531-93168-5_8

EEOC (2022). U.S. Equal Employment Opportunity Commission. *EEOC Portal*. https://www.eeoc.gov/employees-job-applicants

El-Faitouri, R. (2014). Board of directors and Tobin's Q: Evidence from UK firms. *Journal of Finance and Accounting*, *2*(4), 82–99. https://doi.org/10.12691/jfa-2-4-2

Elsass, P. M., & Graves, L. M. (1997). Demographic diversity in decision-making groups: The experiences of women and people of color. *Academy of Management Review*, *22*(4), 946–973. https://doi.org/10.5465/amr.1997.9711022111

Else-Quest, N. M., & Hyde, J. S. (2016). Intersectionality in quantitative psychological research II. Methods and techniques. *Psychology of Women Quarterly*, *40*(2), 155–170. https://doi.org/10.1177/0361684316629797

Ely, R. J. (1994). The effects of organizational demographics and social identity on relationships among professional women. *Administrative Science Quarterly*, *39*(2), 203–238. https://doi.org/10.2307/2393234

Ely, R. J. (1995). The power in demography: Women's social constructions of gender identity at work. *Academy of Management Journal*, *38*(3), 589–634. https://doi.org/10.5465/256740

Ely, R. J., & Thomas, D. A. (2001). Cultural diversity at work: The effects of diversity perspectives on work group processes and outcomes. *Administrative Science Quarterly*, *46*(2), 229–273. https://doi.org/10.2307/2667087

Ely, R. J., & Thomas, D. A. (2020). Getting serious about diversity. *Harvard Business Review*, *98*(6), 114–122. https://hbr.org/2020/11/getting-serious-about-diversity-enough-already-with-the-business-case

Erhardt, N. L., Werbel, J. D., & Shrader, C. B. (2003). Board of director diversity and firm financial performance. *Corporate Governance*, *11*(2), 102–111. https://doi.org/10.1111/1467-8683.00011

Fairfax, L. M. (2005). *The bottom line on board diversity: A cost-benefit analysis of the business rationales for diversity on corporate boards* (University of Maryland Legal Research Studies Paper No. 2005-58). Wisconsin Legal Review. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=835406

Fama, E. F. (1980). Agency problems and the theory of the firm. *Journal of Political Economy*, *88*(2), 288–307. http://doi.org/10.1086/260866

Fama, E. F., & Jensen, M. C. (1983). Separation of ownership and control. *The Journal of Law and Economics*, *26*(2), 301–325. https://doi.org/10.1086/467037

Farag, H., & Mallin, C. (2017). Board diversity and financial fragility: Evidence from European banks. *International Review of Financial Analysis*, *49*, 98–112. https://doi.org/10.1016/j.irfa.2016.12.002

Farrell, K. A., & Hersch, P. L. (2005). Additions to corporate boards: The effect of gender. *Journal of Corporate Finance*, *11*(1–2), 85–106. https://doi.org/10.1016/j.jcorpfin.2003.12.001

Ferreira, D. (2010). Board diversity. In R. Anderson & H. K. Baker (Eds.), *Corporate governance: A synthesis of theory, research, and practice* (pp. 225–242). John Wiley & Sons.

Fessler, J., & Anslow, J. (2019, February 11). SEC issues new guidance on diversity disclosure requirements. *Corporate and Securities Law Blog*. https://www.corporatesecuritieslawblog.com/2019/02/sec-issues-new-guidance-on-diversity-disclosure-requirements

Finkelstein, S., & Mooney, A. C. (2003). Not the usual suspects: How to use board process to make boards better. *Academy of Management Perspectives*, *17*(2), 101–113. https://doi.org/10.5465/ame.2003.10025204

Frechette, J., Bitzas, V., Aubry, M., Kilpatrick, K., & Lavoie-Tremblay, M. (2020). Capturing lived experience: Methodological considerations for interpretive phenomenological inquiry. *International Journal of Qualitative Methods, 19*, 1–12. https://doi.org/10.1177/1609406920907254

Gabrielsson, J., & Huse, M. (2004). Context, behavior, and evolution: Challenges in research on boards and governance. *International Studies of Management & Organization*, *34*(2), 11–36. https://doi.org/10.1080/00208825.2004.11043704

Gladstein, D. L., & Reilly, N. P. (1985). Group decision making under threat: The tycoon game. *Academy of Management Journal*, *28*(3), 613–627. https://doi.org/10.5465/256117

Glick, W. H., Miller, C. C., & Huber, G. P. (1993). The impact of upper-echelon diversity on organizational performance. In G. P. Huber & W. H. Glick (Eds.), *Organizational change and redesign: Ideas and insights for improving performance* (pp. 176–214). Oxford.

Granovetter, M. (1978). Threshold models of collective behavior. *American Journal of Sociology*, *83*(6), 1420–1443. https://doi.org/10.1086/226707

Groves, M (2019, Dec 19). How California's 'woman quota' is already changing corporate boards. *Cal Matters.* https://calmatters.org/economy/2019/12/california-woman-quota-corporate-board-gender-diversity/

Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics*. McGraw-Hill.

Hambrick, D. C., Cho, T. S., & Chen, M.-J. (1996). The influence of top management team heterogeneity on firms' competitive moves. *Administrative Science Quarterly*, *41*(4), 659–684. https://doi.org/10.2307/2393871

Hambrick, D. C. (2007). Upper echelons theory: An update. *Academy of Management Review*, *32*(2), 334–343. https://doi.org/10.5465/amr.2007.24345254

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, *9*(2), 193–206. https://doi.org/10.5465/amr.1984.4277628

Hankivsky, O., Cormier, R., & De Merich, D. (2009). *Intersectionality: Moving women's health research and policy forward*. Women's Health Research Network.

Harding, M., & Lemayian, Z. (2018). *SEC regulation S-K and board diversity*. Social Science Research Network. https://doi.org/10.2139/ssrn.3223452

Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *Academy of Management Review*, *32*(4), 1199–1228. https://doi.org/10.5465/amr.2007.26586096

Hermalin, B. E., & Weisbach, M. S. (1991). The effects of board composition and direct incentives on firm performance. *Financial Management*, *20*(4), 101–112. https://doi.org/10.2307/3665716

Hermalin, B. E., & Weisbach, M. S. (2001). *Boards of directors as an endogenously determined institution: A survey of the economic literature* [Working paper]. National Bureau of Economic Research. https://doi.org/10.3386/w8161

Hillman, A. J., & Dalziel, T. (2003). Boards of directors and firm performance: Integrating agency and resource dependence perspectives. *Academy of Management Review*, *28*(3), 383–396. https://doi.org/10.5465/amr.2003.10196729

Ivankova, N. V., & Stick, S. L. (2007). Students' persistence in a distributed doctoral program in educational leadership in higher education: A mixed methods study. *Research in Higher Education*, *48*(1), 93–135. https://doi.org/10.1007/s11162-006-9025-4

Iyengar, R. J., & Zampelli, E. M. (2009). Self-selection, endogeneity, and the relationship between CEO duality and firm performance. *Strategic Management Journal*, *30*(10), 1092–1112. https://doi.org/10.1002/smj.776

Jensen, M. C. (1993). The modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance*, *48*(3), 83–880. http://doi.org/10.1111/j.1745-6622.2010.00260.x

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Joecks, J., Pull, K., & Vetter, K. (2013). Gender diversity in the boardroom and firm performance: What exactly constitutes a "critical mass"? *Journal of Business Ethics*, *118*(1), 61–72. https://doi.org/10.1007/s10551-012-1553-6

Kader, G. D., & Perry, M. (2007). Variability for categorical variables. *Journal of Statistics Education*, *15*(2). https://doi.org/10.1080/10691898.2007.11889465

Kanter, R. M. (1977a). *Men and women of the corporation*. Basic Books.

Kanter, R. M. (1977b). Some effects of proportions on group life: Skewed sex ratios and responses to token women. *American Journal of Sociology*, *82*(5), 965–990. https://doi.org/10.1086/226425

Keck, S. L. (1997). Top management team structure: Differential effects by environmental context. *Organization Science*, *8*(2), 143–156. https://doi.org/10.1287/orsc.8.2.143

Keck, S. L., & Tushman, M. L. (1993). Environmental and organizational context and executive team structure. *Academy of Management Journal*, *36*(6), 314–344. https://doi.org/10.2307/256813

Klein, A. (2002). Audit committee, board of director characteristics, and earnings management. *Journal of Accounting and Economics*, *33*(3), 375–400. https://doi.org/10.1016/S0165-4101(02)00059-9

Konrad, A., & Kramer, V. W. (2006, December). How many women do boards need? *Harvard Business Review Magazine*. https://hbr.org/2006/12/how-many-women-do-boards-need

Kozhevnikov, M. (2007). Cognitive styles in the context of modern psychology: toward an integrated framework of cognitive style. *Psychological Bulletin*, *133*(3), 464–481. https://doi/10.1037/0033-2909.133.3.464

Kress, G. L., & Schar, M. (2012). Applied teamology: The impact of cognitive style diversity on problem reframing and product redesign within design teams. In H. Plattner, C. Meinel, & L. (Eds.), *Design thinking research*: *Understanding innovation* (pp. 127–149). Springer.

Krishnan, H. A., & Park, D. (2005). A few good women—on top management teams. *Journal of Business Research*, *58*(12), 1712–1720. https://doi.org/10.1016/j.jbusres.2004.09.003

Kurylko, D. T. (2005, September 26). *Men still dominate boardroom*. Automotive News.

Lipman, F. D., & Lipman, L. K. (2006). *Corporate governance best practices: Strategies for public, private, and not-for-profit organizations*. John Wiley & Sons.

Lipton, M., & Lorsch, J. W. (1992). A modest proposal for improved corporate governance. *The Business Lawyer*, *48*(1), 59–77. http://www.jstor.org/stable/40687360

Loyd, D. L., Wang, C. S., Phillips, K. W., & Lount, R. B. (2013). Social category diversity promotes premeeting elaboration: The role of relationship focus. *Organization Science*, *24*(3), 757–772. https://doi.org/10.1287/orsc.1120.0761

Lückerath-Rovers, M. (2013). Women on boards and firm performance. *Journal of Management & Governance*, *17*(2), 491–509. https://doi.org/10.1007/s10997-011-9186-1

Lustgarten, S., & Mande, V. (1995). Financial analysts' earnings forecasts and insider trading. *Journal of Accounting and Public Policy*, *14*(3), 233–261. https://doi.org/10.1016/0278-4254(95)00030-i

Mak, Y. T., & Kusnadi, Y. (2002). Size really matters: Further evidence on the negative relationship between board size and firm value. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.303505

Marimuthu, M., & Kolandaisamy, I. (2009). Ethnic and gender diversity in boards of directors and their relevance to financial performance of Malaysian companies. *Journal of Sustainable Development, 2*(3), 139–148. https://doi.org/10.5539/jsd.v2n3p139

Maznevski, M. L. (1994). Understanding our differences: Performance in decision-making groups with diverse members. *Human Relations*, *47*(5), 531–552. https://doi.org/10.1177/001872679404700504

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation* (4th ed.). John Wiley & Sons.

Miller, C. C., Burke, L. M., & Glick, W. H. (1998). Cognitive diversity among upper-echelon executives: Implications for strategic decision processes. *Strategic Management Journal*, *19*(1), 39–58. https://doi.org/10.1002/

Miller, T., & del Carmen Triana, M. (2009). Demographic diversity in the boardroom: Mediators of the board diversity–firm performance relationship. *Journal of Management Studies*, *46*(5), 755–786. https://doi.org/10.1111/j.1467-6486.2009.00839.x

Milliken, F. J., & Martins, L. L. (1996). Searching for common threads: Understanding the multiple effects of diversity in organizational groups. *Academy of Management Review*, *21*(2), 402–433. https://doi.org/10.5465/amr.1996.9605060217

Mintzberg, H. (1983). The case for corporate social responsibility. *Journal of Business Strategy*, *4*(2), 3–15. https://doi.org/10.1108/eb039015

Mohsni, S., & Shata, A. (2021). *Board gender diversity and firm performance: The role of firm size* [White paper]. Carleton University. www.hillsdaleinv.com

Murray, A. (1989). Top management group heterogeneity and firm performance. *Strategic Management Journal*, *10*(S1), 125–142. https://doi.org/10.1002/smj.4250100710

Ong, L. L. (2019). *Gender diversity and financial implications: Endogeneity issues and critical mass of females on corporate boards* [Unpublished doctoral dissertation]. Bond University.

Perez de Toledo, E. (2009). Firm value and the evolution of corporate governance standards in Spain. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1483854

Petersen, R. (2000). The management of a diverse workforce in the business environment of Israel and possible applications for South Africa, *Dissertation Abstracts International Section B: The Sciences and Engineering*, *60*, 42–84. https://www.elibrary.ru/item.asp?id=5453506

Pettigrew, A. M. (1992). On studying managerial elites. *Strategic Management Journal*, *13*(S2), 163–182. https://doi.org/10.1002/smj.4250130911

Pfeffer, J. (1972). Size and composition of corporate boards of directors: The organization and its environment. *Administrative Science Quarterly*, *17*(2), 218–228. https://doi.org/10.2307/2393956

Pfeffer, J. (1985). Organizational demography: Implications for management. *California Management Review*, *28*(1), 67–81. https://doi.org/10.2307/41165170

Pham, P. K., Suchard, J., & Zein, J. (2011). Corporate governance and alternative performance measures. *Australian Journal of Management*, *36*(3), 371–386. http://doi.org/10.1177/0312896211413035

Post, C., & Byron, K. (2015). Women on boards and firm financial performance: a meta-analysis. *Academy of Management Journal*, *58*(5), 1546–1571. https://doi.org/10.5465/amj.2013.0319

Radu, C., & Smaili, N. (2022). Board gender diversity and corporate response to cyber risk: Evidence from cybersecurity related disclosure. *Journal of Business Ethics*, *177*(2), 351–374. https://doi.org/10.1007/s10551-020-04717-9

Rampling, P. N. (2011). Board diversity & corporate performance. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1969229

Rao, C. (1982). Diversity and dissimilarity coefficients: A unified approach. *Theoretical Population Biology*, *21*(1), 24–43. https://doi.org/10.1016/0040-5809(82)90004-1

Rao, H., & Sivakumar, K. (1999). Institutional sources of boundary-spanning structures: The establishment of investor relations departments in the fortune 500 industrials. *Organization Science*, *10*(1), 27–42. https://doi.org/10.1287/orsc.10.1.27

Ratzan, J., & Lant, T. K. (2019). *Top management team diversity in financial services - The influence of functional and demographic diversity on firm financial performance*. Social Science Research Network. https://doi.org/10.2139/ssrn.3526586

Reynolds, A., & Lewis, D. (2017, March). Teams solve problems faster when they're more cognitively diverse. *Harvard Business Review Magazine*. https://hbr.org/2017/03/

Rhode, D., & Packel, A. K. (2010). *Diversity on corporate boards: How much difference does difference make?* Social Science Research Network. https://doi.org/10.2139/ssrn.1685615

Richard, O. (2000). Racial diversity, business strategy, and firm performance: A resource-based view. *Academy of Management Journal*, *43*(2), 164–177. https://doi.o..rg/10.5465/1556374

Richard, O. C., Murthy, B. S., & Ismail, K. (2007). The impact of racial diversity on intermediate and long-term performance: The moderating role of environmental context. *Strategic Management Journal*, *28*(12), 1213–1233. https://doi.org/10.1002/smj.633

Roberson, Q. M., Sturman, M. C., & Simons, T. L. (2007). Does the measure of dispersion matter in multilevel research? A comparison of the relative performance of dispersion indexes. *Organizational Research Methods*, *10*(4), 564–588. https://doi.org/10.1177/1094428106294746

Roberts, J., McNulty, T., & Stiles, P. (2005). Beyond agency conceptions of the work of the non-executive director: creating accountability in the boardroom. *British Journal of Management*, *16(*S1), S5–S26. https://doi.org/10.1111/j.1467-8551.2005.00444.x

Rose, C. (2007). Does female board representation influence firm performance? The Danish evidence. *Corporate Governance: An International Review*, *15*(2), 404–413. https://doi.org/10.1111/j.1467-8683.2007.00570.x

Rouhani, S. (2014). *Intersectionality-informed quantitative research: A primer*. Institute for Intersectionality Research and Policy. https://heni.co.in/rouhani-s-intersectionality-informed-quantitative-research-a-primer2014-the-institute-for-intersectionality-research-policy-sfu-isbn-978-0-86491-356-2/

Salancik, G. R., Pfeffer, J., & Kelly, J. P. (1978). A contingency model of influence in organizational decision-making. *The Pacific Sociological Review*, *21*(2), 239–256. https://doi.org/10.2307/1388862

Sarah, C., & Huang, J. (2020). *Women in the workplace 2020.* McKinsey & Company. https://wiw-report.s3.amazonaws.com/Women_in_the_Workplace_2020.pdf

Sarbanes-Oxley Act of 2002, 5 U.S.C. § 552 (2002). https://www.govinfo.gov/app/details/PLAW-107publ204

Schultz, E. L., Tan, D. T., & Walsh, K. D. (2010). Endogeneity and the corporate governance-performance relation. *Australian Journal of Management*, *35*(2), 145–163. https://doi.org/10.1177/0312896210370079

Seglen, P. O. (1997). Why the impact factor of journals should not be used for evaluating research. *BMJ*, *314*(7079), 497–497. https://doi.org/10.1136/bmj.314.7079.497

Shrader, C. B., Blackburn, V. B., & Iles, P. (1997). Women in management and firm financial performance: An exploratory study. *Journal of Managerial Issues*, *9*(3), 355–372. https://www.jstor.org/stable/i40026438

Silverman, D. (2017). *Doing qualitative research*. SAGE Publications.

Singh, V., Vinnicombe, S., & Johnson, P. (2001). Women directors on top UK boards. *Corporate Governance*, *9*(3), 206–216. https://doi.org/10.1111/1467-8683.00248

Smith, N., Smith, V., & Verner, M. (2006). Do women in top management affect firm performance? A panel study of 2,500 Danish firms. *International Journal of Productivity and Performance Management*, *55*(7), 569–593. https://doi.org/10.1108/17410400610702160

Solanas, A., Selvam, R. M., Navarro, J., & Leiva, D. (2012). Some common indices of group diversity: Upper boundaries. *Psychological Reports*, *111*(3), 777–796. https://doi.org/10.2466/01.09.21.pr0.111.6.777-796

Stirling, A. (1998). *On the economics and analysis of diversity* (Electronic Working Paper Series No. 28). Science Policy Research Unit. http://sro.sussex.ac.uk/view/divisions/d238/1998.html#group_S

Studenmund, A. H. (2014). *Using econometrics, a practical guide*. Pearson.

Sutcliffe, K. M. (1994). What executives notice: Accurate perceptions in top management teams. *Academy of Management Journal*, *37*(5), 1360–1378. https://doi.org/10.5465/256677

Tajfel, H. (1981). *Human groups and social categories.* Cambridge University Press.

Terjesen, S., Couto, E. B., & Francisco, P. M. (2016). Does the presence of independent and female directors impact firm performance? A multi-country study of board diversity. *Journal of Management & Governance*, *20*(3), 447–483. https://doi.org/10.1007/s10997-014-9307-8

Terjesen, S., & Singh, V. (2008). Female presence on corporate boards: A multi-country study of environmental context. *Journal of Business Ethics*, *83*(1), 55–63. https://doi.org/10.1007/s10551-007-9656-1

Timmerman, T. A. (2000). Racial diversity, age diversity, interdependence, and team performance. *Small Group Research*, *31*(5), 592–606. https://doi.org/10.1177/104649640003100505

Torchia, M., Calabrò, A., & Huse, M. (2011). Women directors on corporate boards: From tokenism to critical mass. *Journal of Business Ethics*, *102*(2), 299–317. https://doi.org/10.1007/s10551-011-0815-z

Tsui, A. S., & Gutek, B. A. (1999). *Demographic differences in organizations: Current research and future directions.* Lexington Books.

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory*. Basil Blackwell.

Wagana, D. M., & Nzulwa, J. D. (2016). Corporate governance, board gender diversity and corporate performance: A critical review of literature. *European Scientific Journal*, *12*(7), 221–233. https://doi.org/10.19044/esj.2016.v12n7p221

Walt, N., & Ingley, C. (2003). Board dynamics and the influence of professional background, gender and ethnic diversity of directors. *Corporate Governance*, *11*(3), 218–234. https://doi.org/10.1111/1467-8683.00320

Wang, Y., & Clift, B. (2009). Is there a "business case" for board diversity? *Pacific Accounting Review*, *21*(2), 88–103. https://doi.org/10.1108/01140580911002044

Weber, L., & Parra-Medina, D. (2003). Intersectionality and women's health: Charting a path to eliminating health disparities. In V. Demos & M. T. Segal (Eds.), *Advances in gender research: Gendered perspectives on health and medicine* (pp. 183–226). Elsevier.

Wellalage, N. H., & Locke, S. (2013). Corporate governance, board diversity and firm financial performance: New evidence from Sri Lanka. *International Journal of Business Governance and Ethics*, *8*(2), 116–136. https://doi.org/10.1504/ijbge.2013.054416

Westphal, J. D., & Milton, L. P. (2000). How experience and network ties affect the influence of demographic minorities on corporate boards. *Administrative Science Quarterly*, *45*(2), 366–398. https://doi.org/10.2307/2667075

Wheeler, C. H. (2001). Search, sorting, and urban agglomeration. *Journal of Labor Economics*, *19*(4), 879–899. https://doi.org/10.1086/322823

Williams, K. Y., & O'Reilly, C. A, III. (2000). Demography and diversity in organizations: A review of 40 years of research. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (pp. 77–140). Elsevier. (Original work published 1998)

Williams, R. J., Hoffman, J. J., & Lamont, B. T. (1995). The influence of top management team characteristics on M-form implementation time. *Journal of Managerial Issues*, *7*(4), 466–480. https://www.jstor.org/stable/40604082

Wilson, T., Jr. (2014). Gender board diversity: Further evidence on women in corporate governance. *Journal of Finance and Accountancy*, *16*(1), 1–10. https://www.aabri.com/manuscripts/141855.pdf

Wintoki, M. B., Linck, J. S., & Netter, J. M. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics*, *105*(3), 581–606. https://doi.org/10.1016/j.jfineco.2012.03.005

Yan, C. C., Hui, Y. Z., & Xin, L. (2021, May 12). *The relationship between board size and firm performance* [Paper presentation]. 5th International Workshop on Advances in Energy Science and Environmental Engineering, web conference. https://doi.org/10.1051/e3sconf/202125702079

Yermack, D. L. (1996). Higher market valuation of companies with a small board of directors. *Journal of Financial Economics*, *40*(2), 185–211. http://doi.org/10.1016/0304-405X(95)00844-5

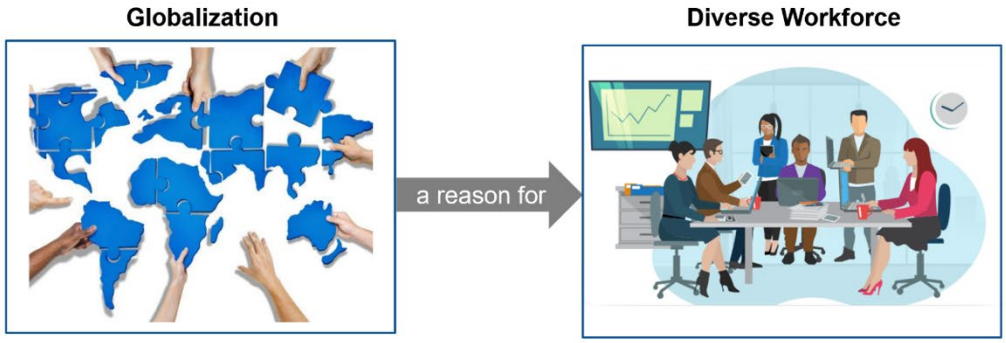
Zahra, S. A., & Pearce, J. A. (1989). Boards of directors and corporate financial performance: A review and integrative model. *Journal of Management*, *15*(2), 291–334. https://doi.org/10.1177/014920638901500208

Zahra, S. A., & Stanton, W. W. (1988). The implications of board of director's composition for corporate strategy and performance. *International Journal of Management, 5*(2), 229–236. https://doi.org/10.1177/014920638901500208

APPENDIX A

Market Perspectives on Diversity

Globalization and Diversity – An Evolving Corporate Phenomenon



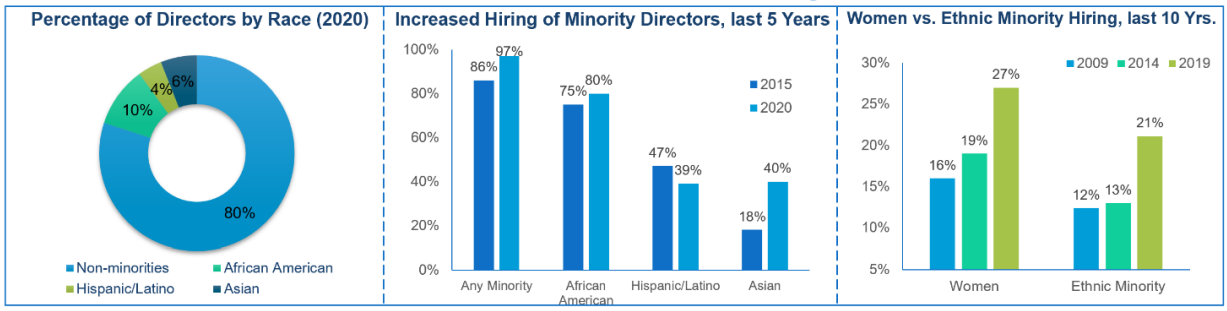
- Diversity in the corporate context reflects different markets, customers, and diverse employees
- Academic research on board diversity increased around the time of globalization
- Companies, investors, and policy makers start to recognize the value of diversity

Moving beyond diversity in the executive ranks/ boards and incorporating inclusion and social equity

Corporate Board Trends: Evidence of More Heterogeneous Boards

Breakdown of Top 200 S&P 500 Board of Directors (2020 data):

Where is the Current Status? | **How is the Progress To-date?**



What are some of the reasons for increased board diversity?:

- Global financial market meltdown in 2008 has driven changes to board composition
- Several post-2008 SEC regulations stipulates board independence and diversity requirements
- Many governments across the globe have passed board quota legislations

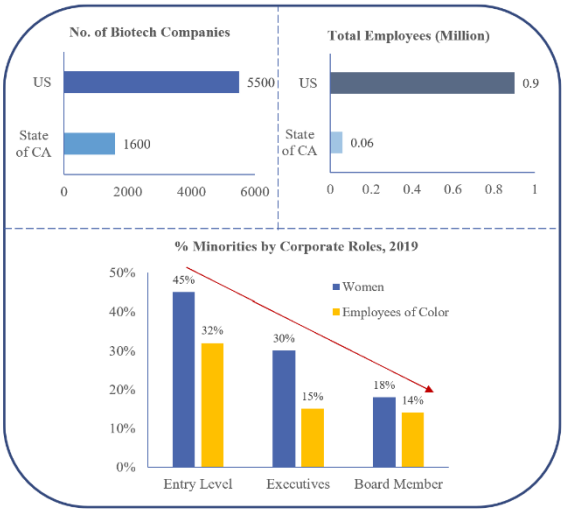
Gaps still exist, but the discussions have moved beyond gender to include other diversities

Source: Spence Stuart Board Index, 2020, ISS Analytics, 2019, U.S. Board Diversity Trends, Harvard Law School Report, 2019

APPENDIX B

A Case for Studying the Biotech Domain

Industry Statistics



- Restricted to multi-national drug manufacturers
- ~1M employees and is increasingly becoming diverse
- Contributes ~$1T in economic output to the US economy
- Biotech domain specific study has not been researched
- 15+ years of professional experience in the industry

A first of its kind domain focused study will provide key insights into the functioning of Biotech boards

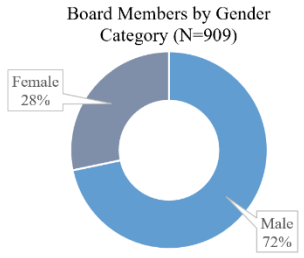
Source: CSLA Report, 2019, First Annual Report on Race, Ethnicity, & Gender in the Biotech Industry, BIO Report, 2020; www.bio.org

APPENDIX C

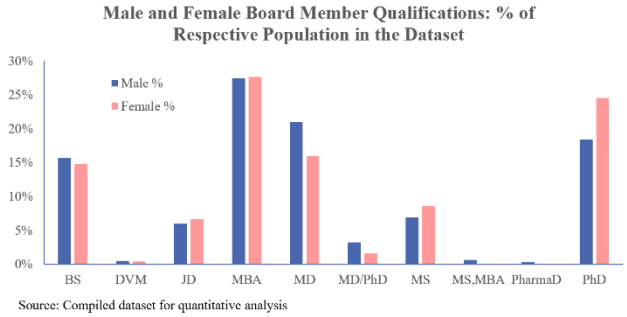
Board of Directors Demographics Data

Diversity Analysis of Compiled Dataset

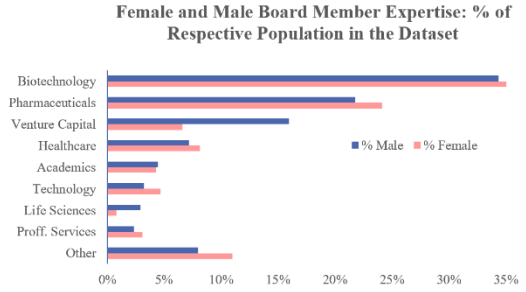
~20% board diversity and there is no difference in education and expertise across race & gender.



Race	Female	Male	Total	% of Total	% Population
African American	17	33	50	6%	13%
Asian	29	63	92	10%	6%
Hispanic	10	12	22	2%	19%
Middle Eastern	4	15	19	2%	4%
Native American	2	2	4	<1%	0.4%
Caucasian	195	527	722	79%	56%
Other					1.8%
Total	**257**	**652**	**909**	**100%**	**100%**



Source: Compiled dataset for quantitative analysis



APPENDIX D

Study Contributions

Data, Methods, and Analysis – Comparison with Prior Literature

Categories	Literature	Current Study
Data Type	• Majority use panel data and/or time-series data. Some use cross-sectional data • Range is 100 - 2000 companies; cuts across multiple industries	• Cross-Sectional data of 100 firms (time period 2020) • Domain focused study – Biotech • Sem-structured interview notes (N = 8 members)
Diversity Variables	• Gender Ratio, Gender, and Race • Some have used functional diversity	• Diversity Indices: ➢ Gender Ratio, Gender, Race, Functional, Cognitive diversities and intersectionality ➢ Interaction effect between gender ratio and other variables
Control Variables (Board and Firm Variables)	• Dependent Variables: ROA/ROE/Tobin's Q • Independent Variables: ➢ Number of Independent Directors, CEO Duality, Ave. Tenure on Board, Firm Age, Firm Size, Leverage, Sales Growth, Ratio of Shares Owned by Board Members, No. of Employees, CEO Experience.	• Dependent Variables: Tobin's Q • Independent Variables: ➢ Number of Independent Directors, CEO Duality, Ave. Tenure on Board, CEO Duality, Firm Age, Firm Size, Leverage, Board Size, Ave. Membership on Other Boards, ROA, No. of Employees
Dependent Variable	• ROA, ROE, Tobin's Q, Leverage	• Tobin's Q
Methods (Quant & Qual)	• Multiple Types of Regression Analysis: OLS, 2SLS, and GMM Methods • Intersectionality NOT Considered	• Descriptive Statistics • OLS (with and without intersectionality) • Slope Dummy Variable • Semistructured interviews of board members

Similarity with literature

APPENDIX E

Computing Different Diversity Indices

Approach used to compute diversity indices

Gender Diversity

- Gender Diversity Index = (Gender Ratio) + (Gender Ratio)^2
- Blau's (Gender) Index = 1- $\sum(P_i)^2$, where i = 1, …n categories

Race and Functional Diversities

- Blau's (Race and Functional) Index = 1- $\sum(P_i)^2$, where i = 1, …n categories

Cognitive Diversity

- Ratio Method:
  - No. of Highest Degree (i.e., PhD, MD, JD) Members / Total Members
- Limitations of Ratio Method:
  - If the board has no member with a PhD or MD degrees, then the ratio is 0.

Interaction between all Three Diversities

- Assume Gender Diversity = X1, Race = X2, Functional = X3, Cognitive = X4. Intersectionality is computed as follows:
- Const*(X1*X2)+Const*(X1*X3)+Const*(X1*X4)+Const(X2*X3)+Const*(X2*X4) +Const*(X3*X4)+Const*(X1*X2*X3*X4) + Error term
- The above intersectionality term gets added to the OLS equation

Gender Interaction Effect Using the Slope Dummy Variable Approach

- Considered three variables to assess gender interaction effect:
  - D_i: 1 if the gender ratio is > 22%, otherwise 0
  - $X_{1i}D_i$: If the gender ratio is > 22%, them GR_i*D_i, otherwise 0
  - $X_{2i}D_i$: If the gender ratio <22%, then GR_i*D_i, otherwise 0

APPENDIX F

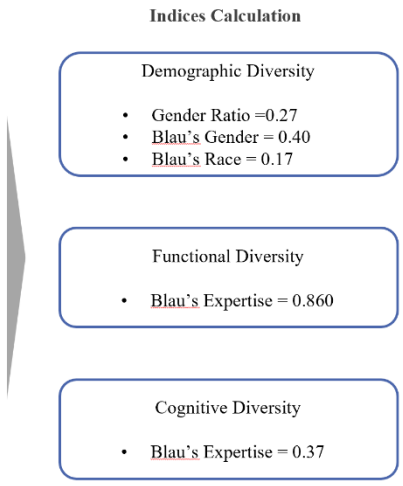
Example of Diversity Analysis

Amgen Inc., Thousand Oaks, CA.

Amgen (AMGN) is a Fortune 100 Biotech company located in Thousand Oaks, CA. It is Biotech drug manufacturer with a global employee base of 22,000. The corporate board is composed of a total of 11 directors including the CEO who is the chairman of the board. The board mix can be characterized as 9 White, 1 Asian, 1 Black from a racial distribution. From a gender distribution the board has eight male and three female directors. A diversity analysis using the different indices discussed earlier is shown in the following table. The analysis shows that Amgen's board composition is more skewed towards functional and cognitive diversity vs. demographic diversity.

Amgen Inc., Board of Director Demographics

Member No.	Gender	Race	Industry Expertise	Education
Member 1	F	B	Aerospace & Defense	PhD
Member 2	M	W	Finance	MBA
Member 3	M	W	Biotechnology	MD
Member 4	M	W	Chemical	MBA
Member 5	M	W	Oil & Energy	BS
Member 6	M	W	Diversified	MBA
Member 7	M	W	Consumer	MBA, CPA
Member 8	M	A	Biotechnology	PhD
Member 9	F	W	Chemical	MBA
Member 10	M	W	Entertainment	MBA
Member 11	F	W	Biotechnology	PhD



APPENDIX G

Qualitative Portion of the Study – Board Member Background

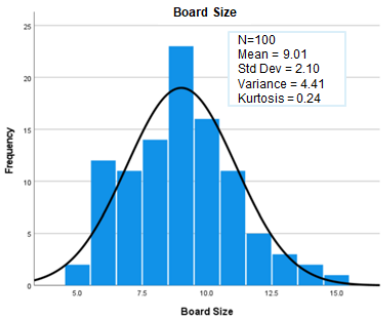
Member #, Interview Date, & Duration	Gender	Race	Education	Total Board Exp.	Expertise	Other Board Membership	Current Position
Member 1 (04/06/2022, 50 minutes)	F	White	Nursing, MBA	5	Operations	1	COO/Board member
Member 2 (04/1/42022, 50 minutes)	F	White	BS, MBA	7	Commercial Operations	3	Ex-CCO
Member 3 (04/15/2022, 50 minutes)	M	White	BS, MBA	30	Leadership & Strategy	4	CEO
Member 4 (05/05/2022, 45 minutes)	F	White	PhD	10	Board Search	2	CEO
Member 5 (05/07/2022, 45 minutes)	M	SE Asian	MS	6	Manufacturing	3	Ex-COO
Member 6 (05/10/2022, 60 minutes)	M	White	BS	15	Finance	3	Ex-CFO
Member 7 (05/11/2022, 45 minutes)	M	White	BS	10	Operations	3	President
Member 8 (06/08/2022, 70 minutes)	M	Black	BS, MBA	3	Sales & Marketing	0	CEO

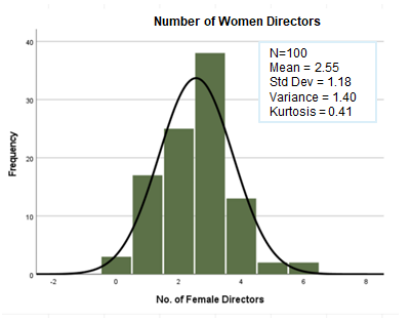
Interview Panel Diversity Indices vs. Indices Median in the Study Dataset:

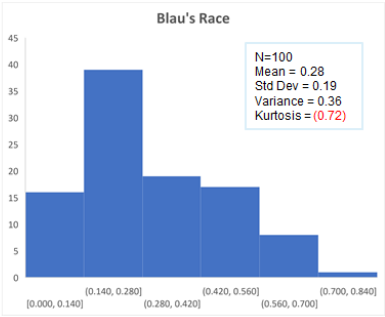
- Gender Ratio = 0.375 (dataset median = 0.29)
- Blau's Gender Index = 0.47 (dataset median = 0.41)
- Blau's_Race Index = 0.40 (dataset median = 0.25)
- Cognitive Index = 0.125 (dataset median = 0.5)

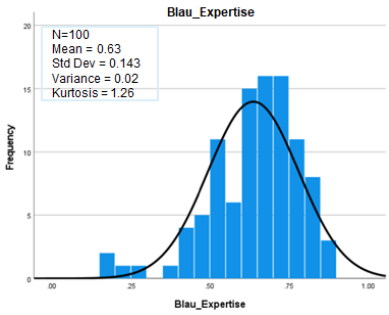
APPENDIX H

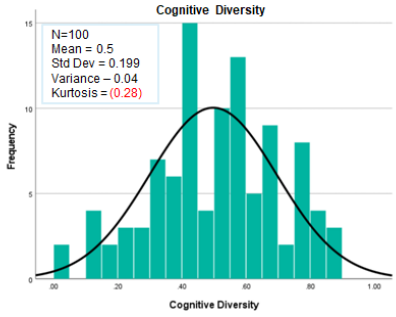
Distribution of Diversity Indices

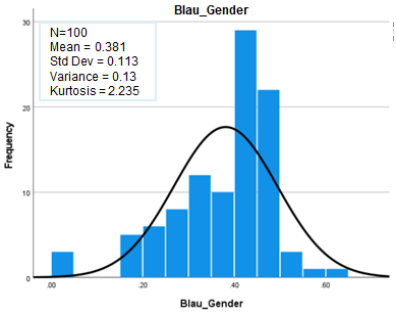








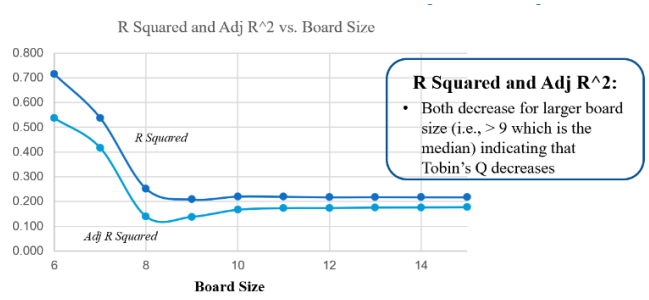




APPENDIX I

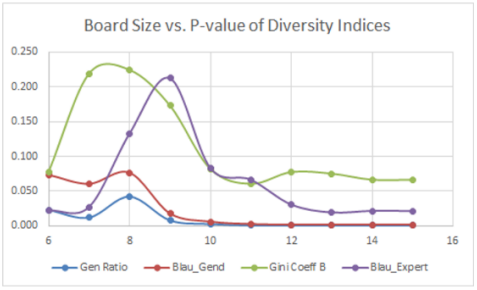
Impact of Board Size on Diversity Indices

Graphs of Board Size Versus *p* values of Diversity Indices



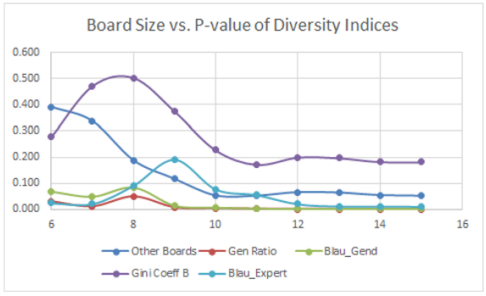
R Squared and Adj R^2:

- Both decrease for larger board size (i.e., > 9 which is the median) indicating that Tobin's Q decreases



Varying Boards vs. Indices:

- Gender Ratio (G/R), Gender for all Boards
- Expertise is relevant for large boards
- Cognitive diversity is relevant at the 10% level for larger boards (>10)



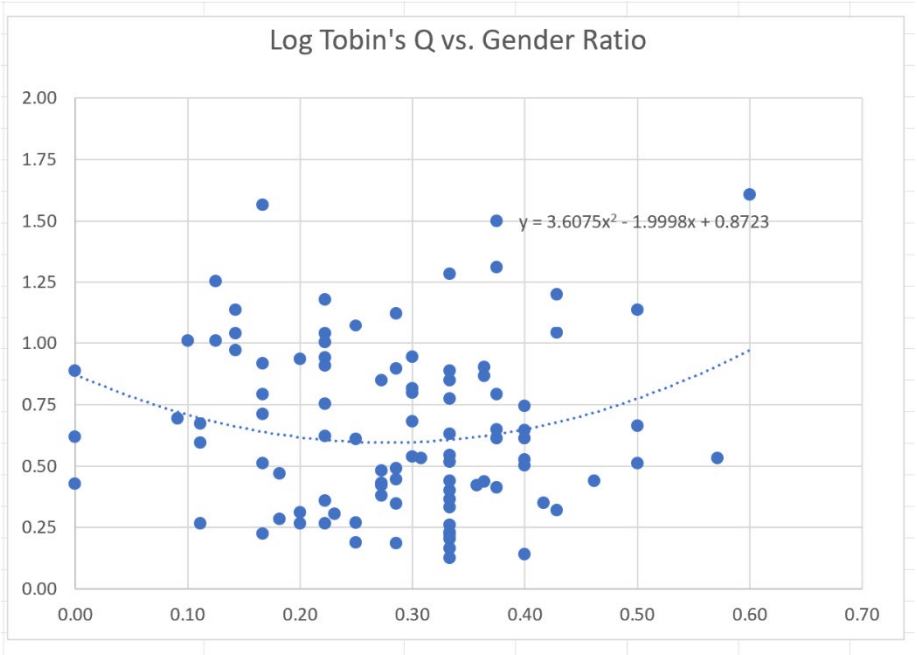
When Membership in Other Boards (MOB) is Considered:

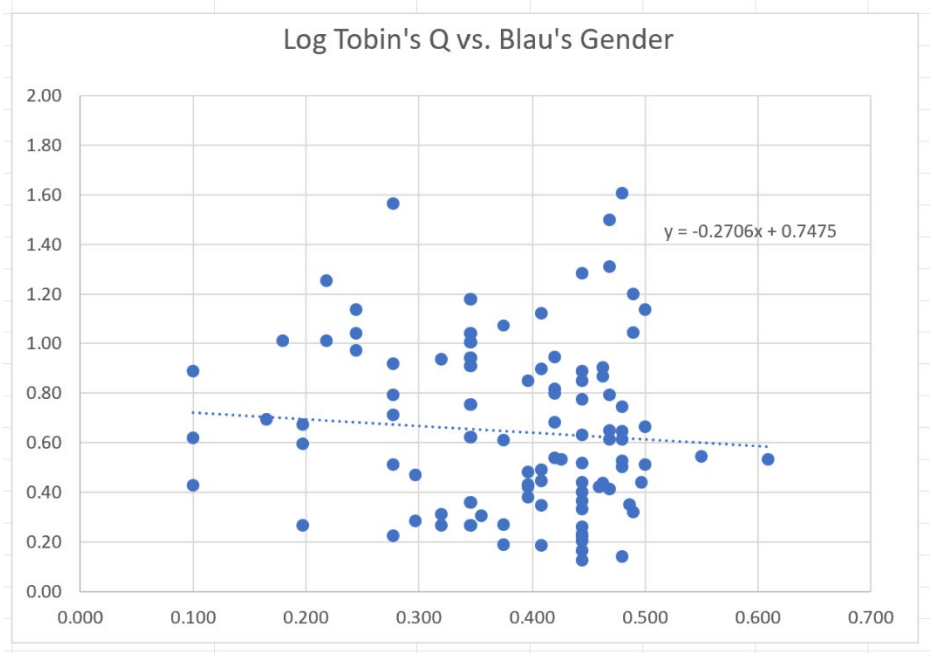
- Gender Ratio, Gender are significant for all board sizes
- MOB and Expertise are relevant for board sizes > 9

Only G/R and Gender ARE significant for all Board Sizes. Cognitive Diversity, Functional Expertise and Membership on Other Boards are significant in large boards

APPENDIX J

Mapping Blau's Gender Index and Gender Ratio against Tobin's Q (log)





Institutional Review Board Approval Letter

Date: 8-2-2022

IRB #: IRB-2022-297
Title: A qualitative study of the influence of board diversity on firm performance
Creation Date: 2-12-2022
End Date:
Status: Approved
Principal Investigator: Sheshadri Sharma
Review Board: USD IRB
Sponsor:

Study History

Submission Type	Review Type	Decision
Initial	Expedited	Approved

Key Study Contacts

Member Sheshadri Sharma	Role Principal Investigator	Contact sheshadrisharma@sandiego.edu
Member Hans Schmitz	Role Primary Contact	Contact schmitz@sandiego.edu